Year 9 Knowledge Organisers

Summer Term

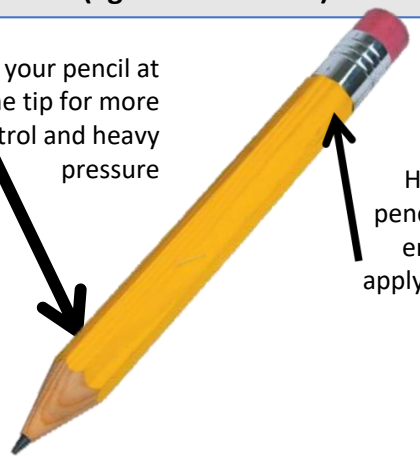
Knowledge Organiser Year

Drawing Rules

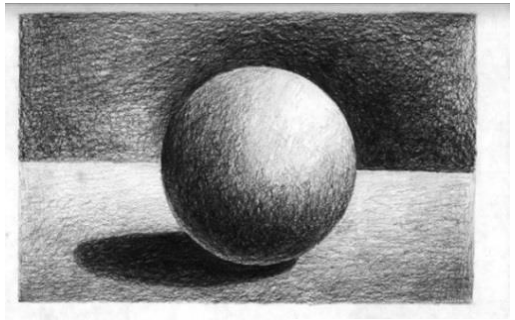
Remember:
Most objects we are drawing do not have a line around them. we can see edges of objects because of a difference in tone (light next to dark)

Gradual - As your tone progresses from light to dark
Composition – The placement or layout of an image
Sketch – A rough drawing used as a study or proposal
Media – The materials that are used to create artwork.
Cross-hatching – Drawing overlapping layers of lines to create tone and texture
Refine – Making small changes to improve the appearance of the drawing
Mark making – Apply lines or marks to the surface to create texture

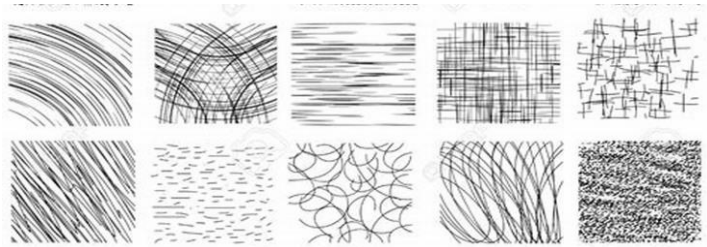
Step 1: Shape (Outline or plan)
Record shape accurately. Make sure to use LIGHT PENCIL outline so that you can easily rub it out if you make a mistake

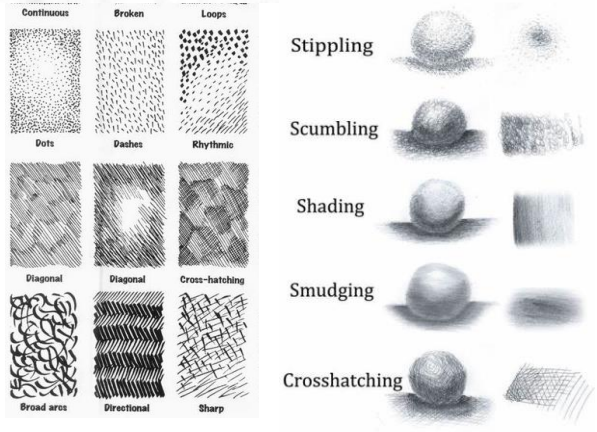


Step 2: Tone (Gradual pressure - light to dark)
You can create a range of tones by using different pressure or layering with your pencil. Make sure that you start with your lightest tones first and work your way towards the darker tones. Remember to use the correct line direction, following the shape of the object.

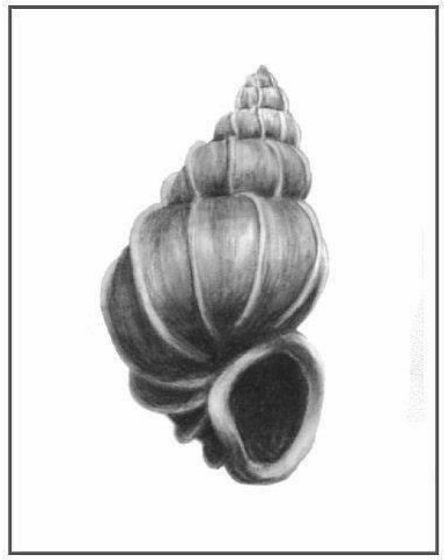


Step 3: Texture (The surface quality)
Create a range of textures using different mark making types. It is important to include texture in your drawings so your image doesn't look flat.





Step 4: Detail (Small marks and refinement)
Apply detail to the shape to refine the edges and the small details. This step helps you to evaluate the drawing and make small improvements. This might involve an eraser and a sharp pencil.



Shape > Tone > Texture > Detail

Relationships in an Ecosystem
Knowledge Organiser

Feeding relationships within a community can be represented by food chains.

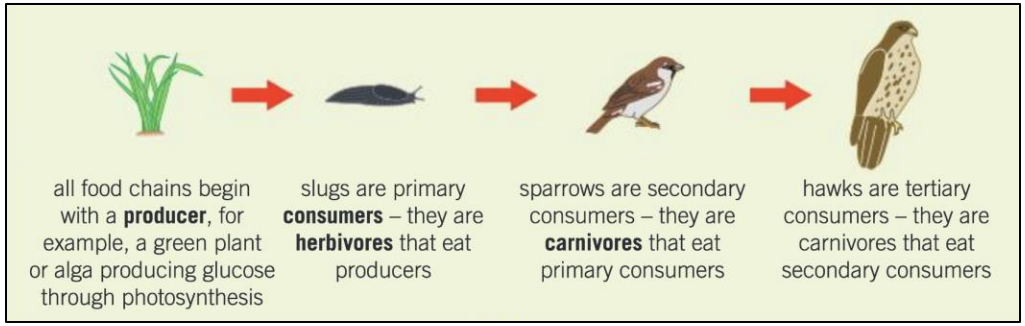
Photosynthetic organisms that synthesise molecules are the producers of all biomass for life on Earth, and so are the first step in all food chains.

A range of experimental methods using transects and quadrats are used by ecologists to determine the distributions and abundance of different species in an ecosystem.

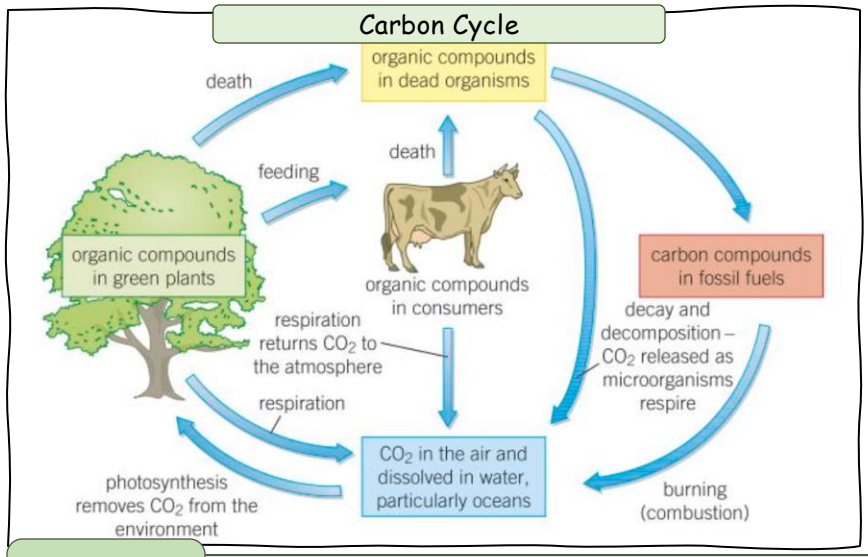
Consumers that kill and eat other animals are predators, and those that are eaten are prey.

Apex predators are carnivores with no predators.

Organisms usually have more complex feeding relationships, with more than one predator or more than one source. These can be shown in a food web.



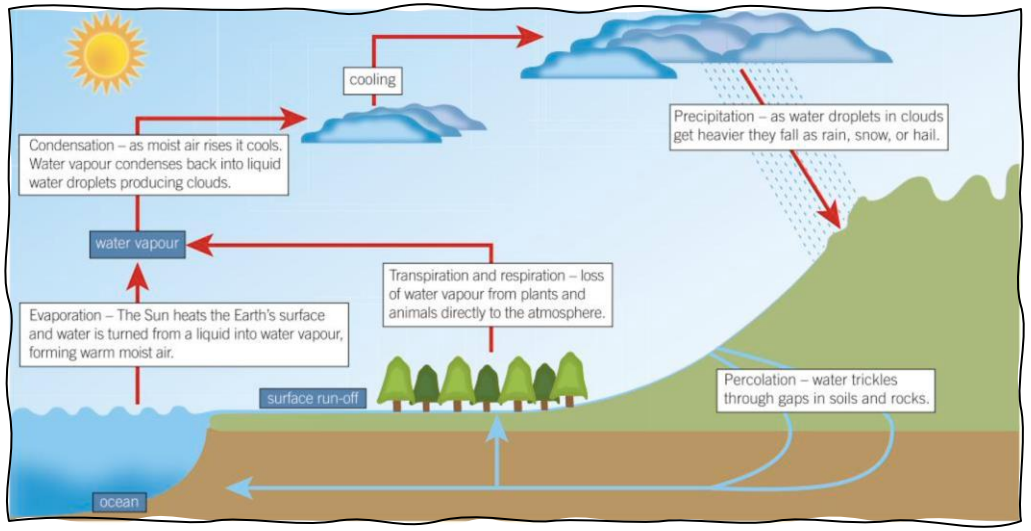
Carbon Cycle



How materials are recycled

All materials in the living world are recycled, which provides the building materials for future organisms.

Water Cycle



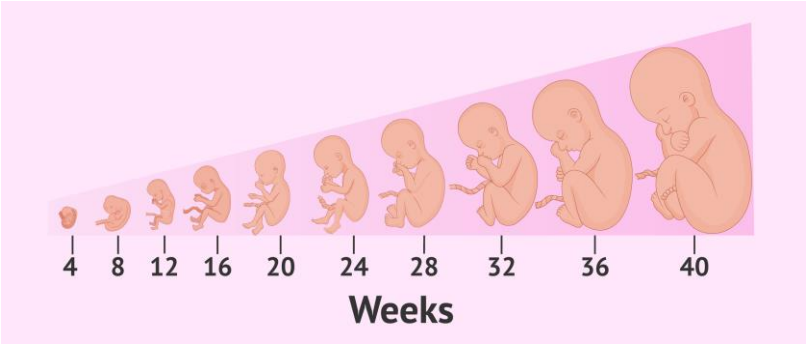
Key terms

biodiversity carbon cycle carnivore consumer deforestation evaporation food chain food web herbivore precipitation predator prey producer water cycle

What are the rights and wrongs of medical ethics?

Key Terms

Abortion=the deliberate termination of a human pregnancy, most often performed during the first 28 weeks of pregnancy.
Euthanasia=the painless killing of a patient suffering from an incurable and painful disease or in an irreversible coma.
Sanctity of life=The phrase **sanctity of life** refers to the idea that human life is sacred, holy, and precious.
Cloning=Cloning is the process of producing individuals with identical or virtually identical DNA, either naturally or artificially.
Genetic engineering = the deliberate modification of the characteristics of an organism by manipulating its genetic material.



Euthanasia

Euthanasia is illegal under English law

Depending on the circumstances, euthanasia is regarded as either manslaughter or murder. The maximum penalty is life imprisonment.

Example: if a doctor deliberately gave a patient with a terminal illness a drug they do not otherwise need, such as an overdose of sedatives or muscle relaxant, with the sole aim of ending their life.

voluntary euthanasia – where a person makes a conscious decision to die and asks for help to do so
non-voluntary euthanasia – where a person is unable to give their consent (for example, because they're in a coma) and another person takes the decision on their behalf, perhaps because the ill person previously expressed a wish for their life to be ended in such circumstances**.**

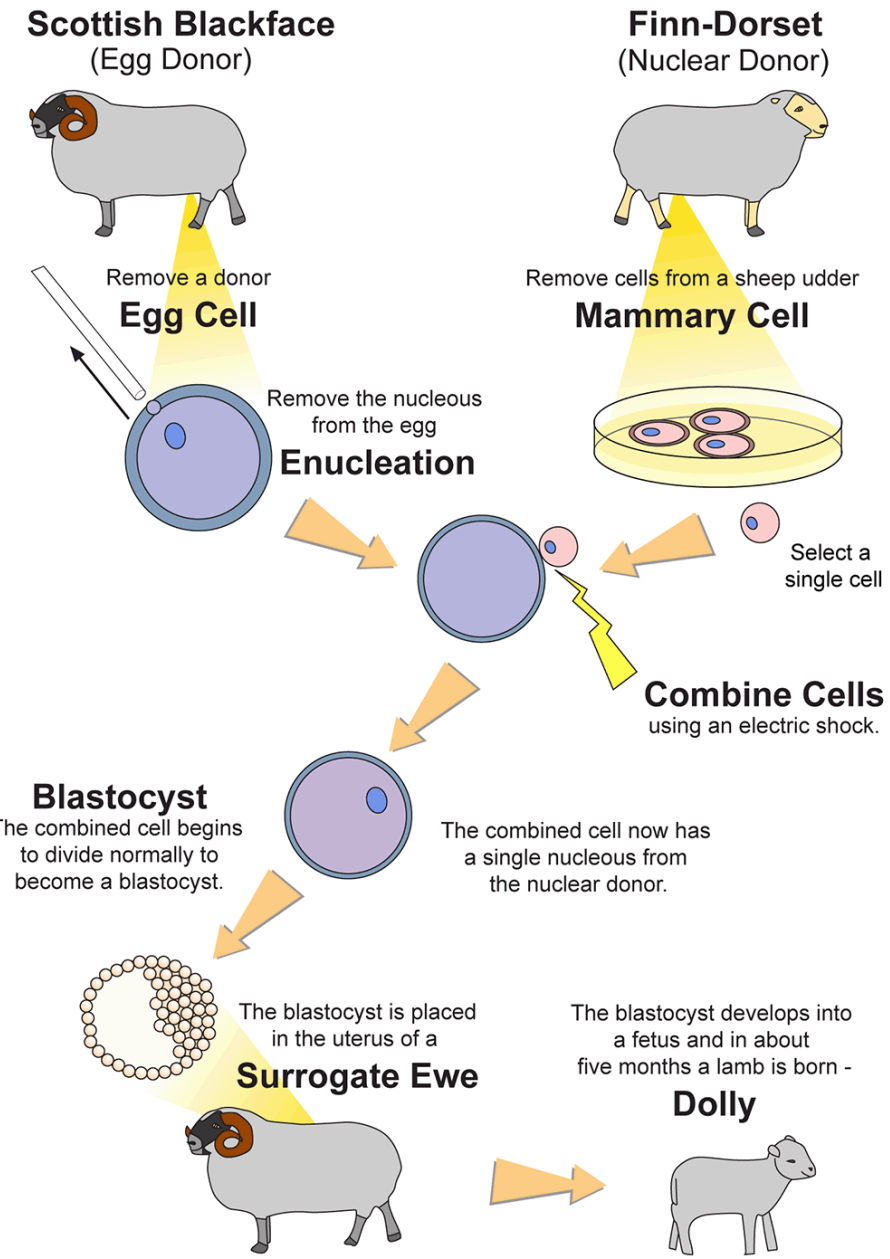
Abortion

Abortions can only be carried out under the care of an NHS hospital or a licensed clinic, and are usually available free of charge on the NHS.

Most abortions in England, Wales and Scotland are carried out before 24 weeks of pregnancy.

They can be carried out after 24 weeks in very limited circumstances – for example, if the mother's life is at risk or the child would be born with a severe disability.

The Story of Dolly



Year 9 – Computing – Advanced Image Editing – Knowledge Organiser

Key Words	
Vector Image 	• Is created in graphics packages and consist of shapes called objects. • Even if an object in a vector graphic is quite large, it doesn't need a lot of computer. memory. Therefore the file size of a vector graphic is often very small. • Are scalable - i.e. when you resize them, they do not lose quality.
Bitmap (raster) Image 	• Is composed of many tiny parts, called pixels. The pixels are often many different colours. • It is possible to edit each individual pixel. • Since the computer has to store information about every single pixel in the image, the file size of a bitmap graphic is often quite large. • Are NOT scalable – i.e. when you resize a bitmap graphic, it tends to lose quality.
Manipulation 	• Transforming or altering an asset using methods/techniques to achieve desired results.
Composition	• Is the result of 2 or more images that have been combined or overlaid.
Layer 	• Photoshop layers are like sheets of stacked acetate. • Transparent areas on a layer let you see layers below. You use layers to perform tasks such as compositing multiple images, adding text to an image, or adding shapes.
Client brief	• Outlines the client's objectives, expectations, target audience, budget, timeline, and any specific requirements or constraints that must be considered
Target audience	• A group of people identified as likely customers of a product. The product should be developed with them in mind so they are more likely to buy.

Why someone might use Photoshop to manipulate an image.

- To improve it in some way, e.g. by removing a spot from a supermodel's nose!
- To use as proof that something actually happened, e.g. UFO flying over your house!
- To provoke a shock reaction.
- To create a piece of art.

File Types.

- . JPG (Lossy) - Joint Photographic Experts Group, does not keep transparency.
- . PNG (Lossless) - Portable Network Graphic, good for images in colour, larger file size than a jpeg, keeps transparency.
- . TIFF (Lossless) - Tagged Image File Format, not used on the WWW due to its very large file size, file standard in printing.

Shortcuts

Ctrl + D	Deselect
Ctrl + T	Free transform
Ctrl + alt + z	Go backwards a step
Ctrl + "-" (or use +)	Zoom in and out

Layer effects

Warping Text

GCSE DRAMA COMPONENT 3 KNOWLEDGE ORGANISER

Stages

Proscenium Arch
End-on
Traverse
Thrust
In the round

Words to describe movement

defined, fluid, erratic, smooth, open, closed, naturalistic, non-naturalistic, graceful, exaggerated, mimed, energetic. refined

Words to describe voice

tone, pitch, pace, pause, accent, inflection, volume, emphasis, intonation, articulation, projection

Lighting

angle, position, intensity, coloured -gel, fresnel, profile spot, birdie, gobo, floodlight, shadow, uplighting

Sound and Music

tempo, pitch, tone, rhythm, intonation, diegetic, non-diegetic, atmosphere, volume

Costume

colour, fabric, time-period, texture, style, fit, worn, torn, material

Words to describe the effect on the audience

empathy, pity, shock, horror, outrage, uncomfortable, relieved, distressed, trepidation, bemused, anxious, compassion, appalled, admiration, catharsis, elated, amused, foreboding

DNA Characters

Jan, Mark, Leah, Phil, Adam, John Tate, Lou, Danny, Brian, Cathy, Richard

Words to communicate meaning to an audience

vocal expression, facial expression, gesture, physicality, proxemics, interaction, transition, posture, levels, stance, atmosphere, mood

Context and Themes

'Broken Britain', terrorist threats caused increased anxiety, anti-social behaviour caused increased security, heightened CCTV, advances in technology, distrust in youth, hoodie culture, David Cameron – 'Hug a hoodie', bullying, responsibility, guilt, morality, peer-pressure, gang culture, power struggle

DNA Setting and structure

A Street: Jan and Mark's scenes. A familiar and ordinary setting close to civilisation reminding us of the wider social setting.
A Field: Leah and Phil's scenes. The field is open and spacious and away from the distraction of the other characters.
A Wood: Group scenes. Isolated from society, hidden from view, symbolic of secrecy, the natural habitat of bonobos and chimps
Linear Narrative: intro, problem, crisis, resolution (chronological)
Cyclical structure: the settings are repeated which builds tension

DNA Original performance conditions

Written by Dennis Kelly as part of National Theatre connections project in 2007. It was first performed professionally at the Cottesloe Theatre in 2008 directed by Paul Miller, designer Simon Daw. They used an end-on stage with projection and minimalist set. Daw filmed hours of footage of the three locations, a street, a field and a wood which were projected onto the cyclorama

Search for the Truth KO

WORD	DEFINITION
Riot	Riot public disorder caused by a crowd or group of people protesting against another group.
Bias	A particular trend, tendency, inclination, feeling or opinion. Especially one that is preconceived or unreasoned.
manipulative	Influencing or attempting to influence the behaviour or emotions of others.
impeach	To accuse a public official of misconduct in office.
transcript	A written, typed or printed copy. Usually from speech.
disaster	A calamitous event, especially one occurring suddenly.
rifle	To ransack, search or rob.
harrowing	Extremely disturbing or distressing.
defame	To attack the good name or reputation by slander or libel.
plausible	Having an appearance of truth or reason; seemingly worthy of approval or acceptance.
justice	The quality of being 'just'; righteousness or morally right.
perspective	The state of ones ideas, the facts known to one.

CONTEXT	SUMMARY OF EVENTS
Week 1 – Stonewall	The Stonewall riots, also known as the Stonewall uprising, Stonewall rebellion, or simply Stonewall, were a series of spontaneous protests by members of the gay community in response to a police raid that began in the early morning hours of June 28, 1969, at the Stonewall Inn in New York City.
Week 2 - Grenfell	The fire which destroyed Grenfell Tower in June 2017 was one of the UK's worst modern disasters. Just before 01:00 on 14 June, fire broke out in the kitchen of a fourth floor flat at the 23 storey tower block in North Kensington, West London. Within minutes, the fire had raced up the exterior of the building and then spread to all four sides. By 03:00, most of the upper floors were well alight. Seventy-two people died.
Week 3 – Hillsborough	Hillsborough disaster, incident in which a crush of football fans ultimately resulted in 97 deaths and hundreds of injuries. The crushing occurred during a match at Hillsborough Stadium in Sheffield, England, on April 15, 1989. The tragedy was largely attributed to mistakes made by the police.
Week 4 – Central Park 5	The Central Park jogger case (sometimes termed the Central Park Five case) was a criminal case concerning the assault and rape of Trisha Meili, a white woman in Central Park in Manhattan, New York, on April 19, 1989.

PAF	
Purpose	Why are you writing? e.g. *To entertain, to inform, persuade…*
Audience	Who are you writing for? e.g. *Young adults, children, teachers…*
Form	What type of text are you going to write? e.g. *A recipe, an article, a story…*

Writing	
A – alliteration. The repetition of key sounds or letters.	E – emotive language. Use pathos to really create tone and reader reaction.
F – fact. Support the statement or opinion using key irrefutable facts.	S – statistics. Use key statistics that are believable in context to support your ideas.
O – opinion. State your opinion and make it clear throughout.	T- triple. Create a building verb or building adjective list to create emotion.
R – rhetorical question. Invite the reader to question their own ideas/morals.	*Remember, there are more features you can embed but these are the minimum we expect.*

PUNCTUATION	
,	Clauses and lists
;	Lists and two equal weight clauses
!	Use sparingly
…	Use sparingly

RESEARCH & BACKGROUND INFORMATION

Introduction:

You need to introduce your investigation telling the reader:

- Why you have chosen this task
- What you need to investigate in order to complete the task
- How you plan to investigate (internet, books, visits, etc)

This should take up ½ a page on the rest on the page you should start your background information (see below)

Background information:

Use the internet, recipe books, menus to complete the following questions:

- How is 'International Cuisine' defined? Find the definition on an online dictionary.
- What influences the cuisines (or cookery) of particular countries?
- Who or what promotes or affects international cuisine? (think about celebrity chefs, importing food goods, foods grown in the country, weather, price of ingredients)
- What is the customer demand in the UK for international food (ethnic groups who live in the UK, international travel, speed of importing goods)?
- Explain the impact that international cuisines have had in your area (range of food outlets, food ranges in supermarkets, carnivals). How many _____ restaurants in Peterlee are there? How many _____ restaurants are there in Shotton? Use www.yell.com **1 mark**

- Investigate the quality and range of manufactured international food available to the caterer. (go onto www.asda.co.uk and compare two ready meals from the country of your choice. Comment on the cost, packaging, ingredients used, presentation, nutritional content per portion- Are they healthy? Do these products meet government guidelines?- 5 a day, balanced diet. Do they contain additives/colourings.) Type up your findings. You must consider the nutritional content of these foods.

Choose one country to investigate in more depth. ,

- Background information
- The country I have chosen to study in more depth is…..
- This is because…..
- It has a population of…… people
- The religion in this country is …..
- The staple foods of this country are…
- The foods that grow in this country are…
- The following are traditional dishes….
- **Conduct a survey or visit to a restaurant.**

Write a conclusion at the end of your research.

Italian

Basic skills	Medium skills	High skills
1. Tiramisu with store bought sponge fingers 2. Pizza using shop bought base 3. Bruschetta + simple topping	1. Vegetable lasagne with store bought pasta 2. Focaccia 3. Grissini (breadsticks) 4. Ciabatta bread 5. Risotto (any type) 6. Pizza 7. Spaghetti bolognaise 8. Cannelloni with shop bought pasta tubes 9. Arabiata sauce and shop bought pasta 10. Store bought pasta with homemade sauce 11. Ricotta cheesecake (medium?) 12. Individual Spinach and ricotta bread and butter pudding	1. Tiramisu (med?) 2. Panna Cotta 3. lasagne with HMD pasta 4. mascarpone and homemade pesto stuffed chicken breast wrapped in parma ham and served with a mushroom risotto stuffed pepper 5. tiramisu torta 6. salmon with salsa verde and accompaniments 7. chicken carbonara served with tagliatelle HMD pasta 8. Chicken parmesan 9. Gnocchi 10. Any homemade pasta with homemade sauce 11. Parmesan crisps (garnish) 12. Biscotti (accompaniment) 13. Sweet ravioli with mascarpone and honey HMD pastry 14. Spinach and ricotta cannelloni HMD pasta

POSSIBLE DISHES TO TRIAL
Please consider the following things when choosing dishes:

Food Preparation Skills
The following is a guide to the level of skill found in practical dishes. In order to achieve high marks.
You need to be aiming for the higher-level skills when they carry out practical assessments.

Higher Level Skills:	Medium Skills:	Basic Skills:
• Pastry making – short crust, pate sucre, choux. • Roux based sauces • Meringues and pavlovas • Meat and fish cookery (using high risk foods) • Decorated cakes and gateaux Pasta Dishes (fresh shaped pasta) • Rich yeast doughs • Complex accompaniments and garnishes	• Puff pastry items that need shaping but use ready-made pastry. • Vegetable and fruit dishes requiring even sizes e.g. fruit salad, stir fry which show competent knife skills • Cheesecakes and similar desserts. • Simple sauces e.g. red wine sauce. • Simple cakes, biscuits, cookies and scones. • Basic bread doughs	• Crumbles. • Sandwiches. • Pizza with ready-made base. • Jacket potatoes. • Simple salads. • Assembling products e.g. using prepared sauces, bought meringue nests, etc.

DISHES CHOSEN AND REASONS FOR CHOICE)

Copy the task: ***The local hotel in your area is holding an international week. As the trainee chef you have been invited to take part and have been asked to prepare a two course meal for two from a country of your choice.***
You SHOULD INCLUDE:
•Reference to the task you are completing (in your own words or copy & paste task) and a brief description of what you will be making.
•Explain why the dishes you have chosen **are suitable** for the task in relation to:
•Where it is going to be served (restaurant (type), home or school canteen, etc)
•The standard expected at the establishment.
•Who is going to be eating it - age
•nutritional guidelines of the people eating it and how your dishes meet this need – this is VERY important
•How much is it going to cost (you to make & the customer)
•Where it is going to be cooked (restaurant (type), home or school canteen, etc) and the facilities available to use.
•Time limitations you have
•Reference should be made to health & safety and hygiene.

Choice of Menu
You SHOULD INCLUDE:
•A detailed description of what you are cooking, make it sound fancy! Think of the Marks and Spencer adverts!
•This is only a short paragraph. You should explain the reasons why you have chosen each dish, for example if you were doing cottage pie for an old folks home if might be because of the low cost, easy to eat and traditional.
And complete this table:
In table form for each dish served…

Dish	Suitability For Task	Shape /Size	Colour/ Attractive
Pizza	I think that this is a good choice of dish for this task as it is a well known italian dish and very popular.	Its round and fairly thick It is big enough to serve six to eight people.	Colours include reds, yellows, greens, browns and an olive colour (black). This mixture of colours will make the pizza more attractive.

Carrying out the task

In order to gain high marks in this section, candidates need to demonstrate:

High standards of personal hygiene e.g. wearing of apron / whites, hair back, no nail varnish, no jewellery, etc.

- ✓ Good personal hygiene habits e.g. no licking fingers, tasting with a clean teaspoon, etc.
- ✓ Safe use of equipment, especially knives, pans and electrical equipment
- ✓ Selection of the correct tools e.g. correct knife for chopping, peeling, etc.
- ✓ Use of a wide variety of commodities within the task chosen
- ✓ Good food hygiene e.g. perishable foods refrigerated and not left on work unit / table, using temperature probes to ensure food is cooked
- ✓ Neat, organised work
- ✓ Safe use of cooker
- ✓ Working to time
- ✓ Independent working
- ✓ Good technical skills
- ✓ Little food waste
- ✓ Logical sequence of work e.g. food that needs to be cooked for a long time, be set or served cold needs to be made first
- ✓ A wide variety of skills, including high level skills
- ✓ High standard of final presentation e.g. portion control, use of garnish and decoration, good colour, correct temperature, correct texture, good flavour, appropriate serving dishes
- ✓ Good sequencing and dove-tailing of dishes so that all elements of the meal are served at the correct temperatures
- ✓ Appropriate serving of the meal

Presenting Food

The aim of a cook is to present food as near perfectly as possible. This involves:

- Consistency (how thin or how thick)
- Texture (includes crunchy, soft, crisp)
- Flavour (includes salty, sweet, sour, bitter, well seasoned)
- Seasoning (includes use of herbs, spices, salt and pepper)
- Colour (remember white, cream, brown and green are 'dead' colours)
- Decoration (used on sweet dishes – includes chocolate, cherries, fresh fruit etc
- Garnish (used on savoury dishes – includes tomato, parsley, lemon, cucumber, cress, etc.)
- Accompaniments – these include colourful vegetables and sauces.

As a general rule, do not over season, over-decorate or over fill serving dishes.

Chefs gradually learn the skills of tasting food to check for flavour, texture and seasoning.

Hot foods should be served hot and not warm, preferably on hot plates. Shaped and dramatic coloured plates can add to the overall appearance and 'drama' of food.

Cold food should be served cold, but not frozen and always on cold plates.

Food probes can be used to check temperatures (if available).

Savoury food is usually served in oval dishes or on oval plates if appropriate (with plain doyleys or dish papers)

Sweet food is usually served in round dishes or on round plates if appropriate (with pretty doyleys)

Carrying out the task

Consistency:

The consistency of food will depend on the size of pan used, the cooking time, the amount of thickener e.g. flour used and the quality of ingredients. It is easier to thin a mixture like a soup or a sauce rather than thicken it.

Texture:

Tasting food is essential in order to test texture. This includes checking foods like rice, pasta (cooked al dente), and vegetables to ensure they are not over-cooked.

Cooking alters the texture of food and an experienced cook will know when the right amount of heat has been applied to give the correct texture e.g. cooking steaks.

Contrasting textures are important to give variety and interest to a meal e.g. croutons with soup, wafers and ice cream, cheese and biscuits.

Flavour and seasoning:

Taste is very important. Good cooks know how to retain the flavour of food and how to alter the flavour of food. To retain flavour chefs need to:

- Use food as fresh as possible
- Use the least amount of cooking liquid
- Use the cooking liquid where possible (for sauces, stocks and gravies)
- Use appropriate cooking methods

- Prepare, cook and serve in as short a time as possible
- Not over-season so that customers cannot taste the natural flavour
- Use herbs and strongly flavoured foods with care
- Adjust seasoning at the end.

Y9 3.1 Chez moi

Je voulais habiter	I wanted to live
En ville	In town
Dans un village	In a village
Dans une chaumière	In a cottage
Dans un chalet	In a cabin
Dans un château	In a castle
Dans un foret	In a forest
Pres d'une rivière	Near a river
En plein nature	In the middle of nature

Où on pourrait	Where you could
Faire des magasins	Go shopping
Aller à la pèche	Go fishing
Faire des randonnées	Go hiking
Nager	Swim
Voir les montagnes	See the mountains
Voir les animaux sauvages	See the wild animals

Dans ma maison	In my house
Au rez de chaussée	On the ground floor
Au premier étage	On the first floor
Les pièces	Rooms
Il y a	There is
Il n'y a pas de	There isn't
Un salon	A sitting room
Une entrée	An entrance
Une cuisine	A kitchen
Une salle à manger	A dining room
Un bureau	An office
Un jardin	A garden
Une chambre	A bedroom
Une salle de bains	A bathroom
Une cave	A cellar
Un grenier	An attic

Le meuble	Furniture
Le lit	Bed
La chaise	Chair
Le canape	Sofa
Le bureau	Desk
L'ordinateur	Computer
Le tapis	Carpet / rug
La commode	Chest of drawers
Le mur	Wall
La télévision	TV
La table de nuit	Bedside table
La lampe	Lamp
Les rideaux	Curtains
En bois	Made of wood
En plastique	Made of plastic
En métal	Made of metal
En coton	Made of cotton
En marbre	Made of marble

		Masc	Masc. Pl	Fem.	Fem. Pl
Beauty	**Beautiful**	Beau	Beaux	Belle	Belles
	Pretty	Joli	Jolis	Jolie	Jolies
Age	**Old**	Vieux	Vieux	Vieille	Vieilles
	New	Nouveau	Nouveaux	Nouvelle	Nouvelles
Number	**First**	Premier	Premiers	Première	Premières
	Second	Deuxième	Deuxièmes	Deuxième	Deuxièmes
Goodness	**Good**	Bon	Bons	Bonne	Bonnes
	Bad	Mauvais	Mauvais	Mauvaise	Mauvaises
Size	**Big**	Grand	Grands	Grande	Grandes
	Small	Petit	Petits	Petite	Petites

C'est où?	Where is it?
Sous	Under
Sur	On
Devant	In front
Derrière	Behind
Dans	In
Entre	Between
En face de	Opposite

C'est où?	Where is it?
Pres de	Near to
À droite de	To the right of
À gauche de	To the left of
Au coin de	In the corner of

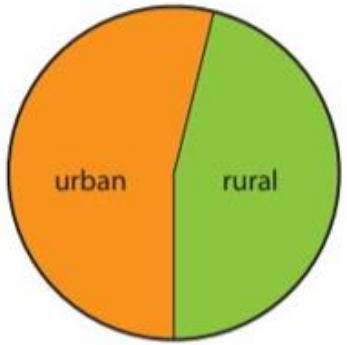
Si j'avais l'argent	If I had the money
Si j'étais riche	If I were rich
Si je gagnais le Loto	If I won the lottery
J'habiterais	I would live
J'achèterais	I would buy
Il y aurait	There would be

Year 9 Topic 5
Urban Contemporary Issues

Make sure you know the 'bare bones' of this unit.

Urban – A densely populated built up area, for example, a town or city
Rural – A sparsely populated area, for example, the countryside
Urbanisation – An increasing percentage of a country's population living in a town or city
Megacity – A city with a population of more than 10 million people
Push factor – A reason why a person is forced away from an area, for example, poverty
Pull factor – A reason why a person is attracted to an area, for example, employment
Social Inequality – The extent to which there are differences between groups in society, related to things such as gender and income.
Deprivation – The damaging lack of material benefits considered to be basic necessities in society
Poverty – Where people struggle to meet daily needs through their income and therefore struggle to participate in society
Brownfield site – Previously sites of industry that have been abandoned and left derelict
Greenfield site - Previously undeveloped sites found on the edge of cities (urban-rural fringe
Energy mix – The range of energy sources of a region or country, both renewable and non-renewable
Landfill site – The disposal of waste material by burying it in the ground
Regeneration – The action or process of regenerating and improving an area

Rates of urbanisation across the world



Since the industrial revolution, urban areas have grown, as people were attracted to find work, usually in factors. During that period, people were forced to move from rural areas due to poverty or lack of work (push factors) and attracted to live in urban centres due to advantages of better healthcare and job prospects (pull factors)

Today, about 54% of humans live in urban areas. By 2050, this figure is likely to be 70%.

Europe and North America were the first continents to have high rates of urbanisation. Asia and Africa have the current highest rates of urbanisation.

Social Inequality

There are a number of strategies in place to help reduce inequality, but social inequality is a huge challenge both nationally and globally.

Income inequality in the UK has risen in the UK faster than any other developed nation. In 2021, the richest 10% of people received 50% more income than the poorest 40%. This has a huge impact on relative poverty.

Income inequality impacts on factors such as health (not everyone will live to the same age, or enjoy a healthy lifestyle), gender (on average, women live years longer than men) and ethnic group.

UK Housing Crisis

Demand for good quality and affordable housing is rising in the UK. This is due to an increasing population, people living longer and social factors, such as people choosing to marry later.

However, the UK has a housing crisis because there are not enough homes and people can't afford the homes they would like to live in.

Houses are becoming increasingly unaffordable to people on low incomes because of rising house prices, spiralling interest rates for mortgages, high private sector rents, and inadequate levels of social housing. This means people are spending a higher amount of their income on housing and less on other basic needs.

Until the 1970s, high rise flats were a common way to home a growing population in a small, inner city area (for example, The Byker Wall). Increasingly, however, high rise flats have been linked with a lack of community and high crime rates.

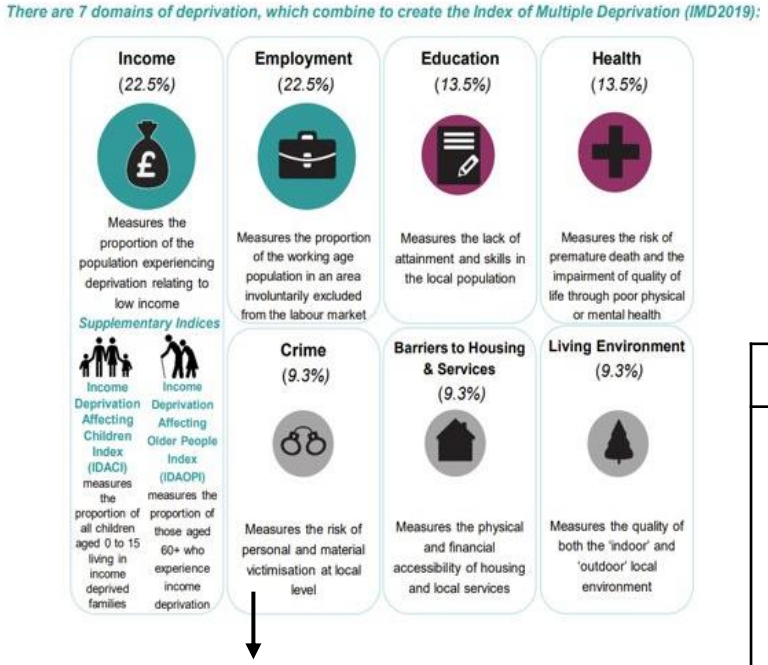
As more housing is needed, the urban-rural fringe is becoming less distinct.

However there is great controversy about building in these greenfield sites since the environment is changed from open space to urban, affecting biodiversity. Some argue inner city brownfield sites should be developed instead.

What is urban deprivation?

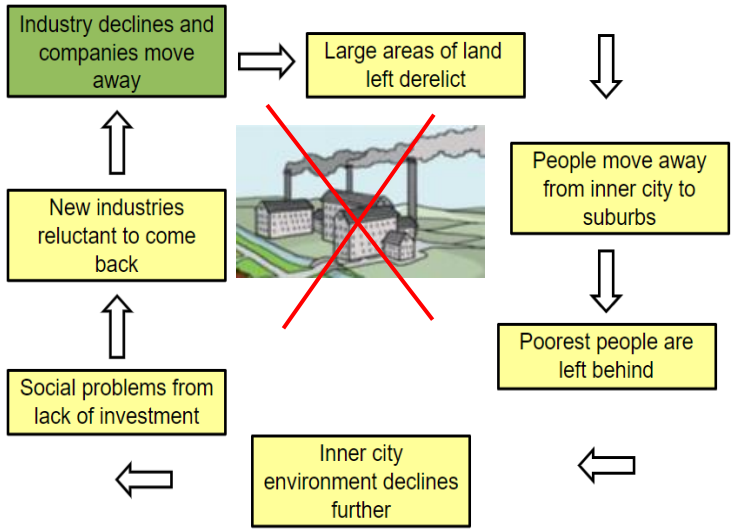
Urban deprivation is defined as a standard of living below that of the majority in a particular society that involves hardship and lack of access to resources.

All the factors that make up quality of life (for example, income, education, levels of crime and health) can be put into an index to show areas that are more deprived than others. This is called The Index of Multiple Deprivation.



An area of multiple deprivation is likely to have a crime rate. **Urban crime** is likely to happen when an area lacks resources and investment, therefore provides the opportunity for crime. The police use GIS (Geographical Information Systems) to map patterns and resulting crime hot spots.

What is the cause of urban deprivation?

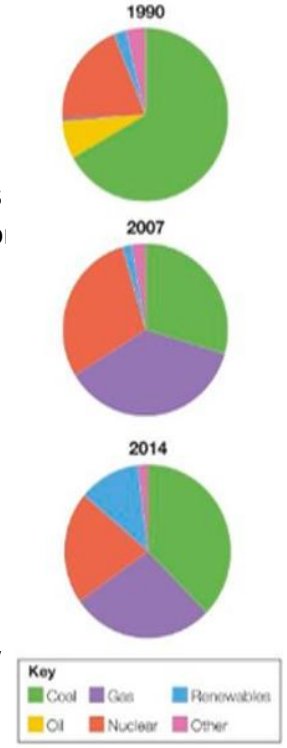


Urban energy

Household energy use has reduced due to homes becoming more energy efficient and people becoming more aware of the environmental costs. However, energy is used increasingly in urban places for transport, to heat homes for a growing populatio and to provide fuel for industries, such as those which make food and clothes.

Fact: Urban areas currently consume around 75% of global primary energy supply, and this is expected to grow

The UK imports most of its energy, and mainly relies on fossil fuels, that are non-renewable, and in thousands of years will run out before being replaced. The UK is investing in renewable energy (including wind, solar and hydro-electricity) and in 2014, this made up a larger share of the UK's energy mix



Urban challenges	Urban solutions
Waste: In HICs like the UK, waste is a growing problem. Items are being replaced often (such as mobile phones and computers) rather than re-used. **Landfill sites** are the most common and oldest form of waste disposal – over 50% of all household waste ends up in the ground; however, waste can take years to decompose, this is not good for the environment, producing greenhouse gases, contaminating soils/water and harming health.	**Waste:** Landfill space is limited and will run out, so it is important to invest in: • Reducing the amount of waste produced • Re-using items rather than replacing them • Recycling raw materials create new products Often recycled goods ends up in landfill because of incorrect labelling or sorting; this is an area for urgent improvement
Traffic: Urban areas have the worst air quality due to high amounts of industry and traffic. In particular, traffic congestion contributes to air pollution due to an increase in the number of cars on the road and the growing number of people who commute to work in city areas, without using public transport. Air pollution causes severe health challenges for people who live in built up areas.	**Traffic:** Traffic management schemes have been introduced including: • Park and ride schemes, • Car pooling • Cycling and Bus lanes • Congestion charges • Traffic Calming

Regeneration

As towns and cities have grown, some areas have become run down and face challenges, such as overcrowding, poor-quality housing, derelict sites (from the loss of industry), traffic congestion, crime and a lack of open space.
Regeneration involves strategies to improve these inner city areas, through construction of infrastructure, development of new housing, refurbishing existing buildings and encouraging investment.

Cast study example: Glasgow

From the late 1960s, Glasgow suffered a slump caused by competition from abroad in industries like ship building. The regeneration of the River Clyde Corridor, through both public and private investment, has changed Glasgow beyond recognition. Architecturally bold structures like the Scottish Exhibition and Conference Centre (SECC) and Tradeston Bridges have altered the water front skyline with striking effect.

New business districts with modern residential (housing) and office spaces have replaced empty yards and have been linked with the bustling city centre by cycle and pedestrian paths. A new lifestyle has been introduced to the river, through quality hotels and shopping centres.

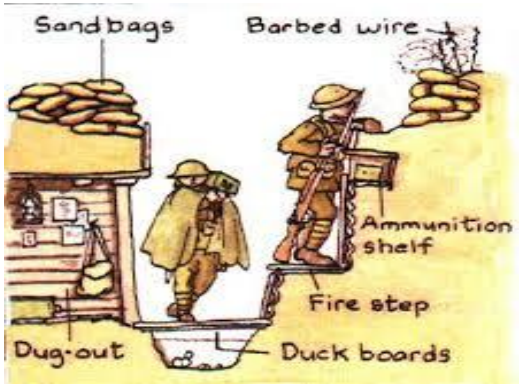
Positives	Negatives
• A reduction in urban sprawl and pressure on greenbelt sites. • Investment in inner city infrastructure, providing job opportunities, improving quality of life for those living in deprived areas.	• Loss of community • Gentrification (where the character of an area changes through wealthier people moving in) can result in local people being prices out of the area, having to move elsewhere.

Year 9

The First World War

1914-1918

Key words	Definitions
The Western Front	The line of **trenches** across France & Belgium.
Artillery bombardment	Heavy guns fired at enemy trenches.
Recruitment Propaganda	Posters & leaflets used to encourage men to join the army.
Going over the top'	Leaving the trench to go into battle.
Conscientious objectors	Someone who refuses to serve in the armed forces on moral or religious grounds.
No man's land	Unoccupied ground between opposing trenches.
Stalemate	When neither side can make any progress; deadlock.
Nationalism	An extreme form of **patriotism** marked by a feeling of superiority over other countries.
Conscription	Compulsory enrolment into the armed forces (Britain, **1916**).
Imperialism	Building an empire
Armistice	Ceasefire; an agreement made to stop fighting. (**November 11th 1918**)



Causes	
The Alliance system	Europe was divided into 2 'teams': The Triple Alliance & the Triple Entente.
The arms race	Competition between countries to have the best armed forces.
The naval race	Rivalry between Britain & German to have the best navy. Both sides built **Dreadnoughts.**
Assassination at Sarajevo	28 June 1914: **Archduke Franz Ferdinand** was killed by **Gavrilo Princip**, a member of the **Black Hand Gang**.

The Battle of the Somme

141 days (July-November 1916). The first day, July 1, was the bloodiest in the British Army's history, with 20,000 deaths & 60,000 casualties. In total there were **400,000 deaths** & **1.3 million casualties**.

The Allies **bombarded** German trenches for 7 days, firing over 1.5 million shells. They then sent 100,000 men over the top to attack the German lines. The **bombardment failed to destroy the German trenches**. As British troops advanced, they were **mown down** by machine gun & rifle fire. This was the first battle where **tanks** were used, & many got stuck in the mud. **General Haig** has been labelled 'Butcher of the Somme.'

Conditions in the trenches

The trenches were dirty, smelly and riddled with disease. Cholera & **trench foot** were common. **Trench fever** was spread by **body lice**. There were millions of **rats**. Many men suffered from **shell shock**. Trench life included long periods of **boredom** mixed with moments of **terror**. **Gas attacks** could kill soldiers or cause temporary blindness. Soldiers mainly ate **bully beef**, bread & biscuits.

Year 9: Inter War Years and Rise of Hitler

Timeline

1	9th Nov 1918	Kaiser abdicates (leaves throne) and flees Germany.
2	9th Nov 1918	Weimar Republic is set up.
3	11th Nov 1918	WWI ends. Armistice agreed after German surrender.
4	Jan 1919	Spartacist Uprising (left wing) in Berlin and other cities. Crushed by army and the Freikorps.
5	26th Jun 1919	Treaty of Versailles is signed.
6	3rd Mar 1920	Kapp Putsch – attempted takeover by Freikorps led by Wolfgang Kapp. Failed due to lack of support.
7	Jan 1923	Ruhr Crisis – France invades the Ruhr over reparations leading to huge problems in Germany.
8	Jun 1923	Hyperinflation causes huge social and economic problems.
9	Aug 1923	Gustav Stresemann becomes Chancellor (but only for 3 months!)
10	Nov 1923	The Munich Putsch – The Nazis try to overthrow the Bavarian government and cause a revolution. They fail. 16 Nazis are killed and Hitler is arrested.
10	Sep 1924	Stresemann signs the Dawes plan which ends hyperinflation.
11	Dec 1925	Germany signs Locarno Pact with France, Britain, Belgium and Italy
12	June 1929	Young plan agreed.
13	Oct 1929	Wall Street crash leads to the Great Depression.

Key Individuals

14	Friedrich Ebert	First Chancellor of Germany and later President.
15	Gustav Stresemann	Chancellor (Aug-Nov 23) and Foreign minister (1923 - 1929). Solved hyperinflation and Ruhr crisis. Brought period of stability to Germany.
16	Kaiser Wilhelm II	King of Germany, who fled Nov 1918.

Key Words/Terms

	Armistice	Agreement to stop fighting. Germany asked for it in 1918.
	November Criminals	Name given to the Weimar politicians who accepted the armistice which ended WWI.
	Constitution	The system of laws and rules in a country.
	Reichstag	The German Parliament.
	Article 48	Gave President emergency powers in times of crisis.
	Proportional Representation.	The number of votes won in an election, determined the number of seats in the Reichstag.
	Chancellor	Head of Government, chosen by the President.
	President	Head of state and military, voted by people, could use Article 48 and had power to dismiss government.
	Coalition	A government of two or more political parties.
	Extremist	Groups that believe in violent or radical ideas.
	Communism	Left wing groups who believe everybody should be equal in the country and it should be run for the workers.
	Fascism	Right wing groups who believe in a strong ruling leader.
	Freikorps	WWI veterans who formed private armies.
	Spartacists	Revolutionary communists who wanted Germany to be run by the working classes. Led by Rosa Luxemburg.
	Putsch	A violent attempt to overthrow the government.
	Reparations	£6.6 bn fine placed on Germany following Versailles Treaty.
	Demilitarised	No military forces are allowed in the area.
	Article 231	The Versailles 'War guilt clause' blaming Germany for WWI.
	Hyperinflation	Extremely high inflation, where prices rise and the value of money plummets and it becomes worthless.
	Rentenmark	Temporary currency introduced by Stresemann to end hyperinflation.

Year 9: Inter War Years and Rise of Hitler

Timeline

1	Sep 1919	Hitler joins German Workers party (DAP)
2	Feb 1920	The DAP is renamed the National Socialist German Workers party (NSDAP) – known as the Nazis.
3	Feb 1920	The Nazis publish their 25 point programme
4	Jul 1921	Hitler becomes leader of the Nazi party
5	Nov 1921	The SA (also known as brownshirts or stormtroopers) are set up as the Nazis armed militia.
6	Nov 1923	The Munich Putsch – The Nazis try to overthrow the Bavarian government and cause a revolution. They fail. 16 Nazis are killed and Hitler is arrested.
7	Feb 1924	Hitler imprisoned in Lansberg but only serves 10 months.
8	Dec 1924	Hitler releases 'Main Kampf' and is released from prison.
9	May 1928	The Nazis get 12 seats in the Reichstag.
10	Oct 1929	Wall Street crash leads to the Great Depression.
11	Sep 1930	Unemployment reaches 3m. Nazis get 106 seats in Reichstag.
12	Apr 1932	Hitler comes runner up in Presidential election. 13.4m votes.
13	Jul 1932	Unemployment reaches 6m, Nazis get 230 seats in Reichstag.
14	30th Jan 1933	Hitler is appointed Chancellor of Germany

Key Individuals

15	Anton Drexler	Founder of the DAP (later the Nazi party)
16	Joseph Goebbels	Head of Nazi propaganda
17	Ernst Rohm	Leader of the SA
18	Paul von Hindenburg	President of Germany, 1926-34
19	Kurt von Schleicher	Chancellor of Germany; June-November 1932

Key Words/Terms

20	Communism	Ideology violently opposed to the Nazis. They promised to destroy it if they came to power. The German communist party was known as the KPD.
21	Anti-Semitism	Hatred and persecution of the Jews
22	Fuhrerprinzip	The idea that the Nazi party and Germany should have one leader obeyed by all.
23	Great Depression	Slump in the economy in the 1930s which led to high unemployment.
24	Manifesto	A public declaration of a political party's policies.
25	Reich	German Empire
26	Reichstag	German Parliament
27	SA	Sturmabteilung – the paramilitary 'storm troopers' of the Nazi party.
28	SS	Schutzstaffel – Nazi paramilitary organization who acted as Hitler's personal bodyguard.
29	Swastika	Emblem of the Nazi Party.
30	Third Reich	Nazi name for Germany. Means 'Third Empire.'
31	Wall Street Crash	Panic selling of more than 16 million shares in October 1929. Led to world economic crisis.
32	Mein Kampf	Book written by Hitler in prison setting out his beliefs and vision for Germany.
33	Putsch	Attempted takeover of the Government.
34	General Election	Democratic process whereby the people cast their vote for who they want to represent them in the Reichstag.
35	Propaganda	Information, often misleading, spread with the intention of promoting a political cause or point of view.

Year 8: The Holocaust

Key Vocabulary	Definitions
Genocide	The deliberate killing of a large group of people, especially those of a particular nation or ethnic group.
Concentration Camp	A camp where people had to do forced labour.
Auschwitz-Birkenau	A Nazi Concentration and extermination camp, became a major site of the Nazi Final Solution to the Jewish Question.
Ethnic Cleansing	Systematic killing of a racial or cultural group.
Warsaw Ghetto	A section of a city which Jews were forced to live in.
Holocaust	The mass murder of Jews and other minority groups under the German Nazi regime from 1941 until 1945.
Deportation	Forced removal often through transportation.
Death Camp	A camp where people were killed immediately upon arrival.
Gas Chamber	A method of killing Jews in Death Camps.
Anti-Semitic	To be hostile to or prejudiced against Jews.

Jewish Life in Nazi Germany

The Jews in Nazi Germany suffered appallingly after January 1933.Some rich Jews could afford to leave Nazi Germany (or were forced to) but many could not.

1933 March 31: A decree in the city of Berlin said that Jewish doctors were suspended from the city's charity services.

1933 April 7: There was a law for the Restoration of the Professional Civil Service. This law removed all Jews from government service.

1933 July 14: The Jewish people lost citizenship because of a Denaturalization Law.

1935 September 15: The Nazi leaders announced the Nuremberg Laws. These laws excluded Jews from having citizenship and marrying or having sex with German women. They also deprived the Jews of basic political rights such has voting rights.

Warsaw Ghetto

The Warsaw Ghetto was the largest ghetto in Nazi-occupied Europe. The Warsaw Ghetto was established on the orders of Hans Frank who was the most senior Nazi in Poland after the success of the invasion that started on September 1st 1939. Frank ordered that all the Jews in Warsaw and the surrounding areas had to live in specified areas within the city boundaries, these were the Ghettos. To begin with it is thought that about 400,000 Jews were forced to live within the ghetto.

The Final Solution

This was the Nazi policy of exterminating European Jews. Introduced by Heinrich Himmler and administered by Adolf Eichmann, the policy resulted in the murder of 6 million Jews in concentration camps between 1941 and 1945.

Anne Frank

Anne was a German-born Jew. One of the most discussed Jewish victims of the Holocaust, she gained fame much later following the publication of *The Diary of a Young Girl* (originally *Het Achterhuis;* English: *The Secret Annex*), in which she documents her life in hiding from 1942 to 1944, during the German occupation of the Netherlands in World War II.

The Liberation of the Camps

Soviet soldiers were the first to **liberate concentration camp** prisoners in the final stages of the war. On July 23, 1944, they entered the Majdanek **camp** in Poland, and later overran several other killing centers. On January 27, 1945, they entered **Auschwitz** and there found hundreds of sick and exhausted prisoners.

Nazi Propaganda

Hitler established a Reich Ministry of Public Enlightenment and Propaganda headed by Joseph Goebbels. The Ministry's aim was to ensure that the Nazi message was successfully communicated through art, music, theatre, films, books, radio, educational materials, and the press. By the late 1930s, the increasingly fanatical tone of Nazi propaganda reflected the growing radicalisation of the regime's anti-Semitic policies. The Jewish stereotypes shown in such propaganda served to reinforce anxieties about modern developments in political and economic life, without bothering to question the reality of the Jewish role in German society.

1933 — **Denaturalization Law the**

1935 — **The Nuremburg Laws.**

1939 — **Jews are placed Warsaw Ghetto**

1941 — **The Final Solution begins**

1945 — **Liberation of Camps**

Year 9– Post War Britain- Present

Key Vocab	Definitions
Welfare State	Labour Government passed a series of measures which aimed to take care of the British people 'from the cradle to the grave' (ie. from birth to death).
New Towns Act	In 1946, the United Kingdom Government passed The New Towns Act, allowing the government to **designate certain areas of land to become "new towns"**..
Independence	To be free from outside control.
Commonwealth	An international association consisting of the UK together with states that were previously part of the British Empire, and dependencies.
Decade	A period of 10 years.
Peter Lee	The town of Peterlee was named after a prominent East Durham man, who was a miners' leader, metho dist preacher, local councillor and trade unionist.

Post War

On 8 May 1945, **Victory in Europe** was celebrated with universal joy and relief across Britain after six years of conflict and sacrifice. However, the country and its people still faced a number of challenges.
One of the key challenges facing the UK in 1945 was the economic position of the country. Life changes dramatically with the introduction of the labour government, Beveridge report, **creation of the NHS** and more.
Between 1945 and 1951, the Labour Government passed a series of measures which became known as the '**Welfare State'**.
This refers to the fact that the Government took **responsibility for looking after the well-being of all its citizens.**
The reforms made were designed to take care of the British people 'from the cradle to the grave' (ie. from birth to death).
The Labour Government introduced a number of reforms and changes in order to attempt to tackle the Five Giants - disease, want, squalor, ignorance and idleness.

Life in the 1950s

Life was tough in the first few years after the second world war as you have seen in the last few lessons. Basic goods such as meat, sugar and clothing were still rationed and few luxuries were available. Even bread was still rationed for a while.
But with careful Government control and loans from the USA, things began to improve.

Life in the 1960s

The 1960s was also known as the 'swinging sixties'. The sixties saw television and motor cars become even more popular than before. Men's hair became longer and the Beatles 'boy band' took the world by storm. There were lots of jobs in the 1960s and young people had money to spend on music, entertainment and clothes.

Life in the 1970s

The decade of the 1970s is well known for crazy, multi-coloured fashions and new types of music and technology. Jobs became harder to find because many factories were closed down, workers went on strike .

Life in the 1980s

The 1980s was the decade of the BMX bike, the chunky mobile phone and the birth of CDs, cheaper games consoles and rap music. Britian had its first female Prime Minister Margaret Thatcher.
1980's Britain heralded the age of computer technology.
Building on a history of space travel in the 70's, when we sent a man to the moon, the 80's began in a confident and pioneering spirit.

Life in the 1990s

The decade of the 1990s saw the end of the cold war and the launch of the national lottery. 24hour shopping began. Mobile phones became much smaller, cheaper and popular and the internet began

Life in the 2000s

The 21st century has seen a dramatic change in the way people live their lives. Since 1901 the population has grown leading to ever-expanding towns and cities and increased pressure on services such as healthcare and power supplies. Advances in technology have also changed people's lives in all sorts of new ways – at home, work and school.

1945 End of World War Two.

1946 New Towns Act

1948 Creation of NHS

1951 Winston Chruchill re-elected.

1946-1951 Creation of Welfare State

Knowledge Organisers and Practice questions

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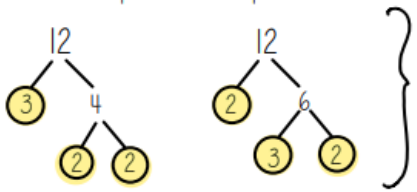
Year 9 Higher Topic 1 Factors and Multiples Student Knowledge Organiser

Key words and definitions

Factor: a number that divides into another number exactly and without leaving a remainder.
Prime number: A prime number has only two factors - the number itself and 1. 1 is not a prime number
Multiple: This is the result of multiplying a number by an integer. The times tables of a number.
Product: the result when terms are multiplied together
Error Interval: the range of values a number could have taken before being rounded or truncated

Product of Prime Factors

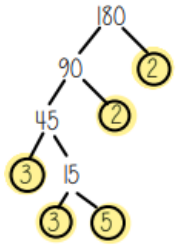
Example 1
Write 12 as a product of it's prime factors



Both of these trees represent the same decomposition

$12 = 2 \times 2 \times 3$
$= 2^2 \times 3$

Example 2
Write 180 as a product of it's prime factors



$180 = 2 \times 2 \times 5 \times 3 \times 3$
$= 2^2 \times 3^2 \times 5$

Always try to write your final answer in ascending order using index notation!

Using prime factor decomposition
If we know that 12 written as a product of it's prime factors, how does that help us to write 36 as a product of it's prime factors?

We know $12 \times 3 = 36$ therefore we can multiply our answer by three and
$36 = 2 \times 2 \times 3 \times 3$
$= 2^2 \times 3^2$

What about 120?
Well 120 is 10 x 12 so we can say
$120 = 2 \times 2 \times 3 \times 10$
$= 2^3 \times 3 \times 5$

Remember $10 = 2 \times 5$

Lowest Common Multiple

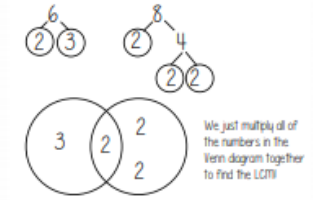
Example 1
What is the LCM of 6 and 8?

6 - 6, 12, 18, 24, 30
8 - 8, 16, 24, 32, 40

The first time their multiples match is 24 therefore

the LCM of 6 and 8 is 24

Example 2
What is the LCM of 6 and 8?



LCM of 6 and 8 = $3 \times 2 \times 2 \times 2$
$= 24$

Highest Common Factor

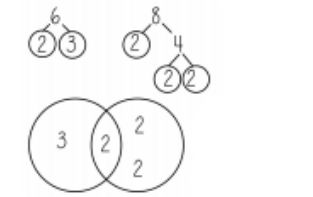
Example 1
What is the HCF of 6 and 8?

6 - 1, 2, 3, 6
8 - 1, 2, 4, 8

The biggest number which is a factor of both 6 and 8 is 2, therefore

the HCF of 6 and 8 is 2

Example 2
What is the HCF of 6 and 8?



HCF of 6 and 8 = 2

Hegarty Maths Links

Product of Prime Factors: 29-30
HCF: 31-32 and LCM: 34-36
Rounding to Significant Figures: 130
Error Intervals: 774 – 777
Bounds Calculations: 137 - 139

Rounding – Decimal Places

2.46192 (to 2dp) - Is this closer to 246 or 247

246 247

2.46 192

This shows the number is closer to 2.46

Rounding – Significant figures

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00000037 to 1 significant figure is 0.0000004

We count significant figures from the first non-zero digit

Error Intervals

An error interval is a way of representing the upper and lower bounds of a value as an **inequality**.

Eg: w has been rounded to 6.4cm correct to one decimal place. Lower Bound = **6.35** Upper Bound = **6.45**

The error interval for w is: $6.35 \leq w < 6.45$

Calculations with Bounds

A = 30 to nearest whole number **LB = 29.5** **UB = 30.5**
B = 11.5 to 1 decimal place **LB = 11.45** **UB = 11.55**
C = 300 to 1 significant figure **LB = 250** **UB = 350**

Calculate the **maximum** value of **A + B**
UB of A + UB of B = 30.5 + 11.55 = 42.05

Calculate the **minimum** value of **A x C**
LB of A x LB of B = 29.5 x 250 = 7375

Calculate the **maximum** value of **C ÷ B**
UB of C ÷ LB of B = 350 ÷ 11.45 = 30.57 (2dp)

Year 9 Higher Topic 1 Factors and Multiples Student Knowledge Organiser

Product of prime factors

Write the following as the product of their prime factors

(a) 70
(b) 90
(c) 24
(d) 126
(e) 75
(f) 84
(g) 99
(h) 500

HCF and LCM

By expressing the following numbers as products of their prime factors and then drawing a Venn diagram, can you find the HCF and LCM of:

(a) 12 and 28
(b) 28 and 42
(c) 48 and 64
(d) 15 and 25
(e) 12 and 32
(f) 30 and 105
(g) 28 and 126

(h) The lowest common multiple of two numbers is 36, one number is 12, what might the other number be?

(i) Jack thinks of two numbers, the HCF of these numbers is 6 and one of the numbers is 24 suggest what his other number may have been.

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Rounding – decimal places and significant figures

Round the following numbers to the given number of decimal places:

(a) 4.763 (1dp)
(b) 0.543 (2dp)
(c) 12.895 (2dp)
(d) 2.956 (2dp)
(e) 7.895 (2dp)
(f) 1.998 (2dp)
(g) 1.005 (2dp)
(h) 0.0996 (3dp)

Round the following numbers to the given number of significant figures:

(a) 36.937 (3sf)
(b) 20643 (2sf)
(c) 19.6754 (4sf)
(d) 23139 (3sf)
(e) 258 (2sf)
(f) 0.04319 (2sf)
(g) 0.00348 (2sf)
(h) 7999032 (1sf)

By rounding all values in the calculation to 1 significant figure, **estimate** the answers to the following calculations:

(a) $\dfrac{480 \times 1.94}{4.7 \times 3.8}$

(b) $\dfrac{164.7 \times 4.2}{8.24 \times 2.09}$

(c) $\dfrac{5.79 \times 312}{0.523}$

(d) $\dfrac{29.8 \times 4.1}{0.21}$

Error Intervals

1. The number of passengers on a coach, *g*, rounded to the nearest 10 is 70 people. Write down the error interval for *g*

2. A number, *g*, rounded to the nearest whole number is 241. Write down the error interval for *g*

3. The density of an alloy, *m*, correct to 2 significant figures is 5.9g/cm^3. Write down the error interval for *m*

4. A number, *p*, **truncated** to 2 decimal places is 13.19. Write down the error interval for *p*

5. The weight of a pencil case, *w*, rounded to the nearest 100g is 900g. Write down the error interval for *w*

Bounds Calculations

Question 1

$m = \dfrac{1}{ps}$

p = 5.37 correct to 2 decimal places.
s = 2.9 correct to 1 decimal place.

Calculate the upper bound for the value for m. You must show your working.

Question 2

$r = p + \dfrac{1}{q}$

p = 4.3 correct to the nearest 0.1
q = 0.4 correct to the nearest 0.1

Work out the upper bound for r. You must show all your working.

Question 3

$D = \dfrac{x}{y}$

x = 99.7 correct to 1 decimal place.
y = 67 correct to 2 significant figures.

Calculate the lower bound for the value of D. You must show your working.

Year 9 Higher Topic 2 Indices and standard form Student Knowledge Organiser

Key words and definitions

Base – The number that gets multiplied by a power
Index number - number that is multiplied by itself one or more times is raised to a power. The power is the index number. The plural is indices.
Standard Form – A system used to write both large and small numbers as a number between 1 and 10 multiplied by a power of 10
Integer – A whole number
Reciprocal – The reciprocal of a number is 1 divided by the number. A number multiplied by its reciprocal will always give an answer of 1.

Index Laws

Rule	
$a^m \times a^n = a^{m+n}$	$2^5 \times 2^3 = 2^8$
$a^m \div a^n = a^{m-n}$	$5^7 \div 5^3 = 5^4$
$(a^m)^n = a^{m \times n}$	$(10^3)^7 = 10^{21}$
$a^1 = a$	$17^1 = 17$
$a^0 = 1$	$34^0 = 1$

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Negative Indices

Rule

$a^{-m} = \frac{1}{a^m}$

a^{-m} is the reciprocal of a^m

Examples

$9^{-2} = \frac{1}{9^2} = \frac{1}{81}$

$\left(\frac{1}{3}\right)^{-3} = \left(\frac{3}{1}\right)^{3} = 27$

Fractional Indices

$a^{\frac{1}{m}} = \sqrt[m]{a}$

$a^{\frac{n}{m}} = \left(\sqrt[m]{a}\right)^n$

$25^{\frac{1}{2}} = \sqrt{25} = 5$

$25^{\frac{3}{2}} = \left(\sqrt{25}\right)^3 = 5^3 = 125$

$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

$(8x^2)^{\frac{1}{2}} = \sqrt{8x^2} = 9x$

Negative Fractional Indices

$8^{-\frac{1}{3}} = \frac{1}{8^{\frac{1}{3}}} = \frac{1}{2}$ (Remember this means the cube root of 8)

$25^{-\frac{3}{2}} = \frac{1}{25^{\frac{3}{2}}} = \frac{1}{5^3} = \frac{1}{125}$

Think about what the negative in the power does first.

Standard Form Conversions

Numbers in standard form should always be written in the following format:

$A \times 10^n$ (This power is always an integer; A is 1 or greater, but less than 10)

Write 32 000 000 in standard form:

$32\,000\,000$
$= 3.2 \times 10\,000\,000$
$= 3.2 \times 10^7$

Write 8.35×10^{-3} as an ordinary number:

8.35×10^{-3}
$= 8.35 \times 0.001$
$= 0.008\,35$

Standard Form Calculations

Add and Subtract

$6 \times 10^5 + 8 \times 10^5$
$= (6 + 8) \times 10^5$
$= 14 \times 10^5$
$= 1.4 \times 10^1 \times 10^5$
$= 1.4 \times 10^5$

The powers **must** be the same before we add or subtract

Be careful! This is **not** standard form!

Multiply and Divide

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$

For multiplication and division you can look at the values of A and the powers of 10 as separate calculations.

$(1.5 \times 10^5) \div (0.3 \times 10^3)$
$15 \div 0.3 \times 10^5 \div 10^3$
$= 5 \times 10^2$

Hegarty Maths Links

Index Laws: 102-107
Negative Indices: 104
Fractional Indices: 108-109
Standard Form Conversions: 122-124
Calculations with Standard Form: 125-127

Year 9 Higher Topic 2 Indices and standard form Student Knowledge Organiser

Index Laws

Simplify the following:

(a) $2^2 \times 2^2$ (b) $2^2 \times 2^3$ (c) $2^6 \times 2^2$

(d) $5^7 \div 5^5$ (e) $5^3 \div 5$ (f) $5^8 \div 5$

(g) $(8^6)^6$ (h) $(8^9)^2$ (i) $(8^4)^8$

Simplify the following using index laws:

$b^4 \times b^{12} \times b^2$

$a^2 \times b^3 \times a^{10} \times b^4$

$a(a^3 \times (a^6)^3)$

$(a^3)^3 \times (a^4)^2$

$b^2(b^8 \div (b^2)^2)$

$(d^5)^2 \div d^8$

$(a^5)^5 \div (a^{13})^2$

$4a \times 5a$

$3a^2 \times 5a^3$

$40b^2 \div 2b$

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Negative Indices

Evaluate the following:

(a) 5^{-2} (b) 2^{-1} (c) 2^{-3}

(d) 4^{-2} (e) 3^{-3} (f) 6^{-1}

Write each of the following as fractions:

(a) a^{-2} (b) y^{-1} (c) w^{-4}

(d) 2^{-x} (e) 5^{-a} (f) x^{-n}

Fractional Indices

Evaluate the following:

(a) $25^{\frac{1}{2}}$ (b) $81^{\frac{1}{2}}$ (c) $4^{\frac{1}{2}}$

(d) $144^{\frac{1}{2}}$ (e) $8^{\frac{1}{3}}$ (f) $125^{\frac{1}{3}}$

(a) $8^{-\frac{2}{3}}$ (b) $25^{-\frac{3}{2}}$ (c) $64^{-\frac{2}{3}}$

Evaluate the following:

$\left(\frac{25}{36}\right)^{1/2}$ $\left(\frac{27}{125}\right)^{2/3}$ $25^{-1/2}$ $\left(\frac{8}{27}\right)^{-2/3}$

Converting Standard Form

Convert to standard form

(e) 100000000 (f) 900 (g) 250000

(i) 54000000 (j) 11000000 (k) 89000

(e) 0.00065 (f) 0.0022 (g) 0.0361

(i) 0.00000423 (j) 0.0000000981 (k) 0.00407

Convert from standard form

(e) 5×10^7 (f) 1.2×10^2 (g) 2.9×10^5

(i) 3.16×10^{-5} (j) 8.62×10^{-4} (k) 7.09×10^{-6}

Standard Form Calculations

Without using a calculator, work out the following:

(a) $3.57 \times 10^3 \times 6.7 \times 10^7$ (b) $9.5 \times 10^4 + 3.8 \times 10^5$

(c) $1.8 \times 10^9 \times 5.2 \times 10^9$ (d) $7 \times 10^{-8} \times 2 \times 10^{-6}$

(e) $(7.71 \times 10^{15}) \div (6 \times 10^4)$ (f) $(8 \times 10^9)^3$

(g) Write these numbers in order of size. Start with the smallest number.

2.5×10^2 0.0025 2.5×10^{-2} 2500

(h) Write these numbers in order of size. Start with the smallest number.

0.0034×10^5 34×10^{-5} -3.4×10^{-3} 3.4×10^4 34×10^2

Year 9 Higher Topic 3 Expressions Student Knowledge Organiser

Key words and definitions

Simplify – reduce an algebraic expression to its simplest terms

Expand – Multiply to remove the brackets from an expression

Factorise – Put brackets into an expression by identifying the common factors of the terms in the expression

Quadratic – An equation of expression where the unknown is raised to the power of 2 (it is squared)

Expanding and simplifying single brackets

Expand $-3(2x + 4)$.

Solution

Multiply the **first term.** $-3(2x + 4)$ Multiply the **second term.**

$= -6x - 12$

Expand and simplify $x(x + 4) - 3(x - 2)$

$x(x + 4) - 3(x - 2)$

Expand as single brackets.

$= x^2 + 4x - 3x + 6$

$= x^2 + x + 6$

Simplify by collecting like terms

Factorising Single Brackets

Factorise $2ab + 4b$.

Find the **HCF** of the **variables.** $2ab + 4b$

$= 2b(a + 2)$

HCF $= 2$

HCF $= b$

Divide each term by the **HCF**s and **close the bracket.**

Only **'open the brackets'** once **all HCFs are found.**

Expanding Double Brackets

Outer, First, Inner, Last

$(x + 3)(x + 4)$

First
Outer
Inner
Last

$=$

$= x^2 + 4x + 3x + 12$

$= x^2 + 7x + 12$

Expand Triple Brackets

Expand and simplify $(x + 1)(x + 2)(x + 3)$

Expand the first **two brackets only.**

$(x + 1)(x + 2)(x + 3)$

$= x^2 + 2x + x + 2$

$= x^2 + 3x + 2$

Expand the **result with the next bracket.**

$(x^2 + 3x + 2)(x + 3)$

$= x^3 + 3x^2 + 3x^2 + 9x + 2x + 6$

$= x^3 + 6x^2 + 11x + 6$

Hegarty Maths Links

Expand Single Brackets: 160-161
Factorise Single Brackets: 168-169
Expand Double Brackets: 162-164
Expand Triple Brackets: 166
Factorise Quadratics: 223-228
Difference of two squares: 165 and 224

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Factorise Quadratics

Factorise $x^2 + 9x + 18$

$x^2 + 9x + 18$

$= (x + 6)(x + 3)$

Write a **list** of **factor pairs** of the **constant term.**

Factors of 18
1, 18
2, 9
3, 6

Choose the pair that **sum to "+9".** These numbers go in the brackets

Factorising more challenging Quadratics

Factorise $5x^2 + 2x - 3$

Multiply the **coefficient of x^2** by the **constant term** & write a **list** of **factor pairs.**

Choose the pair that can be **used to make "+2".**

Set up the **double brackets using** the **coefficient of x^2.**

$5x^2 + 2x - 3$

$\Rightarrow (5x + 5)(5x - 3)$

5

$= (x + 5)(5x - 3)$

$5 \times (-3) = -15$

Factors of 15
1, 15
3, 5

$5x \times 5x = 25x^2$ so we need to **divide** the **brackets by their HCFs to get our final answer**

The difference of two squares

$a^2 - b^2 = (a + b)(a - b)$

Factorise $x^2 - 16$

$= x^2 - 4^2$ $16 = 4^2$

$= (x + 4)(x - 4)$

Factorise $4x^2 - 81y^2$

$= (2x)^2 - (9y)^2$

$= (2x + 9y)(2x - 9y)$

Year 9 Higher Topic 3 Expressions Student Knowledge Organiser

Expanding and factorising Single Brackets

Expand and simplify where possible:

[a] $a(a+6)$

[b] $r(2r+7)$

[c] $s(3s-1)$

[d] $-h(h+5)$

[a] $5(x+6)-3(x-1)$

[b] $7(x-5)+6(x+2)$

[c] $2(x+1)-2(x-1)$

[d] $3(x+3)+(x-8)$

Fully factorise the following expressions

[a] $3d+12$

[b] $6-9h$

[c] $12-18e$

[d] $14+35r$

[e] $2x^2y^2+6xy^2$

[f] $14u^3t-21u^2t$

[g] $9x^2+3x-6xy^2$

[h] $4p^2q-6pq^3+2pq$

Expanding Double Brackets

Expand and simplify the following:

[a] $(x+4)(x+1)$ **[b]** $(x-9)(x+2)$

[c] $(x+3)(x+6)$ **[d]** $(x-3)(x-2)$

[e] $(x+7)(x-2)$ **[f]** $(x+5)(x-10)$

Expand and simplify the following:

[a] $(3x-2)(x+6)$ **[c]** $(2x-1)(3x+2)$

[b] $(4x+3)(2x-5)$ **[d]** $(5x-3)^2$

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Expanding Triple Brackets

Expand the following sets of triple brackets

[a] $(x+1)(x-2)(x-3)$

[b] $(x-1)(x+2)(x+3)$

[c] $(x+1)(x-2)(x+3)$

[d] $(x-1)(x+2)(x-3)$

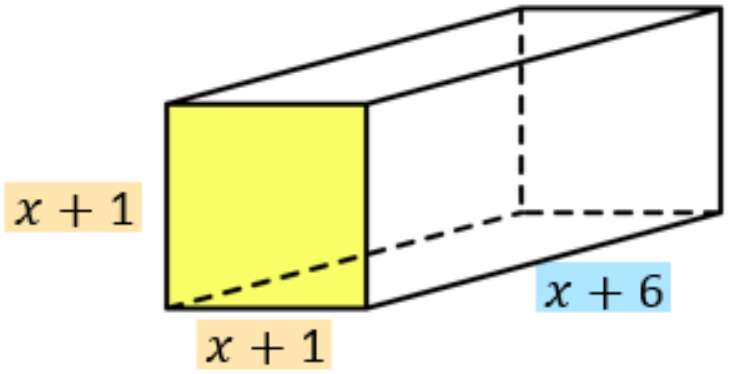
[f] $(x+1)(x-1)^2$

[g] $(x-4)^2(x+2)$

[h] $(x+1)^2(x-5)$

[i] $(x+2)^3$

Write a simplified expression for the volume of the following cuboid.



Factorising Quadratics

Factorise the following expressions:

[a] x^2-5x+6

[b] $x^2+14x+48$

[c] $x^2-8x+12$

[d] $x^2+19x+88$

[e] $x^2-21x+110$

[f] x^2+2x+1

[g] $x^2+14x+24$

[h] $x^2+15x+56$

[i] $x^2-13x+40$

[j] $x^2-17x+42$

[k] $x^2+4x+16$

[l] $x^2-16x+15$

[m] $x^2+20x+75$

[n] $x^2+23x+120$

[o] $x^2-20x+96$

[p] $x^2+17x+52$

Factorising Harder Quadratics

Factorise the following expressions:

[a] $6x^2-13x+5$

[b] $12x^2-7x+1$

[c] $9x^2-9x-4$

[d] $6x^2+7x-3$

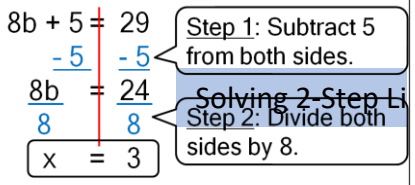
[e] $9x^2+15x+4$

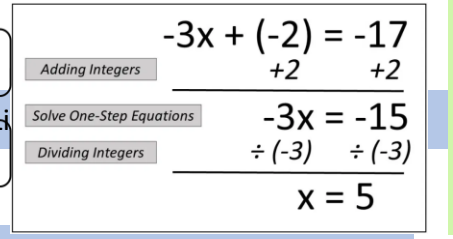
[f] $12x^2+13x-4$

Year 9 Higher Topic 4 Equations Student Knowledge Organiser

Key words and definitions

Equation: An equation says that two things are equal
Expression: Is a set of terms combined using the operations
Variable: A symbol (usually a letter) standing in for an unknown value
Linear: Linear functions are those whose graph is a straight line
Subject: The variable that is being worked out
Inequality: Compares two values, showing if one is less than, greater than, or simply not equal to another value
Integer: Whole number





Solving Equations using Cross-Multiplication

Ex1 Solve,

Solution

$\frac{3x-1}{x+2} = 2$

$\times (x+2)$ $\times (x+2)$

$3x - 1 = 2(x+2)$

Expand

$3x - 1 = 2x$

$-2x$ $-2x$

$x - 1 = 4$

$+1$ $+1$

$x = 5$

Multiply to remove the denominator.

Ex3 Solve,

Solution

$\frac{4x+2}{2x-3} = 10$

$\times (2x-3)$ $\times (2x-3)$

$4x + 2 = 10(2x-3)$

Expand

$4x + 2 = 20x$

$-4x$ $-4x$

$2 = 16x - 30$

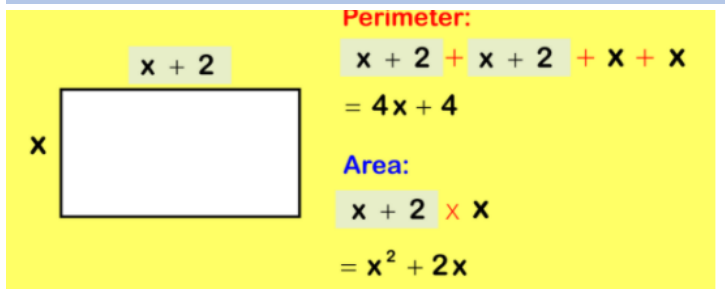
$+30$ $+30$

$\frac{32}{16} = \frac{16x}{16}$

$2 = x$

Multiply to remove the denominator.

Forming Equations



The sum of (x + 2), (x + 3) and (x + 4) is 21.
Work out x.

$x+2+x+3+x+4=21$

$3x+9=21$

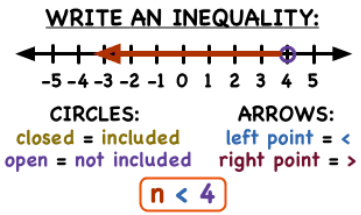
$3x=12$

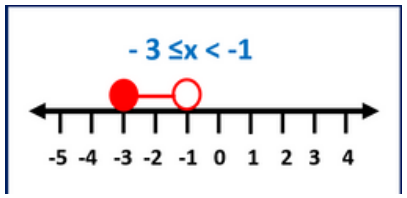
$x=4$

Inequalities

Greater than	$>$	Greater than or equal to	$\geq$
Less than	$<$	Less than or equal to	$\leq$
Not equal to	$\neq$		

Inequalities on a Number Line





Solving Inequalities

Solving Two-Step Inequalities

1. Add or subtract to isolate the variable term.
2. Multiply or divide to solve for the variable. If multiply or divide by a negative number then reverse the inequality symbol.

Example:

$-3x+5 \leq -16$

$-5 \quad -5$ Subtract

$-3x \leq -21$

$\frac{-3x}{-3} \geq \frac{-21}{-3}$ Divide by -3, reverse inequality

$x \geq 7$

Changing the Subject of the Formula

Make 'x' the subject of this formula $y = 3x + 5$

$y = 3x + 5$ (-5) (Subtract 5 from both sides)

$y - 5 = 3x$ $(\div 3)$ (Divide both sides by 3)

$\frac{y-5}{3} = x$ or $x = \frac{y-5}{3}$

Make c the subject

$A = 3b + 3c$

$A - 3b = 3c$

$\frac{A-3b}{3} = \frac{3c}{3}$

$\frac{A-3b}{3} = \frac{3c}{3}$

$\frac{A-3b}{3} = c$

Expand

Subtract 3b

Divide by 3

Cancel out on the RHS

Hegarty Maths Links

Solving Linear Equations: 179-186
Forming Equations: 188
Inequalities on a Number Line: 265 & 267
Solving Inequalities: 269-271
Changing the Subject of the Formula: 280 - 286

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Year 9 Higher Topic 4 Equations Student Knowledge Organiser

Solving Equations

Solve each of the following equations.

a) $8x + 10 = 66$ **b)** $10x + 15 = 115$ **c)** $12x + 9 = 105$ **d)** $15x + 12 = 72$

e) $1.5x - 3 = -24$ **f)** $1.8x - 8 = -62$ **g)** $2.6x - 7 = -59$ **h)** $4.8x - 9 = -57$

a) $7(x + 4) = 63$ **b)** $8(x + 4) = 88$ **c)** $11(x + 3) = 132$ **d)** $14(x + 5) = 98$

e) $16(x - 3) = -80$ **f)** $13(x - 4) = -91$ **g)** $14(x - 2) = -98$ **h)** $18(x - 3) = -180$

a) $6x - 4 = 2x + 16$ **b)** $17x - 2 = 7x + 8$ **c)** $9x - 26 = 5x - 14$

d) $10x - 5 = 3x + 9$ **e)** $6x - 12 = 51 - 3x$ **f)** $5x - 13 = 87 - 5x$

Solving Equations using Cross Multiplication

[a] $\frac{2x+3}{x-1} = 7$ **[a]** $\frac{2x-2}{2x+3} = 6$

[b] $\frac{4x-2}{x+5} = 2$ **[b]** $\frac{4x-1}{3x+1} = 1$

[c] $\frac{5x-3}{x-2} = 4$ **[c]** $\frac{6x-2}{4x+5} = 2$

[d] $\frac{3x-3}{x+3} = 6$ **[d]** $\frac{3x-3}{2x+2} = 1$

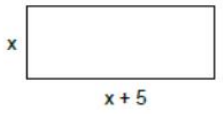
Forming Equations

1) *The length of a rectangle is twice its width, x. If the perimeter is 42 cm find the area of the rectangle.*

2) *The sum of four consecutive numbers is 90. Let x be the first number. Find the numbers.*

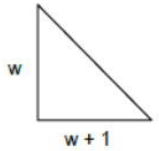
3) *Mushood buys x books at £5.50 each, and (x + 2) books at £3.50 each. The total cost of the books is £25. Find the value of x.*

The area of this rectangle is 300 cm²



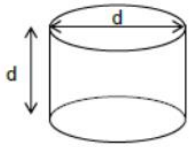
1) Work out the value of x.
2) Work out the perimeter.

The area of this triangle is 6 cm²



3) Work out the value of w.
4) Work out the length of the hypotenuse to 2 dp.

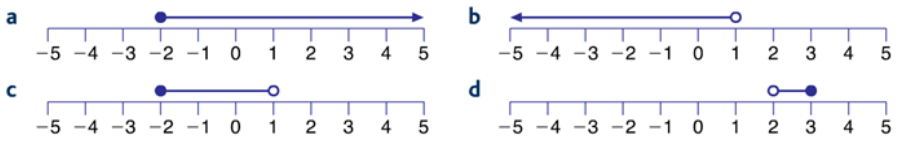
The surface area of this cylinder is 150π cm²



5) Work out the value of d.
6) Find the volume of the cylinder in terms of π.

Writing Inequalities on a Number Line

1 Write down the inequality shown on the number line:



2 Show these inequalities on a number line.

a $x > 2$ **b** $x < 5$ **c** $x \geqslant 0$ **d** $x \leqslant -1$

4 Show these inequalities on a number line.

a $-1 < x \leqslant 3$ **b** $-4 \leqslant x < 0$ **c** $-5 < x \leqslant -2$

Solving Inequalities

(a) $2x + 1 \leq 9$ (b) $3x - 5 > 16$ (c) $4x + 8 < 32$ (d) $5x - 2 \geq 68$

(e) $\frac{x}{2} + 1 \leq 5$ (f) $\frac{x}{9} - 6 > 4$ (g) $\frac{x+3}{2} \geq 5$ (h) $\frac{x-5}{4} > 2$

(a) $4x + 7 < 11$ (b) $3x - 2 \geq 10$ (c) $\frac{x}{2} - 3 > 0$ (d) $\frac{x+18}{4} \leq 5$

(a) $4x + 3 > 2x + 11$ (b) $x + 1 \geq 3x - 18$

(c) $13x - 12 < 3x + 13$ (d) $7x - 5 \geq 3x + 11$

Changing the Subject of the Formula

Question 2: Make x the subject of the following formulae

(a) $4x + c = w$ (b) $dx - t = 8$ (c) $x^2 + 3 = h$

(d) $2x + 2y = P$ (e) $s = x^2 - 3$ (f) $y = xz + s$

(g) $\frac{x}{n} + 2 = w$ (h) $\frac{x}{6} - 5 = w$ (i) $\frac{x+3}{c} = h$

(j) $3y = 4x + 1$ (k) $x^2 + a = v$ (l) $x^3 - 4 = 5y$

Question 1: Make x the subject of each of the following

(a) $A = \frac{1}{2}(x + y)$ (b) $A = \pi r^2 + 2\pi rx$

(c) $T = 3x^2 - y$ (d) $s = \frac{m}{ax}$

(e) $s = uy + \frac{1}{2}xy^2$ (f) $\frac{1}{3}w = \frac{1}{4}x + t$

Question 2: Make m the subject of the following formulae

(a) $5(m + y) = 4(m - 3y)$ (b) $3(3m + 4) = 7(m + 2a)$

(c) $15(2m + 3c) = 5(m + 7c)$ (d) $9m + 4c = 2(a + 3m)$

(e) $a(c + m) = 2(c + 3m)$ (f) $w(m + n) = x(m - n)$

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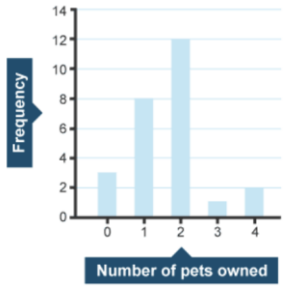
Year 9 Higher Topic 5 Charts and averages Student Knowledge Organiser

Key words and definitions

Qualitative Data: Data which is non numeric
Quantitative Data: Data which is numeric
Discrete Data:
Continuous Data:
Mean: A type of average where all the data is added and divided by the amount of data
Mode: An average which is the most popular piece of data
Median: An average found when all data is put in order and middle value selected.
Range: Difference between the largest value and the smallest value

Bar Chart.

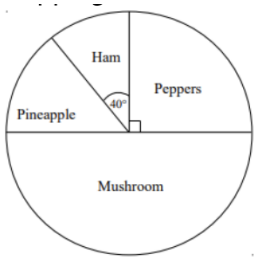
Represents data as vertical blocks. Each bar should be the same width. There should be gaps between each bar. Label each axis



Hegarty Maths Links

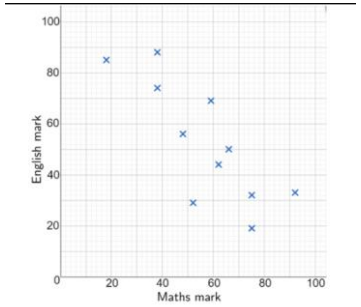
Pie Chart.

When drawing a pie chart, divide 360 by the total frequency. This will give you how many degrees are required for each part of the data. For example, in a survey of 40 people, if you do 360 divided by 40, it would mean each person would be represented by 9 degrees

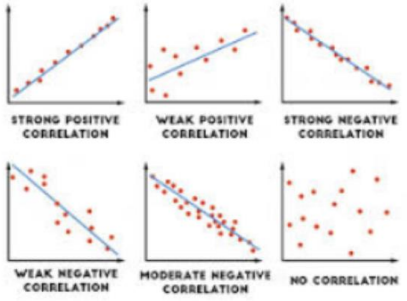


Scatter Graphs.

A scatter graph is used to plot data measured in two ways. Each point plotted is a single piece of data with two measurements.
Eg, each point on the following is for a single pupil, with their Maths and English scores from a test



When the points plotted on a scatter graph are all very close together, we say there is a strong **correlation** between the two things being measured. This might mean the two things are connected



Averages

Mean - Add up the values and divide by how many values there are.
Median - The middle value. Put the data in order and find the middle one
Mode - Most frequent/common.
Range - The difference between the highest and lowest vales

The mean of 3, 4, 7, 6, 0, 4, 6 is $\frac{3+4+7+6+0+4+6}{7} = 5$

Find the median of:
4, 5, 2, 3, 6, 7,6
Ordered: 2, 3, 4, **5**, 6, 6, 7
Median = 5

Find the mode:
4, 5, 2, 3, 6, 4, 7, 8, 4
Mode = 4

Find the range:
3, 31, 26, 102, 37, 97
Range = 102-3 = 99

Averages From Tables

You can use frequency tables to work out the Mead, Median, Mode and Range of a set of Data.

Pets	Frequency
0	12
1	7
2	11

Mode – The mode is the value with the highest frequency – 0
Median - Divide the total frequency by 2 to work out the middle value.
12+7+11=30, 30÷2=15
The first 12 values are 0. The next 7 values (so the 8th, 9th, 10th…) are 1.
So the median is the 15th value, which is 1.
Mean - Total = 0x12 + 1x7 + 2x11 =29
Total Frequency = 30
Mean= 29 ÷ 30 = 0.96666…

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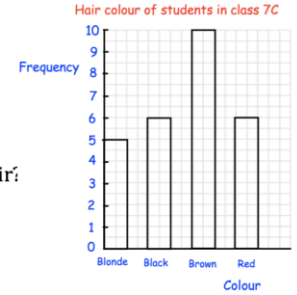
Year 9 Higher Topic 5 Charts and averages Student Knowledge Organiser

Bar Charts

Question 1: The bar chart shows information about the hair colour of students in 7C.



(a) What is the most common hair colour in 7C?

(b) How many students had black hair?

(c) What hair colour is the least popular in 7C?

(d) How many more students had brown than red hair?

(e) How many students are in 7C?

Question 1: Matthew is a milkman.
The table below shows information about how many pints of milk he delivers in one village.

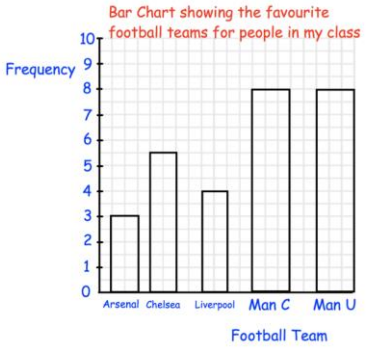
Day	Mon	Tues	Wed	Thurs	Fri	Sat
Pints Delivered	65	40	60	45	70	25

(a) Draw a bar chart to represent this information.
(b) How many pints of milk did he deliver in total?

Question 2: Shannon has drawn a bar chart to show the favourite football teams of the people in her class.

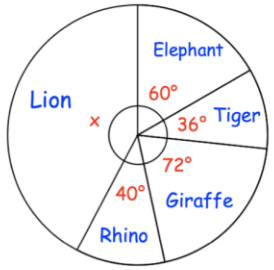
Shannon has made some mistakes.
(a) Explain what her mistakes are.
(b) Draw a correct bar chart for this information

Football Team	Frequency
Arsenal	3
Chelsea	5
Liverpool	4
Man City	8
Man United	8



Pie Chart

Question 5: 90 students went on a school trip to Longleaf Safari Park.
They were asked their favourite animals.
The pie chart shows the results.



(a) What fraction of the students chose elephant?

(b) What fraction of the students chose tiger?

(c) What fraction of the students chose giraffe?

(d) What fraction of the students chose rhino?

(e) Find x

(f) How many students chose elephant?

(g) How many students chose tiger?

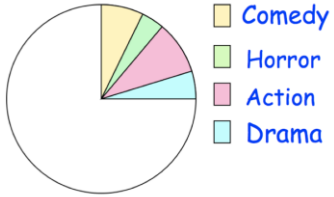
(h) How many students chose giraffe?

(i) How many students chose rhino?

(j) How many students chose lion?

Question 2: Bill has drawn a pie chart to show his friends' favourite genre of film.

Genre	Frequency
Comedy	26
Horror	14
Action	33
Drama	17



(a) Can you explain to Bill what he has done wrong?
(b) Draw a correct pie chart for Bill.

Scatter Graphs

Question 1: Plot the following information as scatter graphs

(a)

Maths score	9	13	6	18	11	4	15	10
Physics score	10	13	5	20	8	5	12	14

(b)

Age, years	4	7	2	4	1	9	3	6
Cost, £	6000	3000	7500	5000	8000	1500	6000	4000

(c)

Height, cm	157	160	148	160	177	156	166	170
Weight, kg	53	60	44	53	54	60	54	70

(d)

Distance, miles	2.5	0.8	1.2	4.1	2.8	3.3	3.7	1.5
Cost	£3.20	£1.40	£1.80	£4.40	£3.00	£3.60	£4.80	£2.40

Averages from tables

For each set of data, calculate the mean, mode and median

(a)

Age	Frequency
5	2
6	2
7	5
8	1

(b)

Number of phones	Frequency
0	1
1	3
2	2
3	0
4	4
5	0

(c)

Number of pets	Frequency
0	13
1	28
2	50
3	9

Averages

For each data set, calculate the mode median, mean and range

(a) 5, 6, 6, 7, 8, 10

(b) 1, 1, 1, 4, 6, 8, 12

(c) 5, 5, 7, 7, 7, 8, 8, 9

(d) 5, 7, 3, 5, 8, 9, 10, 2

(e) 8, 3, 3, 4, 6, 8, 13, 3, 18

(f) 12, 14, 15, 17, 15

(g) 2.3, 2.6, 2.8, 2.7, 2.8, 2.7, 2.4, 2.3, 2.1, 2.3

(h) −2, −1, 5, 8, −2, 2, −1, 9, −1, 1, 2, −1

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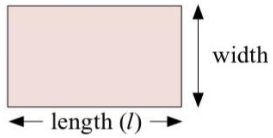
Year 9 Higher Topic 6 Area and volume Knowledge Organiser

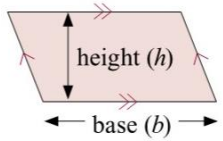
Key words and definitions

Perimeter: total distance around the edge of a shape
Perpendicular: two straight lines at right-angles to each other
Radius: distance from the centre to outer edge of a circle – notation is r
Diameter: distance from one side of a circle to the other passing through the centre – notation is d
Circumference: total distance around a circle
Arc: part of the circumference
Sector: part of a circle, cut from the centre to the edge (a pizza slice)
Π: Pi – mathematical value used when calculating with circles/curved shapes
Prism: 3D shape with constant cross-section through the entire length

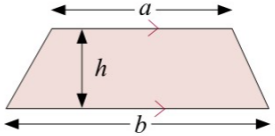
Area



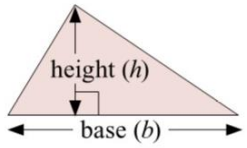
Area = length × width



$A = bh$



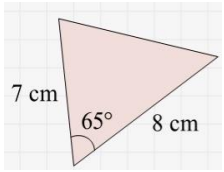
$A = \frac{1}{2}(a+b) \times h$



Area = $\frac{1}{2}$ × base × perpendicular height

You can also find the area of a triangle using Sine. You must know 2 sides and the angle formed between them.

$Area = \frac{1}{2}ab \sin C$



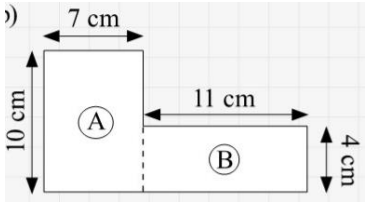
Area = $(\frac{1}{2} \times 7 \times 8)\sin 65°$
= **25.38 cm²** (to 2 d.p.)

Hegarty Maths Links

Area: 44, 45, 48, 49
Sine rule: 337
Compound area: 41
Circles: 40, 59, 60
Sectors: 46, 58
Volume: 355 – 358
Surface area: 310 – 312, 315

Compound shapes – formed by merging multiple shapes

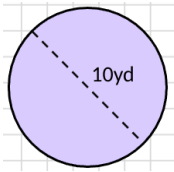
Split the shape up into basic shapes. Find the area of each, then add together.



Area of rectangle A = 10×7 = $70\ cm^2$
Area of rectangle B = 11×4 = $44\ cm^2$
Total area of shape = $70 + 44$ = **$114\ cm^2$**

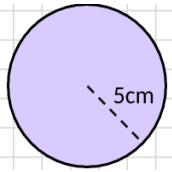
Circles – Circumference & Area

$C = \pi d$



$C = \pi d$
$= \pi \times 10yd$
$= 10\pi$ yd
$= 31.4yd$

$A = \pi r^2$



$A = \pi r^2$
$= \pi \times 5^2$
$= \pi \times 25$
$= 78.5cm^2$

Sectors

Length of arc = $\frac{\theta}{360}$ × circumference of circle = $\frac{\theta}{360} \times 2\pi r$

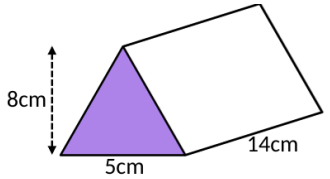
Area of sector = $\frac{\theta}{360}$ × area of circle = $\frac{\theta}{360} \times \pi r^2$

Area of sector $= \frac{60}{360} \times \pi \times 3^2 = \frac{1}{6} \times 9\pi = \frac{3}{2}\pi\ cm^2$

Length of arc $= \frac{60}{360} \times (2 \times \pi \times 3) = \frac{1}{6} \times 6\pi = \pi\ cm$

Volume of Prisms – example shown of triangular prism

Volume of a prism = area of cross section x length of prism



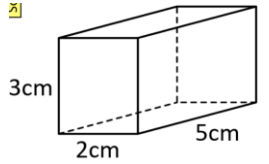
This volume formula works for all prisms. Only the formula for the cross-section area will change dependent on the shape.

Area of Δ = $\frac{5 \times 8}{2}$ = **$20cm^2$**

Volume = **$20cm^2$** × 14 = **$280cm^3$**

Surface area of Prisms – examples of cuboid & cylinder

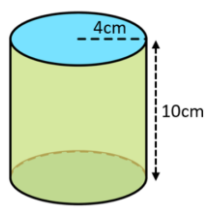
Surface area of a prism = sum of the areas of all the faces

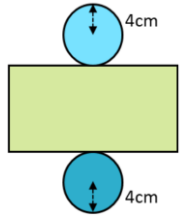


Front = 2 x 3 = 6
Back = 2 x 3 = 6
Top = 2 x 5 = 10
Base = 2 x 5 = 10
Left side = 3 x 5 = 15
Right side = 3 x 5 = 15

Total surface area = $62\ cm^2$

Surface area of cylinder = $2\pi r^2 + \pi dh$ *special case





The 2 dimensions of the rectangular face are the circumference of the circular end and the height. So, the area of this face is π x d x h.

Area of ○ = πr^2 = $\pi \times 4^2$ = **16π**

○ + ○ = **16π** × 2 = **32π**

Area of □ = $8\pi \times 10$ = **80π**

Total SA = $32\pi + 80\pi$ = **$112\pi cm^2$**

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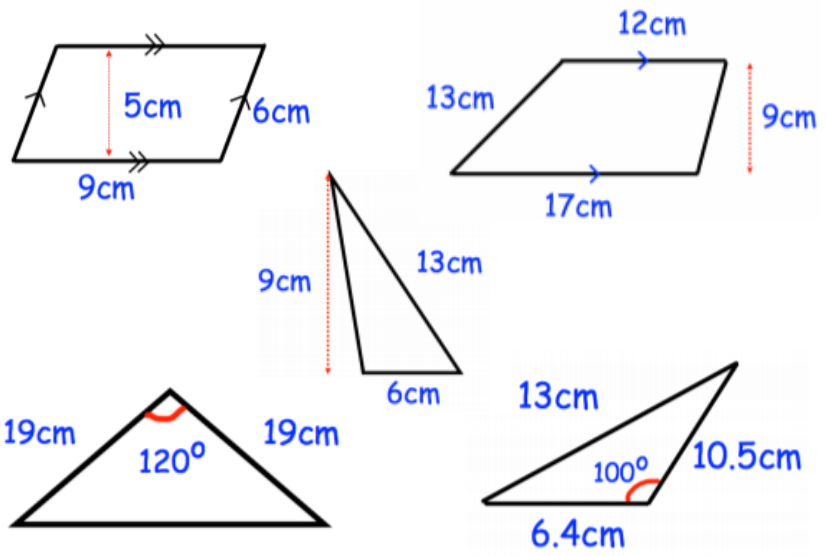
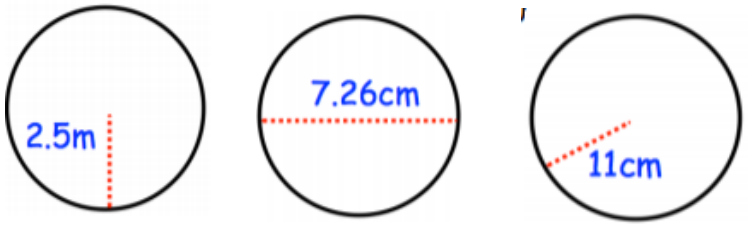
Year 9 Higher Topic 6 Area and Volume 1 Knowledge Organiser

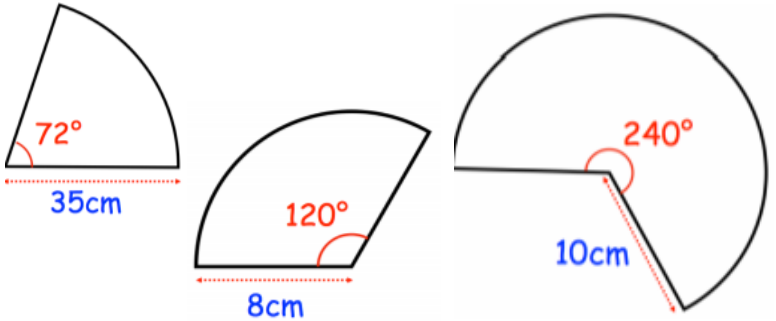
Area – Find the area of each shape



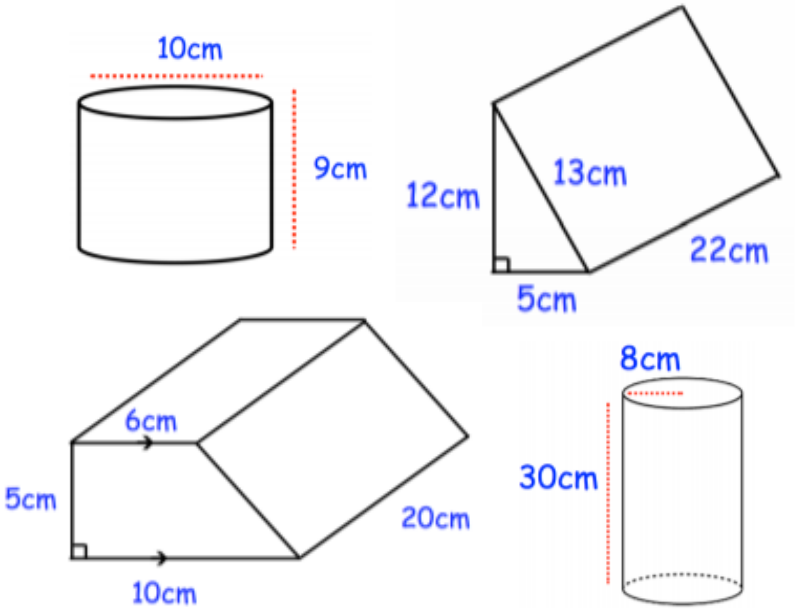
Circles – Find the area and circumference of each circle



Sector – Find the area and arc length of each sector

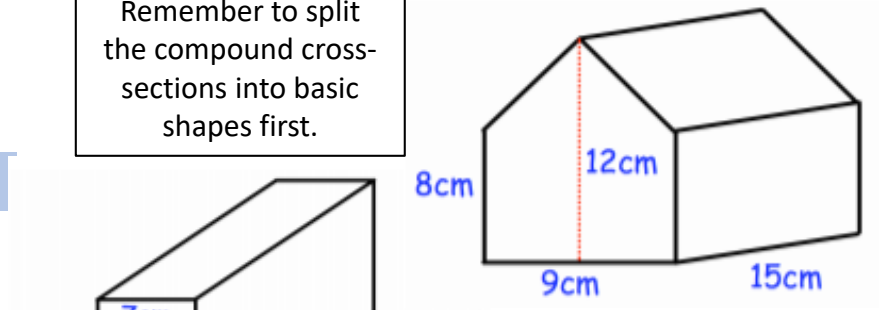


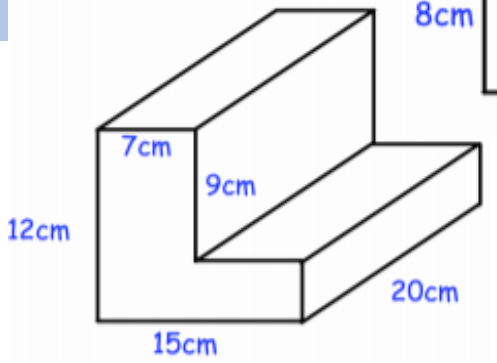
Volume – Find the volume of each 3D shape



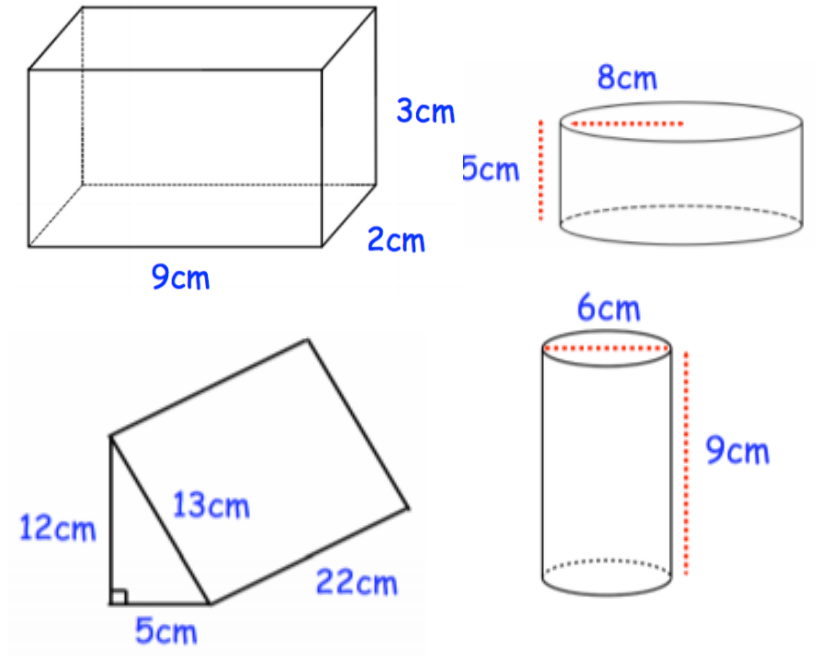
Volume – Find the volume of each compound 3D shape

Remember to split the compound cross-sections into basic shapes first.

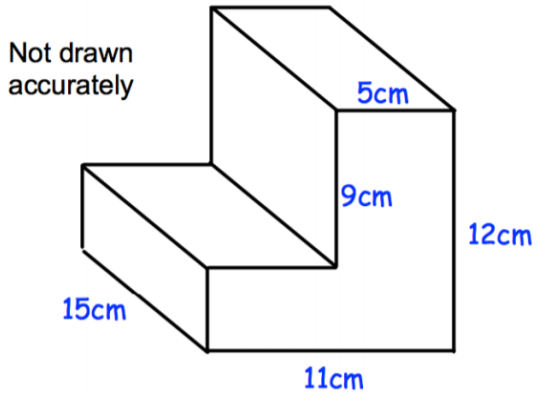




Surface Area – Find the surface area of each 3D shape



Surface Area – Find the surface area of the compound 3D shape



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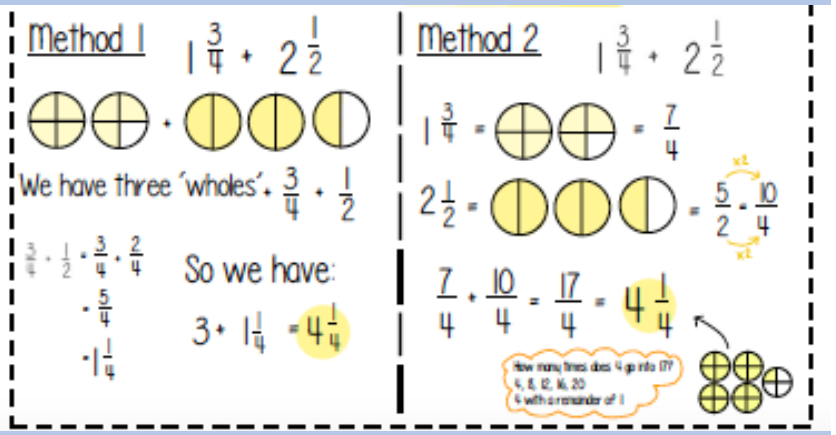
Year 9 Higher Topic 7 Fractions, decimals and percentages Student Knowledge Organiser

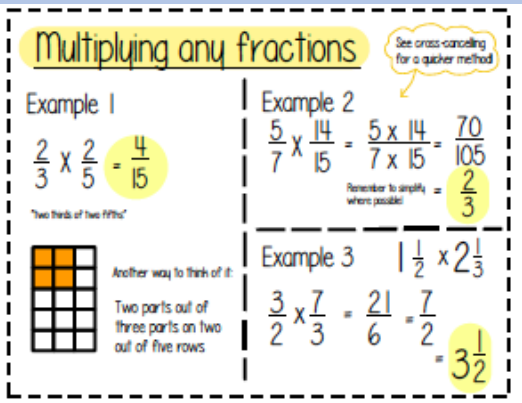
Key words and definitions

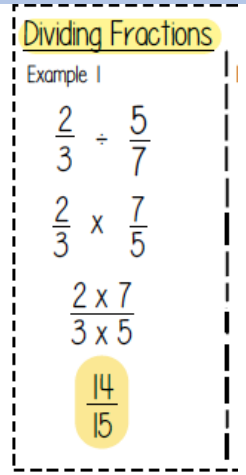
- Reciprocal – The reciprocal of a number is 1 divided by the number
- Simple Interest – Interest calculated as a percentage of the original amount
- Compound Interest – Interest calculated on the amount borrowed plus previous interest
- Equivalent – Of equal value
- Recurring Decimal – A decimal number with a digit, or group of digits, that repeat forever

Adding and Subtracting Mixed Numbers



Multiplying and Dividing Fractions





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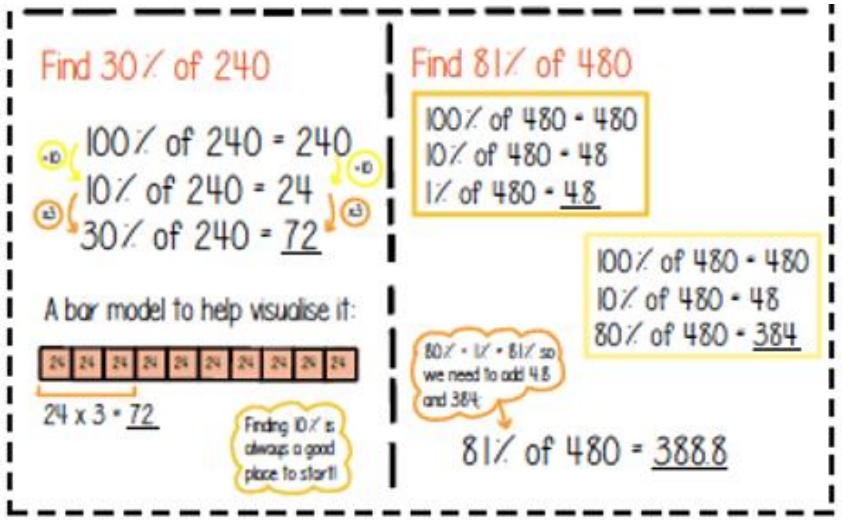
Percentages of Amounts



Reverse Percentages

60% of a number is 48. What is the number?

60% of x = 48
10% of x = 8
100% of x = 80

A pair of shoes are on sale for 87.5% off. The sale price is £49.50, how much did they cost originally?

12.5% of x = £49.50
25% of x = £99
100% of x = £396

Hegarty Maths Links

- Recurring decimals to fractions: 53, 54
- Converting FDP: 72–76, 82–85
- Adding and Subtracting Fractions: 66
- Multiplying Fractions: 67, 68, 69
- Dividing Fractions: 70
- Percentages of amounts: 86, 87, 89
- Compound Interest: 94
- Percentage Change: 97
- Reverse Percentages: 96

Compound Growth and Decay

I put £1000 in a bank account. It earns compound interest of 10% per year. How much will be in the account after 5 years?

INTEREST:

Compound interest means we work out the interest each year and the original amount plus any interest in the account.

- 10% of £1000 = £100

So after year 1, the account will have £1100

- 10% of £1100 = £110

So after year 2, the amount is £1210 etc..

If we are increasing by 10% each time, this is the same as finding 110% of the amount, or multiplying by 1.1 (see multipliers). So another way we can work this out is:

£1000 x 1.1 x 1.1 x 1.1 x 1.1 x 1.1

Or £1000 x 1.1^5 = £1610.51 (5 years)

I know which account I'd go for!

For compound decay or depreciation questions we would do the same thing, just our multiplier at the start is calculated by subtracting rather than adding

Recurring decimals to fractions

Example (TWO RECURRING DIGITS)

Convert $0.\dot{3}\dot{5}$ to a fraction

$x = 0.353535...$

$100x = 35.353535...$

Because we have two digits that are repeating, we need to multiply it by 100!

$99x = 35 \rightarrow x = \frac{35}{99}$

Example

Convert $0.2\dot{5}$ to a fraction

$x = 0.255555...$

$10x = 2.555555...$

$100x = 25.55555$

25.555... - 2.55... = 23

Here, we cannot just take 2.555 away from 0.255 as we will not reduce it to an integer

$90x = 23 \rightarrow x = \frac{23}{90}$

100x - 10x = 90x

Year 9 Higher Topic 7 Fractions, decimals and percentages Student Knowledge Organiser

Adding and Subtracting Fractions

Work out the following. Answers should be simplified and written as mixed numbers where necessary

(a) $\frac{3}{4}+\frac{1}{2}$ (b) $\frac{5}{9}+\frac{2}{3}$ (c) $\frac{7}{10}+\frac{1}{3}$

(d) $\frac{4}{5}-\frac{2}{3}$ (e) $\frac{8}{9}-\frac{1}{3}$ (f) $\frac{2}{3}+\frac{1}{6}$

Work out the following. Answers should be simplified and written as mixed numbers where necessary

(a) $1\frac{1}{2}+\frac{2}{3}$ (b) $\frac{7}{9}+1\frac{1}{3}$ (c) $1\frac{3}{5}-\frac{3}{4}$

(d) $1\frac{5}{8}-1\frac{1}{4}$ (e) $2\frac{1}{2}+1\frac{1}{3}$ (f) $2\frac{2}{9}-1\frac{1}{3}$

Multiplying and Dividing Fractions

Work out the following. Answers should be simplified and written as mixed numbers where necessary

(a) $\frac{1}{2}\times\frac{1}{5}$ (b) $\frac{1}{2}\times\frac{3}{4}$ (c) $\frac{1}{4}\times\frac{3}{5}$

(d) $\frac{2}{3}\div\frac{5}{6}$ (e) $\frac{1}{10}\div\frac{4}{9}$ (f) $\frac{6}{11}\div\frac{5}{6}$

Work out the following. Answers should be simplified and written as mixed numbers where necessary

(a) $1\frac{2}{3}\times\frac{1}{4}$ (b) $4\frac{3}{5}\times1\frac{2}{3}$ (c) $3\frac{1}{8}\times2\frac{1}{2}$

(d) $\frac{2}{3}\div1\frac{4}{5}$ (e) $2\frac{1}{3}\div5\frac{1}{2}$ (f) $4\frac{1}{3}\div2\frac{9}{10}$

Percentages of Amounts

Calculate the following. You should **not** use a calculator to complete these questions.

(a) 10% of 70m (b) 25% of 16 seconds (c) 10% of 400kg (d) 50% of 26g

(e) 3% of $9000 (f) 40% of 75 seconds (g) 15% of 90 hours (h) 5% of 14kg

(i) 90% of 1250ml (j) 76% of £80,000 (k) 85% of 90 hours (l) 12% of £6

Calculate the following. You should use calculator methods to complete these questions

(a) 15% of 80ml (b) 9% of 205kg (c) 45% of £135 (d) 17% of 540km

(e) 0.3% of 44km (f) 85.2% of 6000 marks (g) 0.25% of $840 (h) 3.175% of 52g

Reverse Percentages

1. A camera costs £180 in a 10% sale. What was the pre-sale price?
2. After fuel prices rose by 15%, a family's annual heating bill was £1654. What would the bill have been without the price increase?
3. The cost of a holiday, including VAT at 20% is £540. What is the pre-VAT price?
4. The world's tiger population has decreased by 95% since 1910 and is now believed to be as low as 3200. If these figures are correct, what was the tiger population in 1910?
5. The sale price of a television is £420 after a 15% reduction. What was the price before the sale?
6. After a 6.5% pay rise an engineer's salary is £36,700. What was the salary before the increase?
7. Due to falling orders a company reduces its workforce by 12% to 792. What was the original number of employees?
8. An engine modification improved the fuel consumption of a car by 27% to 17.2 km per litre. What was the fuel consumption before the modification?

Compound Growth and Decay

1. If £500 is invested for 3 years at a rate of compound interest of 4% per annum, how much will be in the account after 3 years?
2. Dave invests £3000 at a rate of interest of 6% a year. How much is in his account after 5 years?
3. Annie invests £1500 at a rate of compound interest of 2.5% for 6 years. How much is in her account after the six years?
4. Harry invests £1000 at a rate of interest of 5% a year. After how many years will he have doubled his investment?
5. John buys a house for £219000. The house depreciates in value at 6% each year. What is the value of the house after 7 years?
6. Sam bought his car 13 years ago for £14000. It has depreciated at 26% each year. How much is it now worth?
7. The value of a car depreciates by 15% each year. At the end of 2007, the value of the car was £8490. Work out the value of the car at the end of 2010.
8. Bob's new machine for work cost him £6700. It will depreciate at 28% each year. After how many years will it be worth less than £1000?

Recurring Decimals to Fractions

Convert the following recurring decimals to fractions. You should give each answer in its simplest form

(a) $0.\dot{2}$ (b) $0.\dot{8}$ (c) $0.\dot{1}\dot{8}$

(d) $0.5\dot{3}$ (e) $0.7\dot{5}$ (f) $0.6\dot{3}$

(g) $0.1\dot{1}\dot{2}$ (h) $0.3\dot{3}\dot{9}$ (i) $0.1\dot{7}\dot{1}$

Convert the following recurring decimals to fractions. You should give each answer in its simplest form. Think carefully about which parts are recurring.

(a) $0.2\dot{8}$ (b) $0.0\dot{3}$ (c) $0.9\dot{6}$ (d) $0.5\dot{2}\dot{1}$

(e) $0.3\dot{9}\dot{0}$ (f) $0.12\dot{3}\dot{5}$ (g) $0.12\dot{6}$ (h) $0.50\dot{3}\dot{5}$

Year 9 Higher Topic 8 Ratio Student Knowledge Organiser

Key words and definitions

Compound measure: Compound measures are measures that are made up of two or more other measures. For example, speed is a compound measure, It is made up of distance and time.

Ratio: A ratio shows how much of one thing there is compared to the other.

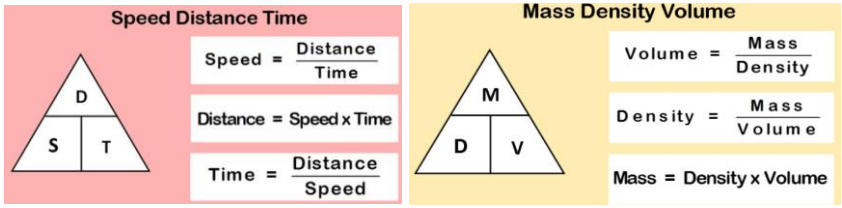
Direct proportion: Direct proportion is when two (or more) quantities increase or decrease in the same ratio.

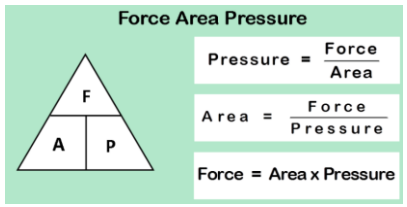
Indirect proportion: Inverse proportion is when an increase in one quantity results in a decrease in another quantity.

Hegarty maths links

Speed, density & pressure: 716 – 738
Ratio: 328 – 338
Proportion: 339 - 348

Speed, density & pressure.





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Simplifying ratio.

Example 1

There are 15 fiction books and 10 non-fiction books on a shelf.
Write down the ratio of fiction books to non-fiction books in its simplest form.

1. Write down the ratio and divide both sides by the same number.
2. Stop when you can't divide any further.

$\div 5$ (15 : 10 / 3 : 2) $\div 5$

The simplest form is **3 : 2**

Dividing a ratio into parts.

Example 1

Nigel is going to split £40 between his two children. He shares the the money between Matthew and Emily in the ratio 2:3. How much money do Matthew and Emily receive?

40				
8	8	8	8	8

2 + 3 = 5 total shares

1 share = 40 ÷ 5 = **£8**

Matthew's share
2 shares = £8 × 2 = **£16**

Emily's share
3 shares = £8 × 3 = **£24**

Example 2

To make purple paint, red paint and blue paint are mixed in the ratio 3:5. Richard uses 720mL of paint altogether. How much blue paint does he use?

720							
90	90	90	90	90	90	90	90

3 + 5 = 8 total parts

1 part = 720 ÷ 8 = **90**

Red paint
3 shares = 90 × 3 = **270mL**

Blue paint
5 shares = 90 × 5 = **450mL**

Richard uses 450mL of blue paint.

Calculating a part of the ratio, given another.

Example 1

Laura makes some orange juice by mixing orange cordial and water in the ratio 3:10. She uses 42mL of orange cordial.
How much water does she use?

14		
14	14	14	14	14	14	14	14	14	14

3 parts = 42mL
1 part = 42 ÷ 3 = **14mL**
10 parts = 14 × 10 = **140mL**

Laura uses 140mL of water.

Example 2

Michael and Justine share some money in the ratio 5:3. Justine gets £108.
How much money did they share?

Michael	36	36	36	36	36
Justine	36	36	36		

3 parts = £108
1 part = 108 ÷ 3 = **£36**

5 + 3 = 8 total parts
8 parts = 36 × 8 = **£288**

Michael and Justine shared £288.

Direct proportion

Example 1

y is directly proportional to x.
Fill in the gaps in the table.

x	3	5	10	12	
y			25		100

1. Write the proportionality statement and make it into an equation. $y \propto x$, so $y = kx$
2. The table shows that when $x = 10$, $y = 25$. Use this to find k. $25 = k \times 10$, $k = 25 \div 10 = 2.5$, So $y = 2.5x$
3. Use the equation to complete the table:

x	3	5	10	12	$100 \div 2.5 = \mathbf{40}$
y	$2.5 \times 3 = \mathbf{7.5}$	$2.5 \times 5 = \mathbf{12.5}$	25	$2.5 \times 12 = \mathbf{30}$	100

Example 2

m is directly proportional to e. Given that $m = 72$ when $e = 6$,

a) find the constant of proportionality,
1. Write the proportionality statement and make it into an equation. $m \propto e$, so $m = ke$
2. Use the given values to find k. $72 = k \times 6$, so $k = 72 \div 6$, $\mathbf{k = 12}$

b) calculate the value of e when $m = 37$.
1. Put the value of k from part a) into the equation $m = ke$. $m = 12e$
2. Substitute $m = 37$ into the equation and solve for e. $37 = 12e$, $e = 37 \div 12 = \mathbf{3.08}$ (to 2 d.p.)

Inverse proportion

Example 1

y is inversely proportional to x.
Fill in the gaps in the table.

x	1	5	10	
y			20	100

1. Write the proportionality statement and make it into an equation. $y \propto \frac{1}{x}$, so $y = \frac{k}{x}$
2. The table shows that when $x = 10$, $y = 20$. Use this to find k. $20 = \frac{k}{10}$, $k = 20 \times 10 = 200$, So $y = \frac{200}{x}$
3. Use the equation to complete the table:

x	1	5	10	$200 \div 100 = \mathbf{2}$
y	$200 \div 1 = \mathbf{200}$	$200 \div 5 = \mathbf{40}$	20	100

Example 2

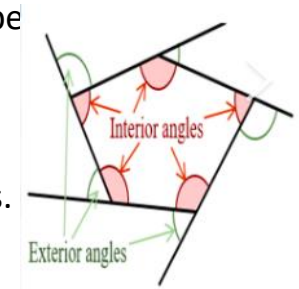
y is inversely proportional to x and $x = 4$ when $y = 15$.

a) Find y when $x = 10$.
1. Write the proportionality statement and make it into an equation. $y \propto \frac{1}{x}$, so $y = \frac{k}{x}$
2. Use the given values to find k. $15 = k \div 4$, so $k = 15 \times 4 = 60$
3. Put $k = 60$ into the equation. $y = \frac{60}{x}$
4. Substitute $x = 10$ into the equation and solve for y. $y = \frac{60}{x} = \frac{60}{10} = \mathbf{6}$

Year 9 Higher Topic 9 Shapes and angles Student Knowledge Organiser

Key words and definitions

Interior angle – angle inside the shape
Exterior angle- angle on the outside.



Polygon- shape with all straight sides.
Regular polygon- all sides and angles are equal

Angles around a point, on a straight line and in a triangle.

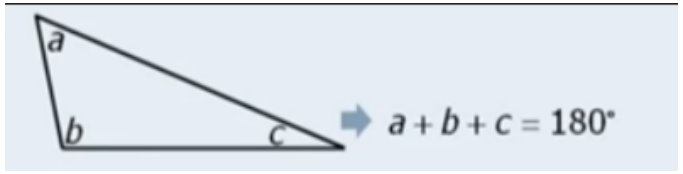
Angles on a straight line add up to 180°

$a+b+c=180°$

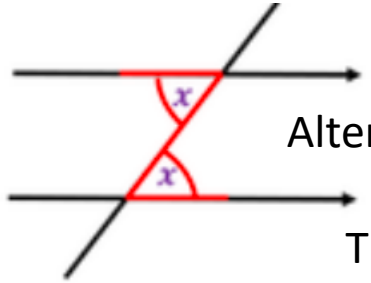
Angles around a point add up to 360°

$d+e+f+g+h=360°$

Angles in a triangle sum to 180°



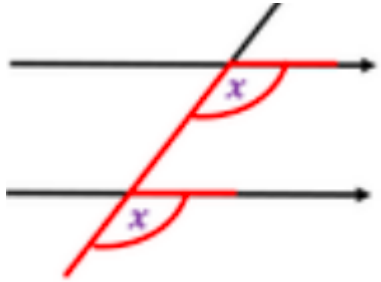
Alternate angles



Alternate angles are equal

They form a Z shape

Corresponding angles



Corresponding angles are equal

They form a F shape

Co-interior angles

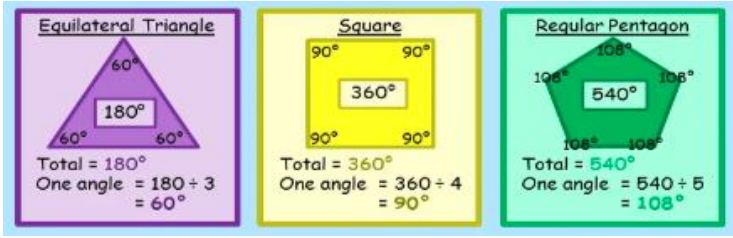
Co-interior angles add to 180°

They form a C shape

Interior angles sum of polygons

A polygon with n number of sides
Angle sum = $(n-2)\times180°$

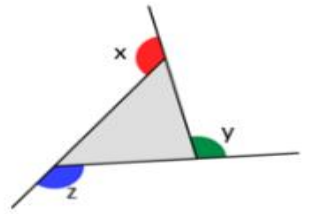
An angle of a regular polygon = $\frac{(n-2)\times180°}{n}$



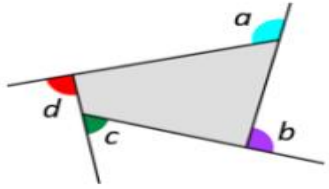
Exterior angles

The sum of the exterior angles of any polygon is 360°.

The exterior angle of a regular n-sided polygon is $\frac{360°}{n}$



$x + y + z = 360°$



$a + b + c + d = 360°$

Hegarty Maths Links

Angles in parallel lines 481 – 483
Angles around a point 812-814
Angles on a straight line 477-478
Angles in a triangle 486-487
Interior angles 560-562
Exterior angles 563-564

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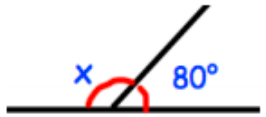
Year 9 Higher Topic 9 Shapes and angles Student Knowledge Organiser

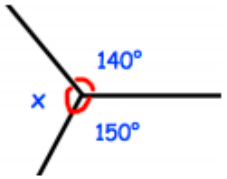
Angles around a point and on a straight line

Calculate x

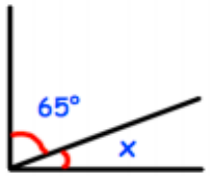
(a)



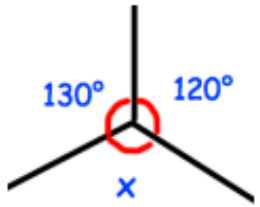
(b)



(c)

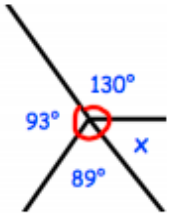


(d)

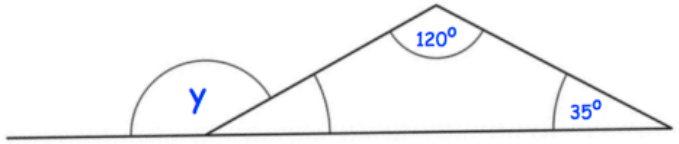


(e)

(f)



Calculate y

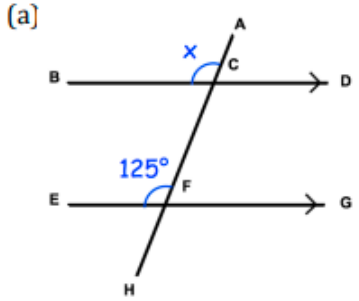


Work out the size of angle y.

Angles in parallel lines

Calculate x

(a)



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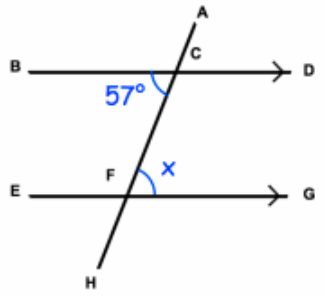

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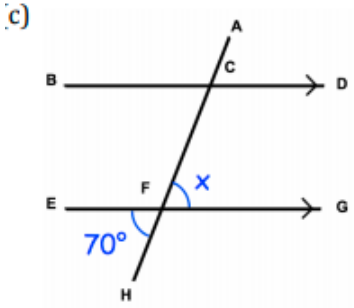

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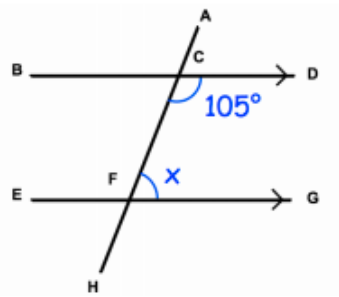

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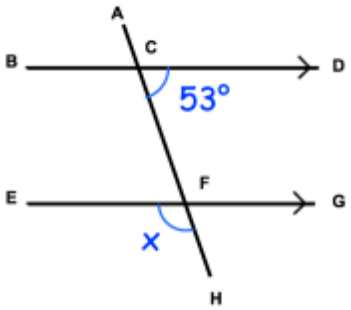

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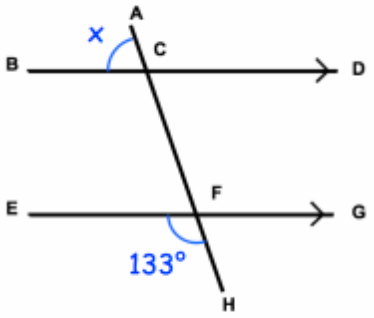


Interior angles

Work out the sum of the interior angles for polygons with

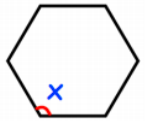
(a) 10 sides (b) 14 sides (c) 20 sides (d) 45 sides

Each of the polygons below are regular.
Calculate the size of each interior angle, x.

(a)

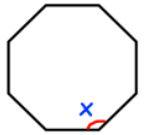
regular pentagon

(b)



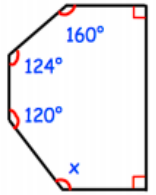
regular hexagon

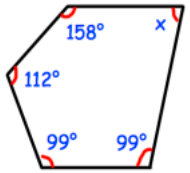
(c)

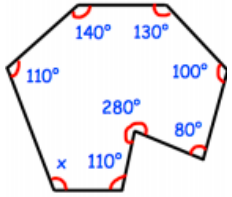


regular octagon

Find the missing angle in each irregular polygon



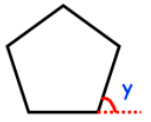




Exterior angles

Each of the polygons below are regular.
Calculate the size of each exterior angle, y.

(a)

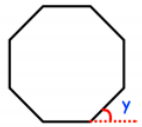


regular pentagon

(b)

regular hexagon

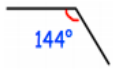
(c)



regular octagon

Shown below is one interior angle from regular polygons.
Calculate how many sides the polygons have.

(a)



(b)

(c)

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Year 9 Higher Topic 10a Pythagoras Student Knowledge Organiser

Key words and definitions

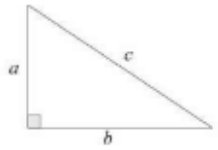
Pythagoras: A Greek mathematician born in 570 BC
Right angled Triangle: A Triangle with one angle exactly 90 degrees.
Hypotenuse: The longest side of a right-angled triangle that has position always opposite the right angle
Isosceles Triangle: a triangle with two equal sides and two equal angles. There is a unique Isosceles triangle that is also right angled. Angles would be 45- 90- 45
Pythagorean Triple : are three integers that form the sides of a right- angled triangle for example 3-4-5.

Pythagoras Theorem

Pythagoras Theorem links all three sides of a right angled Triangle together. Commonly we get two sides and need to find the third side

Pythagoras' Theorem

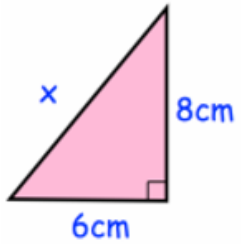
For any **right angled triangle**:



$$a^2 + b^2 = c^2$$

Used to find **missing lengths**.
a and b are the shorter sides, c is the **hypotenuse (longest side)**.

Finding the Longest Side (Hypotenuse)



Replace the values into the formula $a^2 + b^2 = c^2$

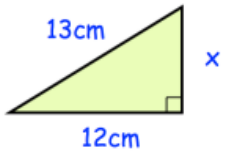
using $a = 6cm$ *and* $b = 8cm$ *to give* $6^2 + 8^2 = c^2$

$$36 + 64 = c^2$$

$$100 = c^2$$

This would give the missing side as $10cm$

Finding a shorter side (not the hypotenuse)



Replace the values into the formula $a^2 + b^2 = c^2$

using $c = 13cm$ *and* $a = 12cm$ *to give* $12^2 + b^2 = 13^2$

$$144 + b^2 = 169$$

$$b^2 = 169 - 144$$

$$b^2 = 25$$

$$b = 5\,cm$$

This would give the missing side as $5\,cm$

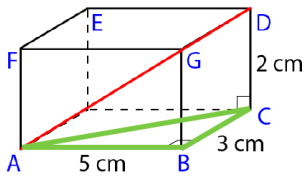
Checking if a Triangle is Right Angled

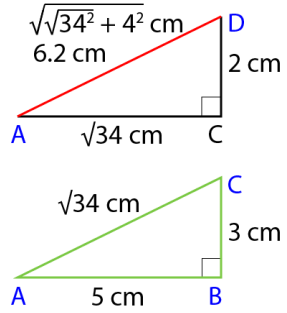
With an inaccurate diagram or just three lengths.
Carry out Pythagoras and see if the sum of the squares of the two shorter lengths are equal to the square of the longer side.

If Pythagoras Theorem holds true, these three sides form a right-angled triangle

Pythagoras In 3D

Commonly used as repeated Pythagoras. Using Pythagoras once to find the missing Length AC then again to find AD





Hegarty Maths Links

Pythagoras: Videos 497-507

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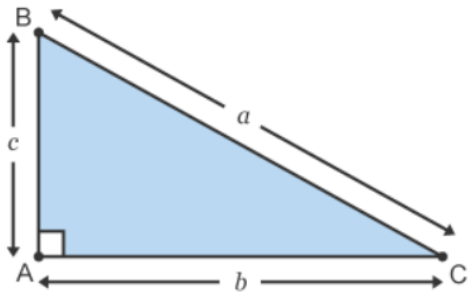
Year 9 Higher Topic 10a Pythagoras and Surds Student Knowledge Organiser

Pythagoras

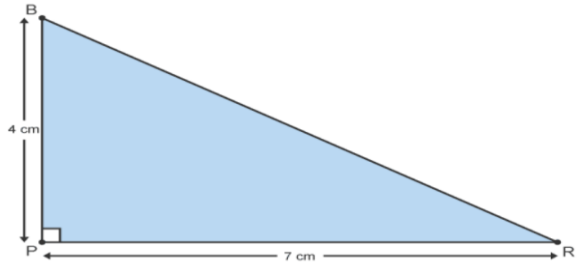


$$a^2 = b^2 + c^2$$

$$b^2 = a^2 - c^2$$

$$c^2 = a^2 - b^2$$

Work out the length of the line BR, correct to 1 decimal place.



A fireman has a ladder that is 13 metres long. If he wants to reach a window that is 12 metres above the ground, how far from the wall should he put the bottom of his ladder?

Peter's house is exactly 481m from school. To get home he walks 480m south and then he walks west. How far west does he have to walk?

A triangle has sides of length 23.8cm, 31.2cm and 39.6cm.

Is this a right-angled triangle?

Show how you decide.

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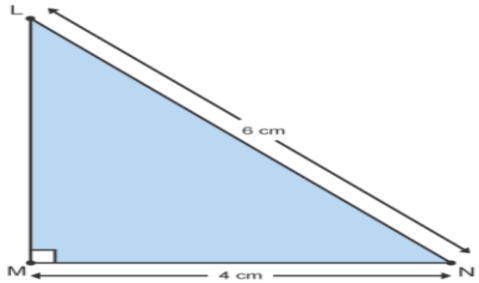
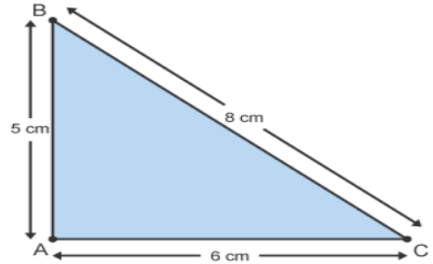
Pythagoras

Work out the length of the line LM, correct to 1 decimal place.



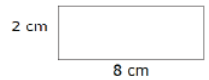
Which of the following triangles is right-angled?

a)

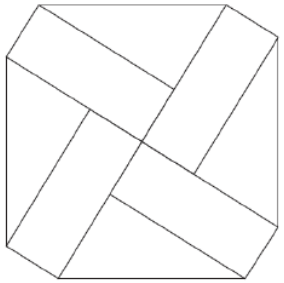


b)

Here is a rectangle.



The 8-sided shape below is made from 4 of these rectangles and 4 congruent right-angled triangles.



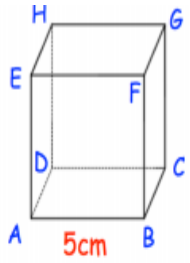
Work out the perimeter of the 8-sided shape.

3D Pythagoras

ABCDEFGH is a cube with side length 5cm.

(a) Work out the length of AC

(b) Work out the length of AG



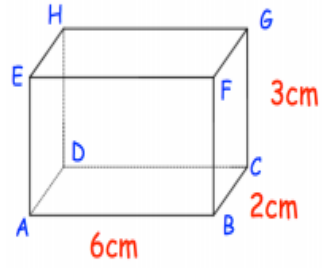
ABCDEFGH is a cuboid.
AB = 6cm, BC = 2cm and CG = 3cm.

(a) Work out the length of BG

(b) Work out the length of BD

(c) Work out the length of HC

(d) Work out the length of AG

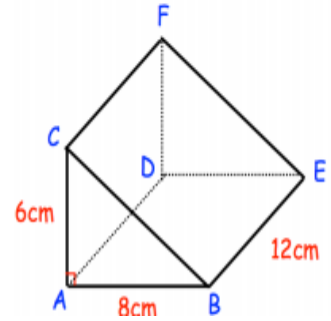


Shown is a triangular prism.
Triangle ABC is a right angle triangle.

(a) Work out the length of BC

(b) Work out the length of CD

(c) Work out the length of BF



Year 9 Higher Topic 10b Surds Student Knowledge Organiser

Key words and definitions

Integer: a whole number (could be positive or negative)
Prime number: A prime number has only two factors - the number itself and 1. 1 is not a prime number
Rational Number: A number that can be whole or expressed as fraction $\frac{a}{b}$ where a and b are integers
Irrational Number : any number than cannot be expressed as fraction. Generally, means decimal values with no recurring/pattern
Square Number: the result of multiplying an integer by itself
Surd: An irrational number that is better expressed as a square root. If written as decimal they would continue forever with no pattern.

Surds are roots of numbers. Not every Root is a Surd

$\sqrt{5}$ ✓ $\sqrt{4}$ ✗ this can be simplified to 2, which is a rational number

$5\sqrt{6}$

$\sqrt{2}$

$3\sqrt{2}$

$\sqrt{3}$

$\sqrt{11}$

$\sqrt{197}$

this can be simplified to 3, which is a rational number $\sqrt[3]{27}$

$(\sqrt{5})^2$ this can be simplified to 5, which is a rational number

Simplifying Surds – Method 2 is linked to Unit 1 work

Method 1

Simplify $\sqrt{24}$.

Here we are looking for the largest square number which is also a factor of 24

Factors of 24:
1 x 24
2 x 12
3 x 8
4 x 6

So $\sqrt{24} = \sqrt{4} \times 6$
$= \sqrt{4} \times \sqrt{6}$
$= 2\sqrt{6}$

Simplify $\sqrt{96}$.

Here we are looking for the largest square number which is also a factor of 96

Factors of 96:
1 x 96
2 x 48
3 x 32
4 x 24
6 x 16
8 x 12

So $\sqrt{96} = \sqrt{6} \times 16$
$= \sqrt{6} \times \sqrt{16}$
$= 4\sqrt{6}$

Method 2

Simplify $\sqrt{24}$.

Using prime factor decomposition and our knowledge that $\sqrt{a}\,\sqrt{b} = \sqrt{a} \times \sqrt{b}$, we can say

24 = 2 x 2 x 2 x 3
So $\sqrt{24} = \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{3}$
$= 2 \times \sqrt{2} \times \sqrt{3}$
$= 2\sqrt{6}$

Simplify $\sqrt{96}$.

96 = 2 x 2 x 2 x 3 x 2 x 2
So $\sqrt{96} = \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{3} \times \sqrt{2} \times \sqrt{2}$
$= 2 \times 2 \times \sqrt{2} \times \sqrt{3}$
$= 4\sqrt{6}$

Adding and Subtracting Surds

$\sqrt{5} + \sqrt{5} = 2\sqrt{5}$ ← think of this like x + x, or 2 lots of x

coefficients are dealt with just like they are in algebra!

$4\sqrt{3} + 7\sqrt{3} = 11\sqrt{3}$

$8\sqrt{2} - 5\sqrt{2} = 3\sqrt{2}$

$2\sqrt{3} - 7\sqrt{5}$ ← $\sqrt{3}$ and $\sqrt{5}$ are UNLIKE TERMS so this cannot be simplified any further

$4\sqrt{7} + 3\sqrt{10} - \sqrt{7} - 2\sqrt{10} = 3\sqrt{7} + \sqrt{10}$

$\sqrt{12} + \sqrt{27} = 2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$

$\sqrt{12} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$

$\sqrt{27} = \sqrt{9} \times \sqrt{3} = 3\sqrt{3}$

It is important to try and simplify your surds before working with them so you don't miss things like this!

Multiplying and Dividing Surds

$\sqrt{2} \times \sqrt{5} = \sqrt{2 \times 5} = \sqrt{10}$

$\sqrt{3} \times \sqrt{7} = \sqrt{3 \times 7} = \sqrt{21}$

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\sqrt{a} \times \sqrt{a} = a$

$\sqrt{2} \times \sqrt{2} = \sqrt{2 \times 2} = \sqrt{4} = 2$

$\sqrt{5} \times \sqrt{5} = \sqrt{5 \times 5} = \sqrt{25} = 5$

$\sqrt{10} \div \sqrt{2} = \sqrt{10 \div 2} = \sqrt{5}$

$\sqrt{a} \div \sqrt{b} = \sqrt{\frac{a}{b}}$

$\sqrt{12} \div \sqrt{3} = \sqrt{12 \div 3} = \sqrt{4} = 2$

Expanding Single and Double Brackets

Example 1

Expand and simplify $\sqrt{3}(2 + \sqrt{6})$

x	2	$+\sqrt{5}$
$\sqrt{3}$	$2\sqrt{3}$	$\sqrt{18}$

$\sqrt{18} = \sqrt{9} \times \sqrt{2}$
$= 3\sqrt{2}$

$= 2\sqrt{3} + \sqrt{18}$
$= 2\sqrt{3} + 3\sqrt{2}$

Always remember to check if you can simplify your surds

Example 2

Expand and simplify $\sqrt{3}(3\sqrt{8} - 2\sqrt{2})$

x	$3\sqrt{8}$	$-2\sqrt{2}$
$\sqrt{3}$	$3\sqrt{24}$	$-2\sqrt{6}$

24 = 2 x 2 x 2 x 3
So $\sqrt{24} = \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{3}$
$= 2 \times \sqrt{2} \times \sqrt{3}$
$= 2\sqrt{6}$

$= 3\sqrt{24} - 2\sqrt{6}$
$= 6\sqrt{6} - 2\sqrt{6}$
$= 4\sqrt{6}$

Example 3

Expand and simplify $(1 + \sqrt{3})(\sqrt{2} - 1)$

We can treat this just like we do double brackets in algebra!

x	1	$+\sqrt{3}$
$\sqrt{2}$	$\sqrt{2}$	$\sqrt{6}$
-1	-1	$-\sqrt{3}$

none of these are 'like terms' so we cannot simplify anymore!

$= \sqrt{2} - \sqrt{3} + \sqrt{6} - 1$

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Year 9 Higher Topic 10b Surds Student Knowledge Organiser

Surds are almost exclusively a non- Calculator Topic at GCSE. You can use a calculator to check your answers. Type your question into the calculator, type your answer in, compare them.

Simplifying Surds – Exam Questions

1) $\sqrt{12}$
2) $\sqrt{50}$
3) $\sqrt{72}$
4) $\sqrt{60}$
5) $\sqrt{28}$
6) $\sqrt{96}$
7) $\sqrt{108}$
8) $\sqrt{32}$

Adding and Subtracting Surds

1) $2\sqrt{3} + 3\sqrt{3}$
2) $7\sqrt{7} - 3\sqrt{7}$
3) $7\sqrt{5} - 3\sqrt{5}$
4) $2\sqrt{7} - 3\sqrt{7}$
5) $2\sqrt{32} + 3\sqrt{2}$
6) $2\sqrt{27} - 3\sqrt{3}$
7) $2\sqrt{125} - 3\sqrt{80}$
8) $3\sqrt{24} - 3\sqrt{6}$
9) $\sqrt{108} + 2\sqrt{300}$
10) $5\sqrt{7} + 3\sqrt{28}$
11) $5\sqrt{294} - 3\sqrt{216}$

Multiplying and Dividing Surds

1) $\sqrt{12} \times \sqrt{6}$
2) $\sqrt{50} \times \sqrt{8}$
3) $\sqrt{14} \times \sqrt{28}$
4) $\sqrt{30} \times \sqrt{10}$
5) $\sqrt{15} \times \sqrt{45}$
6) $\sqrt{18} \times \sqrt{15}$
7) $\sqrt{120} \times \sqrt{15}$
8) $\sqrt{32} \times \sqrt{8}$
9) $3\sqrt{2} \times \sqrt{2}$
10) $5\sqrt{5} \times \sqrt{5}$
11) $2\sqrt{3} \times 3\sqrt{3}$

Expanding Single and Double Brackets

1) $\sqrt{2}(1 + \sqrt{2})$
2) $\sqrt{3}(2 - \sqrt{3})$
3) $\sqrt{3}(2\sqrt{3} + 1)$
4) $\sqrt{2}(3\sqrt{2} - 2)$
5) $2\sqrt{2}(1 + 2\sqrt{2})$
6) $3\sqrt{2}(2 - 2\sqrt{2})$
7) $2\sqrt{5}(3 + 4\sqrt{5})$
8) $6\sqrt{2}(\sqrt{2} - 6)$
9) $(1 + \sqrt{2})(2 + \sqrt{2})$
10) $(2 - \sqrt{3})(2 + \sqrt{3})$
11) $(\sqrt{3} + 2)(2\sqrt{3} + 1)$

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Year 9 Higher Topic 11 Trigonometry Student Knowledge Organiser

Key words and definitions

The HYPOTENUSE (h) is the longest side opposite the right angle

The OPPOSITE side(o) is opposite the angle in the question.

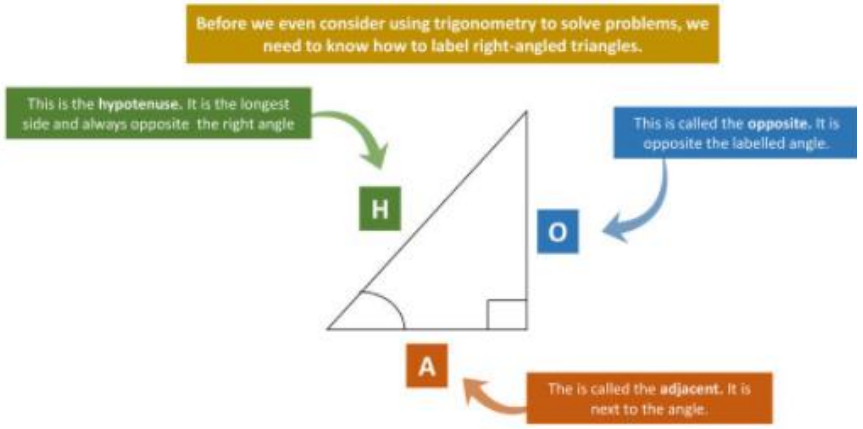
The ADJACENT side (a) is next to the angle in the question

Trigonometric ratios, SIN = $\frac{O}{H}$, COS = $\frac{A}{H}$, TAN = $\frac{O}{A}$

INVERSE trig ratios, used to find the angles in a triangle,

$\sin^{-1} = \frac{O}{H}$ $\cos^{-1} \frac{A}{H}$ $\tan^{-1} \frac{0}{A}$

Labelling a right-angled triangle



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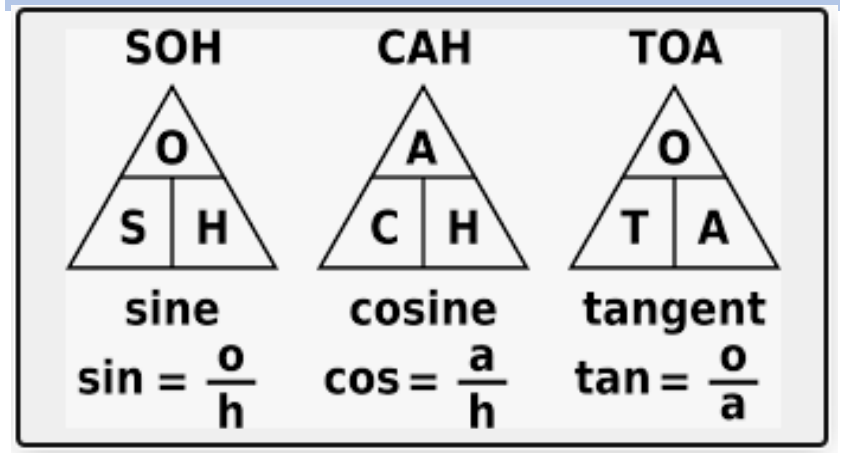
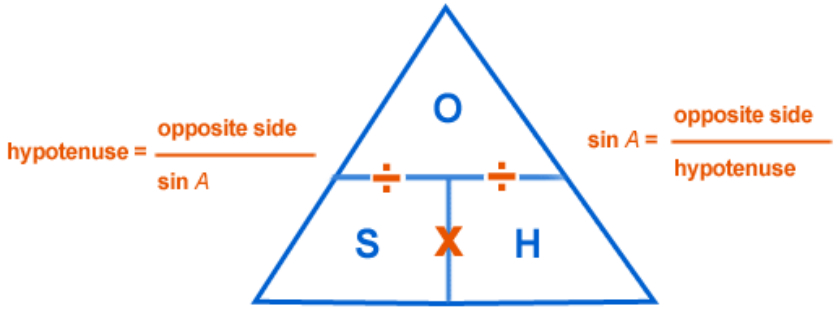
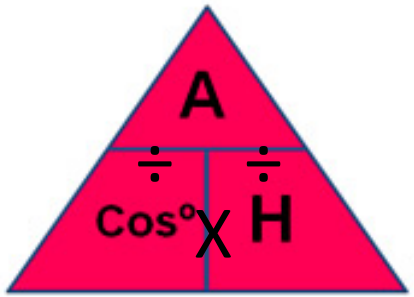
Trigonometric ratios



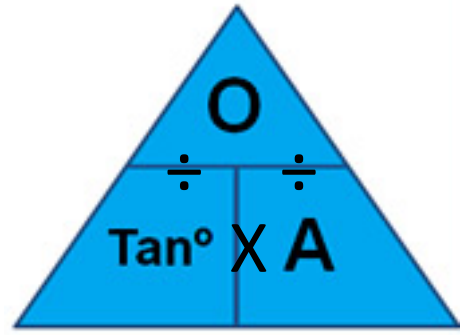
SINE (sin)



COSINE (cos)

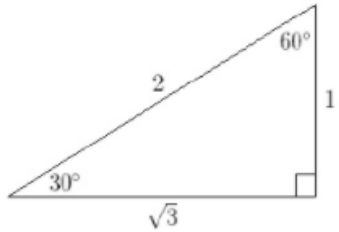


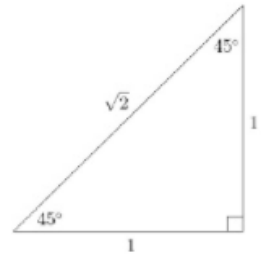
TANGENT (tan)



Special triangles, exact values

Special Triangles:





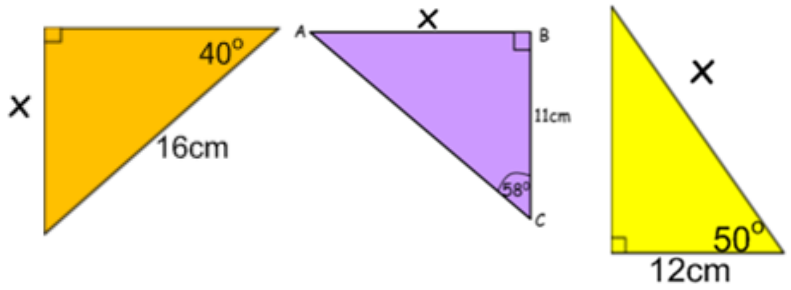
Hegarty Maths Links

508-Trigonometry introduction
509-510 finding sides
511-512 finding angles
513-514 trigonometry multi step
515 trigonometry (elevation/depression)
852-853 non-calculator problem solving
854-863 trigonometry in 3d

Year 9 Higher Topic 11 Trigonometry Student Knowledge Organiser

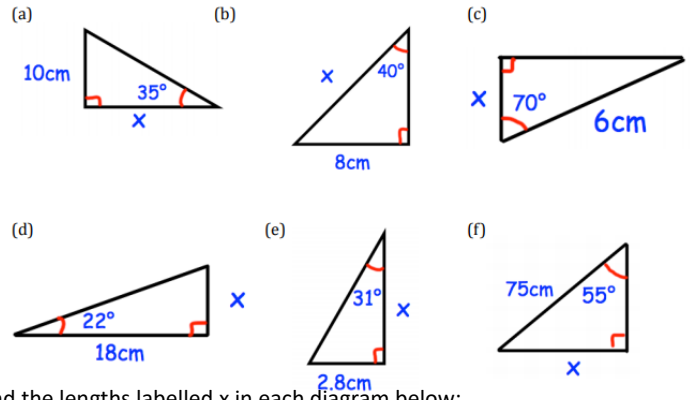
Missing Sides – Which ratio?

Label the sides of the following triangles. Which ratio would you use to calculate the missing side lengths in each one?

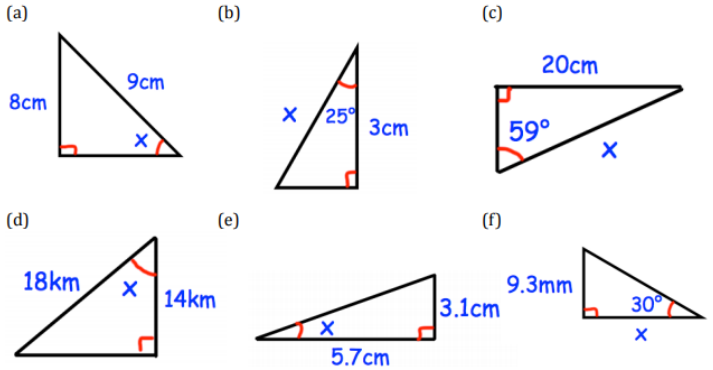


Finding Missing Side Lengths

Find the lengths labelled x in each diagram below:

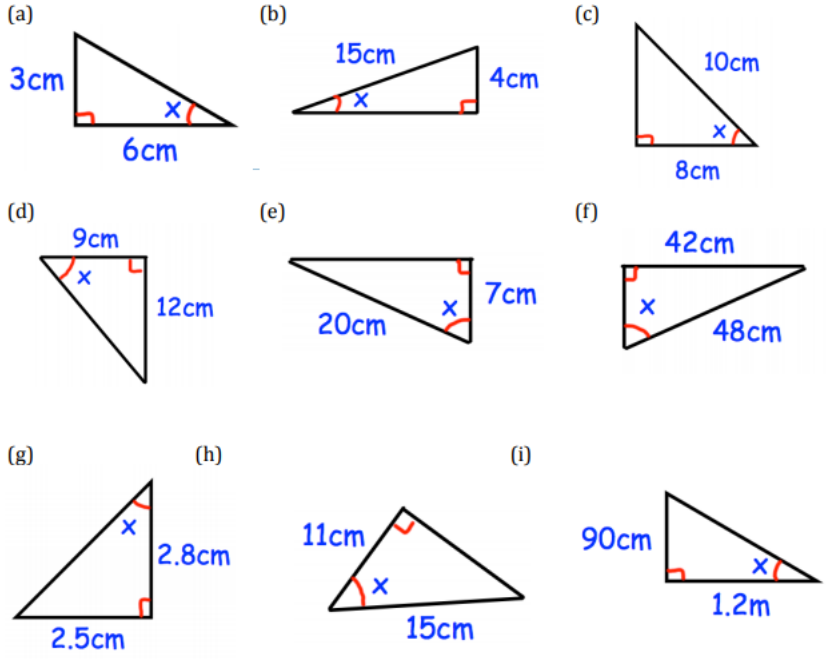


Find the lengths labelled x in each diagram below:



Finding angles

Calculate the size of the missing angles in the triangles below:



Exact values

Write down the exact values of the following:

a) sin 30°

b) cos 0 °

c) tan 45 °

d) sin 90 °

e) sin 0 °

f) cos 60 °

g) tan 0 °

h) sin 45 °

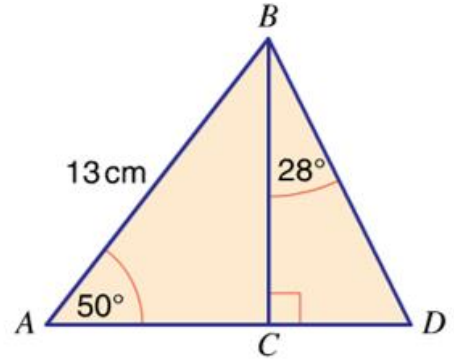
i) cos 30 °

j) tan 60 °

k) cos 90 °

l) sin 60 °

Multi step

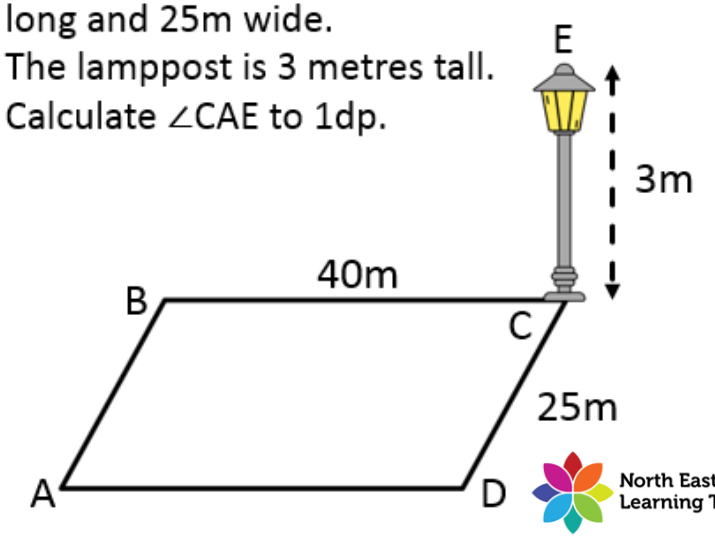


Length of CD

Length of AD

Pythagoras/ Trigonometry in 3d

A lamppost is located in the corner of a rectangular car park. The car park is 40m long and 25m wide.
The lamppost is 3 metres tall.
Calculate ∠CAE to 1dp.



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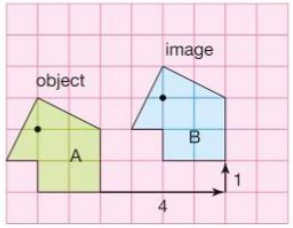
Year 9 Higher Topic 12 Transformations Student Knowledge Organiser

Key words and definitions

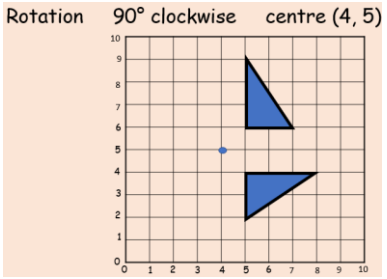
Enlarge – To make a shape larger (or Smaller)
Reflect – To produce an image of a shape as seen in a mirror
Rotate – To turn a shape about a centre point
Translate – To move a shape left or right and up or down
Column Vector - Used to describe a translation $\begin{pmatrix} x \\ y \end{pmatrix}$ with x being left or right, y being up or down.
Congruence – Two shapes are congruent if they are both the same size and shape.
Similarity – Two shapes are similar if one is an enlargement of the other.
Scale Factor – By multiplying each side of a shape by this number you produce an image that has been enlarged.

Translation

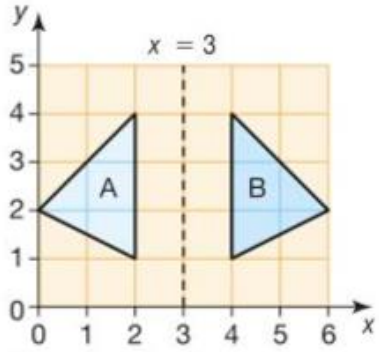


The shape is translated by $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$.

Rotation



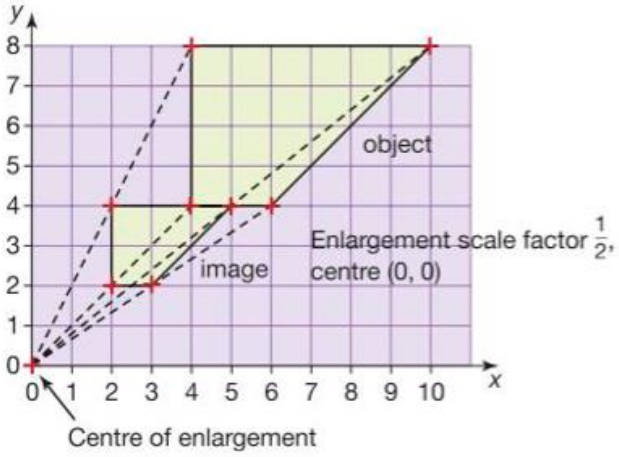
Reflection



The mirror line is $x = 3$.

Enlargement

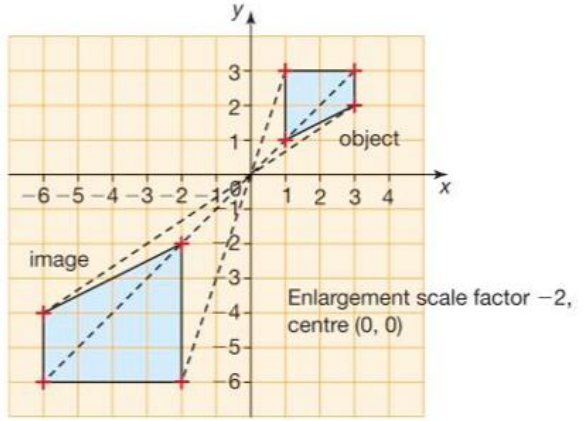
Enlargement with a fractional scale factor reduces the size of the shape.



Scale factor $\frac{1}{2}$: all lengths on the image are half the corresponding lengths on the object.

Enlargement – Negative Scale factor

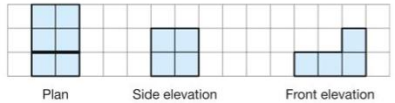
Enlargement with a negative scale factor produces a shape upside down on the opposite side of the centre.



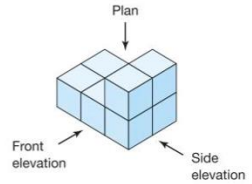
Scale factor −2: all lengths on the image are twice the corresponding lengths on the object; the image is inverted.

Plans and Elevations

- A **plan** of a solid is the view from directly overhead (bird's eye view).
- An **elevation** is the view from the front or the side of the solid.



Notice the extra bold line in the plan, when the level of the cubes alters.



Hegarty Maths Links

Translations – 637,638
Reflections – 639-641
Rotations – 648,649
Enlargement – 642 – 647
Describing Transformations – 650 – 654
Combined Transformations – 656,657
Similarity - 608-614
Plans and Elevations – 837-844

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Year 9 Higher Topic 13 Probability Student Knowledge Organiser

Key words and definitions

Event: one or more outcomes from an experiment
Outcome: the result of an experiment. I
Intersection: elements (parts) that are common to both sets
Union: the combination of elements in two sets.
Expected Value: the value/ outcome that a prediction would suggest you will get
Universal Set: the set that has all the elements
Systematic: ordering values or outcomes with a strategy and sequence

Combinations

To find the total number of outcomes for two or more events, multiply the number of outcomes for each event together. This is called the product rule because it involves multiplying to find a product.

Example

A restaurant menu offers 4 starters, 7 main courses and 3 different desserts. How many different three-course meals can be selected from the menu?

Multiplying together the number of choices for each course gives $4 \times 7 \times 3 = 84$ different three-course meals.

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Sample Space

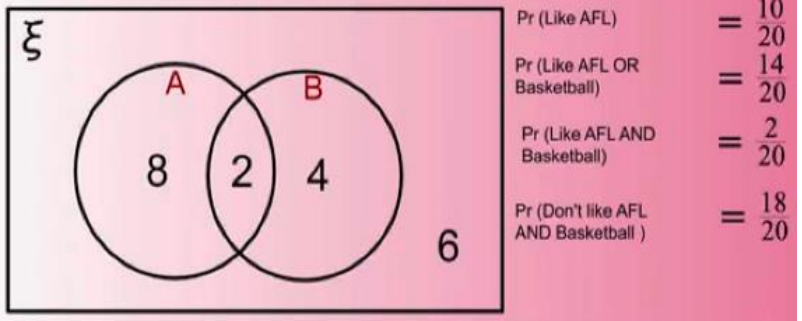
A fair three sided spinner numbered from 1 to 3 is spun and a six sided die is rolled. The scores are added together. Put the results into the probability space diagram below.

Spinner \ Die	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9

What is the probability of the result being

1. 9 $\frac{1}{18}$
2. Less than 4 $\frac{3}{18} = \frac{1}{6}$
3. 7 $\frac{3}{18} = \frac{1}{6}$
4. 1 Zero

Venn Diagrams

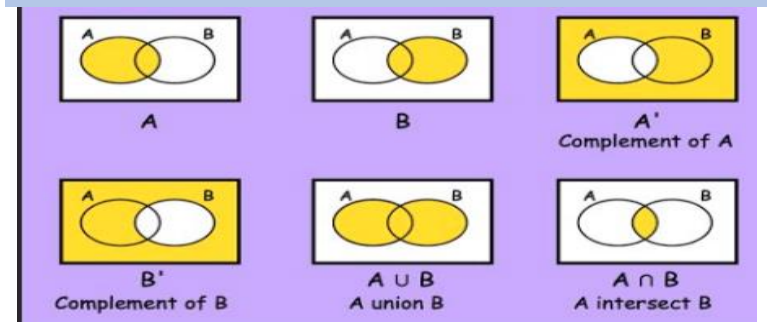


Pr (Like AFL) = $\frac{10}{20}$
Pr (Like AFL OR Basketball) = $\frac{14}{20}$
Pr (Like AFL AND Basketball) = $\frac{2}{20}$
Pr (Don't like AFL AND Basketball) = $\frac{18}{20}$

From a total of 20 students, 10 like AFL (A), 6 like Basketball (B) and 2 like both.

Represent this information in a Venn diagram.

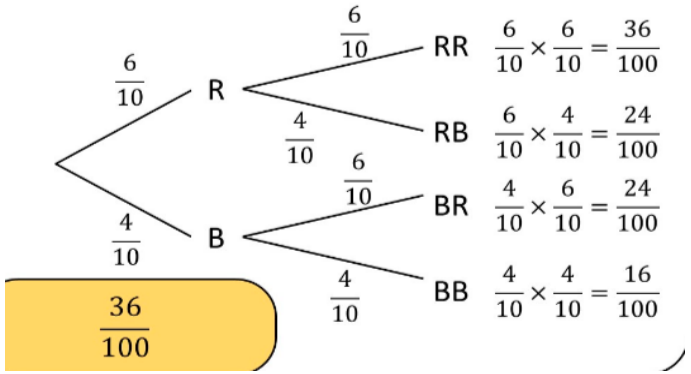
Set notation



Tree diagrams - unconditional

A bag contains 6 red cubes and 4 black cubes.
Jane randomly draws a cube. She **replaces it** and picks another.

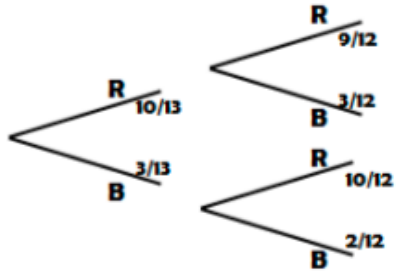
What is the probability she picks two red cubes?



$\frac{36}{100}$

Tree Diagrams- conditional

1. A bag contains 10 red balls and 3 blue balls. A ball is chosen and not replaced before a second is chosen. Find the probability that,
a) two red balls are chosen
b) the balls are the same colour
c) the balls are different colours.



a) P(RR) = 10/13 x 9/12
= 90/156

b) P(RR) + P(BB)
= 10/13 x 9/12 + 3/13 x 2/12
= 90/156 + 6/156
= 96/156

c) P(RB) + P(BR)
= 10/13 x 3/12 + 3/13 x 10/12
= 30/156 + 30/156
= 60/156

Hegarty Maths Links

Tree Diagrams 361-362
Set notation 381-382
Sample space 359
Venn diagrams- 378-391

Year 9 Higher Topic 13 Probability Student Knowledge Organiser

Combinations

There are three dials on a combination lock.
Each dial can be set to one of the numbers 1, 2, 3, 4, 5
The three digit number 553 is one way the dials can be set, as shown in the diagram.

(a) Work out the number of different three digit numbers that can be set for the combination lock.

.....

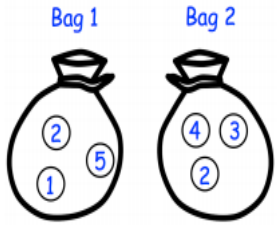
(2)

(b) How many of the possible three digit numbers have three different digits?

Sample Space

Question 1

Two bags, 1 and 2, each contain three counters.
In bag 1, the counters are labelled 1, 2 and 5.
In bag 2, the counters are labelled 2, 3 and 4.



A counter is drawn at random from bag 1 and a counter is drawn from bag 2.

The two numbers are multiplied together to give a score

(a) Complete the table to show all possible scores

(b) Find the probability of scoring a 6

(c) Find the probability of scoring a multiple of 4

(d) Find the probability of scoring an odd number

Bag 1

Bag 2 ×	1	2	5
2			
3			
4			

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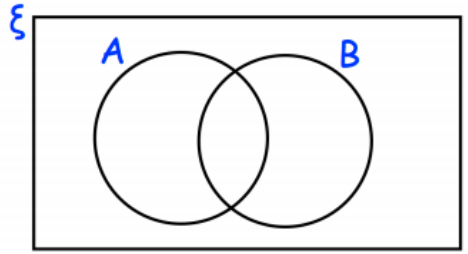
Venn Diagrams and set notation

ξ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}

A = multiples of 3
B = multiples of 5

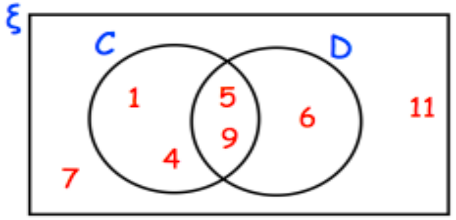
(a) Complete the Venn diagram



One of the numbers is selected at random.

(b) Write down P (A ∩ B)

2. Here is a Venn diagram



Write down the numbers that are in set

(a) D

.....

(b) C ∪ D

.....

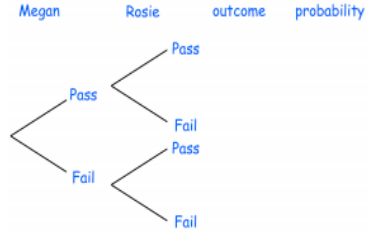
(c) C'

.....

Tree Diagrams

Megan and Rosie sit their driving tests.

The probability that Megan passes the test is 0.8
The probability the Rosie fails the test is 0.3



(a) Copy and complete the tree diagram

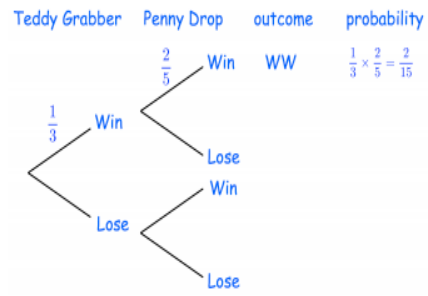
(b) Find the probability that both women pass

(c) Find the probability that Megan fails and Rosie passes

(d) Find the probability that at least one woman passes

(3)

Harry goes to an arcade. He has one go on the Teddy Grabber and one go on the Penny Drop.
The probability that he wins on the Teddy Grabber is ⅓
The probability that he wins on the Penny Drop is ⅖



(a) Copy and complete the tree diagram

(b) Work out the probability that Harry loses on the Teddy Grabber and he also loses on the Penny Drop

(c) Work out the probability that Harry wins on exactly one machine

The probability that a bus arrives late is 0.1

Victor is travelling by bus on Monday and Tuesday.

(a) Show this information on a tree diagram

(b) Calculate the probability that the bus is on time both days.

Knowledge Organisers and Practice questions

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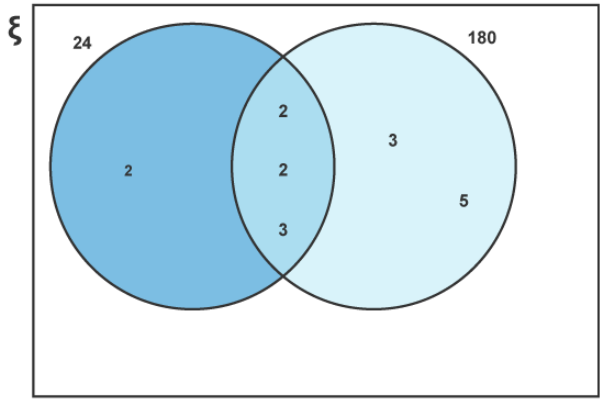
Year 9 Foundation Topic 1 Calculations Student Knowledge Organiser

Key words and definitions

A **factor** is a number that divides into another number exactly and without leaving a remainder.
A **prime number** has only two factors - the number itself and 1.
1 is not a prime number
A **Multiple** is the result of multiplying a number by an integer. The times tables of a number.

HCF & LCM from Venn diagrams

Put each prime factor in the correct place in the Venn diagram. Any common factors should be placed in the intersection of the two circles.



The highest common factor is found by **multiplying together the numbers in the intersection** of the two circles.

HCF = $2 \times 2 \times 3 = 12$

The LCM is found by **multiplying together the numbers from all three sections** of the circles.

LCM = $2 \times 2 \times 2 \times 3 \times 3 \times 5 = 360$

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Rounding to Significant Figures

Examples
Round 53,879 to 1 significant figure, then 2 significant figures.
5|**3**879 to 1 significant figure is 50,000
53|**8**79 to 2 significant figures is 54,000
Notice that the number of significant figures in the question is the maximum number of non-zero digits in your answer.
Round 0.005089 to 1 significant figure, then 2 significant figures.
0.005|**0**89 to 1 significant figure is 0.005
0.0050|**8**9 to 2 significant figures is 0.0051

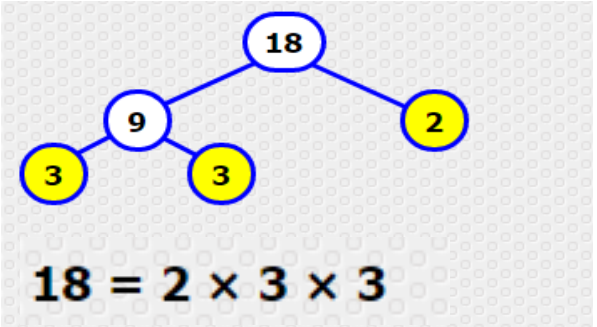
Highest Common Factor (HCF) and Lowest Common Multiple (LCM)

HCF Example
Consider the numbers 12 and 15:
The factors of 12 are : **1, 2, 3, 4, 6, 12**.
The factors of 15 are : **1, 3, 5, 15**.
1 and **3** are the only **common factors** (numbers which are factors of <u>both</u> 12 and 15).
Therefore, the **highest common factor** of 12 and 15 is **3**.

LCM Example
Consider the numbers 12 and 15 again:
The multiples of 12 are : **12, 24, 36, 48, 60, 72, 84, ...**.
The multiples of 15 are : **15, 30, 45, 60, 75, 90, ...**.
60 is a **common multiple** (a multiple of <u>both</u> 12 and 15), and there are no lower common multiples.
Therefore, the **lowest common multiple** of 12 and 15 is **60**.

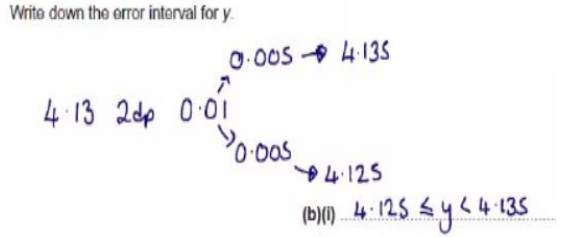
Product of Prime Factors

Finding out which prime numbers multiply together to make the original number. Use a prime factor tree. Also known as 'prime factorisation'.



Error Intervals

An error interval is the range of values that a number could have taken before being rounded or truncated. Error intervals are usually written as a range using inequalities, with a lower bound and an upper bound.



Hegarty Maths Links

Error Intervals: 74-77
Rounding to Significant Figures: 130
HCF: 31-32
LCM: 34-36
Product of Prime Factors: 29-30

Year 9 Foundation Topic 1 Calculations Student Knowledge Organiser

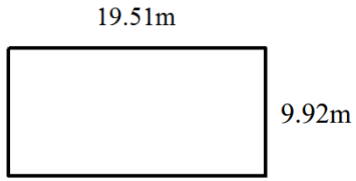
Product of Prime Factors

Write the following as the product of their prime factors

(a) 70
(b) 90
(c) 24
(d) 126
(e) 75
(f) 84
(g) 99
(h) 500

Estimation

A diagram of a farmer's field is shown below:



a. Calculate an estimate for the area of the field.
b. Each cow needs at least $4.5m^2$ of room in a field, use your answer to part a to estimate the maximum number of cows which can be placed in the field.

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HCF &LCM

1. Find the Highest Common Factor of these numbers:

(a) 18 and 30
(b) 15 and 20
(c) 16 and 24
(d) 12 and 36
(e) 28 and 70
(f) 39 and 65
(g) 38 and 57
(h) 20 and 30

2. Find the Lowest Common Multiple of these numbers

(a) 6 and 7
(b) 4 and 6
(c) 5 and 8
(d) 10 and 4
(e) 16 and 5
(f) 14 and 21
(g) 2.2 and 5
(h) 0.4 and 7

3. The lowest common multiple of two numbers is 36, one number is 12, what might the other number be?

4. Jack thinks of two numbers, the HCF of these numbers is 6 and one of the numbers is 24 suggest what his other number may have been.

Error Intervals

Write down the error interval for each of the following questions.

1. The number of passengers on a coach, *g*, rounded to the nearest 10 is 70 people. Write down the error interval for *g*

2: A number, *g*, rounded to the nearest whole number is 241. Write down the error interval for *g*

3: The density of an alloy, *m*, correct to 2 significant figures is $5.9g/cm^3$. Write down the error interval for *m*

4: A number, *p*, **truncated** to 2 decimal places is 13.19. Write down the error interval for *p*

5: The weight of a pencil case, *w*, rounded to the nearest 100g is 900g. Write down the error interval for *w*

6: The length of a piece of string, *j*, rounded to 1 decimal place is 48.2cm. Write down the error interval for the length *j*

7: The volume of a box, *d*, correct to 1 significant figure is $70cm^3$. Write down the error interval for *d*

8: The weight of a suitcase, *u*, **truncated** to 1 decimal place is 13.2kg. Write down the error interval for the weight of the suitcase.

9: A number, *r*, rounded to 2 decimal places is 4.05. Write down the error interval for *r*

10: A number, *k*, correct to 3 significant figures is 4.45. Write down the error interval for *k*

Year 9 Foundation Topic 2 Indices and Standard Form Student Knowledge Organiser

Key words and definitions

Index number - number that is multiplied by itself one or more times is raised to a power. The power is the index number. The plural is indices.

Power - A number that is multiplied by itself one or more times is raised to a power

Standard Form – Writing large and small numbers as a number between 1 and 10 multiplied by a power of 10

Square Root – square root of a number is a value that, when multiplied by itself, gives the number

Powers/Indices

2^4 is a short way of writing $2 \times 2 \times 2 \times 2$.

Index laws

1. $a^m a^n = a^{m+n}$
2. $\frac{a^m}{a^n} = a^{m-n}$ e.g. $b^5 \times b^3 = b^{5+3} = b^8$
3. $(a^m)^n = a^{mn}$
4. $(ab)^m = a^m b^m$
5. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ e.g. $(a^2)^5 = a^{2\times5} = a^{10}$
6. $a^0 = 1$
7. $a^{-n} = \frac{1}{a^n}$

Standard Form

Standard form, or standard index form, is a system of writing numbers which can be very large or very small numbers. It is based on using powers of 10.

Convert to

50,000 can be written as: $5 \times 10,000$

$10,000 = 10 \times 10 \times 10 \times 10 = 10^4$

So, $50,000 = 5 \times 10^4$

0.0005 can be written as 5×0.0001.

$0.0001 = 10^{-4}$

So, $0.0005 = 5 \times 10^{-4}$.

Convert from

1.34×10^3 is 1,340, since $1.34 \times 10 \times 10 \times 10 = 1,340$.

4.78×10^{-3} is 0.00478, as $4.78 \times 0.001 = 0.00478$.

BIDMAS

Mathematical operations must be carried out in the correct order. BIDMAS is a way of remembering this order.

B – Brackets
I – Indices/Powers
D – Division
M- Multiplication
A – Addition
S- Subtraction

e.g $2^2 \times 5 - 6 \div 3$.

1.There are no brackets (B), so calculate the indices first (I), giving

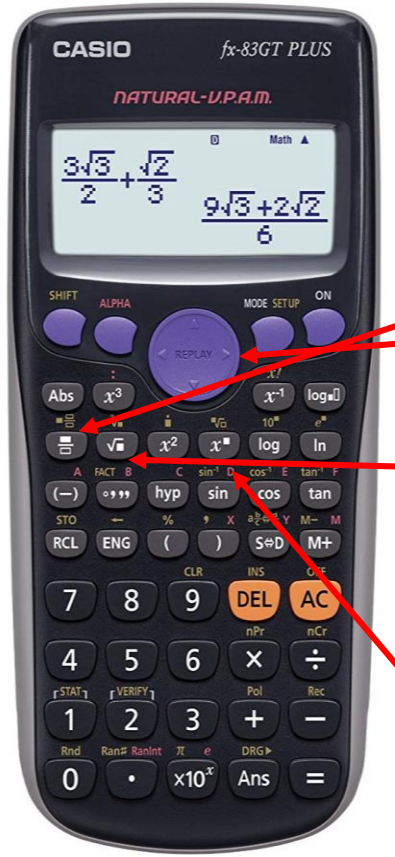
$4 \times 5 - 6 \div 3$

2.Do any divisions or multiplications (DM), working left to right:

$4 \times 5 = 20$ and $6 \div 3 = 2$

3. And, finally, do any additions or subtractions (AS): $20 - 2$ gives 18

Calculator Methods



Calculate

$$\frac{\sqrt{678} - 1.42^2}{3^4 \times 1.57}$$

1. Press fraction button (use arrow keys to move around the fraction)
2. Press square root button and fill in 678, use arrow key to go out of the square root
3. Subtract 1.42^2
4. Move down the fraction and press the indices button and use the arrow keys to fill in the numbers and multiply by 1.57

Hegarty Maths Links

Powers and roots – 99 to 110

Standard Form – 121 to 128

Order of calculation - 24

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Year 9 Foundation Topic 2 Indices and Standard Form Student Knowledge Organiser

Index Laws

(h) $2^8 \times 2^8$ (i) $2^9 \times 2^2$ (j) 2×2^8 (k) $2^6 \times 2^5$

(a) $5^5 \div 5^2$ (b) $5^8 \div 5^3$ (c) $5^9 \div 5^2$ (d) $5^7 \div 5^5$

(a) $(8^5)^2$ (b) $(8^3)^2$ (c) $(8^4)^3$

$(2a)^4$ $(ab^2)^3$ $(3x^4)^2$

2^{-4} b^{-3} 3^{-2}

Bidmas

(a) $7 + 2 \times 3$ (b) $9 + 4 \times 2$ (c) $10 + 2 \times 2$

(a) $5 - 2^2$ (b) $7 + 3^2$ (g) $(1 + 2)^3$

(e) $8 + (5 - 1) \times 3$ (f) $50 - (1 + 4) \times 4$ (g) $19 \times 2 + 5^2$

(a) $5 \times 3 + 2 \times 6$ (b) $9 \div 3 + 15 \times 2$ (c) $10 \div 2 - 2 \times 1$

(i) $10 - \sqrt{16}$ (j) $\sqrt{(2 + 14)}$ (k) $\sqrt{4} + 3^2$

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Standard Form

Convert to standard form

(e) 100000000 (f) 900 (g) 250000

(i) 54000000 (j) 11000000 (k) 89000

(e) 0.00065 (f) 0.0022 (g) 0.0361

(i) 0.00000423 (j) 0.0000000981 (k) 0.00407

Convert from standard form

(e) 5×10^7 (f) 1.2×10^2 (g) 2.9×10^5

(i) 3.16×10^{-5} (j) 8.62×10^{-4} (k) 7.09×10^{-6}

Calculator Methods

Use your calculator to find the exact value to these calculations

(a) $\dfrac{3.5}{1.4 + 3.8}$ (b) $\dfrac{7.8 \times 5.3}{11.7}$

(d) $\dfrac{0.18 + 0.175}{2.4 \times 1.9}$ (e) $\dfrac{0.495}{0.091} \times 604.6$

(d) $\dfrac{18.2 + 7.4}{\sqrt{9.22}}$ (e) $\dfrac{\sqrt{17.8 - 9.93}}{1.25 - 5.9}$

Applying Knowledge

Hannah thinks the answer to should be 4 because $3.25 - 1.25^2 = 2$ and then $2^2 = 4$ Explain why the answer on her calculator is 1.6875.

Put brackets in the following statements to make them true

(a) $6 \times 7 + 3 - 8 = 52$

(b) $4 + 3 \times 7 - 1 = 42$

Show that 5.9×10^8 is approximately 100 times bigger than 4.2×10^6

Simplify

(i) $y^6 \times y^5 \times y^2$ (j) $y^8 \times y \times y^3$

$2a^3c^3 \times 3a^2c$

Year 9 Foundation Topic 3 Expressions Student Knowledge Organiser

Key words and definitions

Substitution: putting numbers where the letters are
Simplify: make an algebraic expression easily understandable and solvable
Expand: multiply to remove the ( )
Factorise: putting an expression back into brackets.

Substitution

$2b^2c = 2 \times b^2 \times c$

(substituting $b = 4$ $c = 3$)

This gives: $2b^2c = 2 \times b^2 \times c = 2 \times 4^2 \times 3$

$2 \times 16 \times 3 = 96$

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Simplify

Simplify $b + b + b + b$.

Adding the four like terms together gives $4b$.

Simplify $5m + 3m - 2m$. = 8m-2m = 6m

Expand (Single Brackets)

To remove brackets, multiply the term on the outside of the bracket with each term inside the brackets.

Expand and simplify:

$3(x + y) + 2(x + y)$ $= 3x + 3y + 2x + 2y$

$= 5x + 5y$

Simplify (with multiplication and division)

Simplify $b \times b \times b$.

$b \times b \times b = b^3$.

Simplify $16e^2 \div 2e$.

$16 \div 2 = 8$ and $e^2 \div e = e$

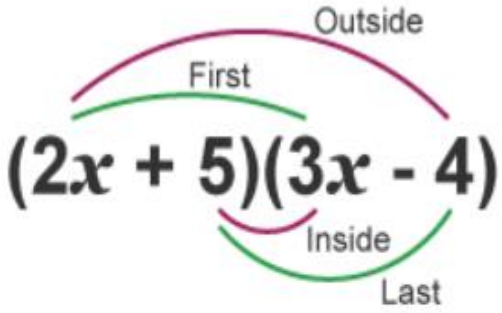
$16e^2 \div 2e$ simplified is $8e$.

When you divide powers you subtract them (shown below):

$$\frac{a^5}{a^2} = a^{5-2} = a^3$$

Expand (Double Brackets)

Expand and Simplify $(2x + 5)(3x - 4)$



$(2x + 5)(3x - 4)$

$= (2x \times 3x) + (2x \times -4) + (5 \times 3x) + (5 \times -4)$

$= 6x^2 - 8x + 15x - 20$

$= 6x^2 + 7x - 20$

Hegarty Maths Links

Expressions: Video 154

Substitution: Videos 155, 780-789

Expansion: Videos 160-166

Simplify: Videos 170-171

Year 9 Foundation Topic 3 Expressions Student Knowledge Organiser

Simplify:

1) 3a + 2b + 4c + 2a

2) 5c + 2d + 3c + 4d

3) 2b – b + 4a – 3c

4) 5a + 2b + 6a – 2b

5) 8h – 4g + 5g + 2h =

6) 7b + 6a – 5b + 3a =

7) 5k + 4j – 3k + 6j =

8) 3a + 2a – 5a + b =

Expand:

1) 5(a + 3)

2) 3(b + 4)

3) 6(c – 2)

4) 4(d – 5)

5) 3(2e + 4)

6) 7(6f – 2)

7) 8(3 – 2g)

8) 9(7 + 4h)

6(x + 3) =

7(x + 7) =

11(x + 1) =

9(x + 8) =

4(x + 7) =

1) $(x+4)(x-2)$
2) $(x+6)(x+3)$
3) $(x-7)(x-9)$
4) $(x-2)(x-8)$
5) $(x-4)(x+6)$

1) $(2x+4)(x-7)$
2) $(x+2)(3x+3)$
3) $(4x-6)(x-9)$
4) $(5x-6)(2x+3)$

Substitution: Find the value of

Let $x = 4$ and $y = -3$

1) $3x + 6$
2) $3x - 15$
3) $2y - 2$
4) $4x + 9$
5) $3 - x$
6) $3 - y$
7) $5 - 2x$

Let $s = -2$ and $t = -4$

1) $s^2 + 4$
2) $s^2 - 7$
3) $2s^2 + 5$
4) $6s^2 - 2$
5) $t^2 + 7$
6) $t^2 - 20$
7) $t^3 + 1$

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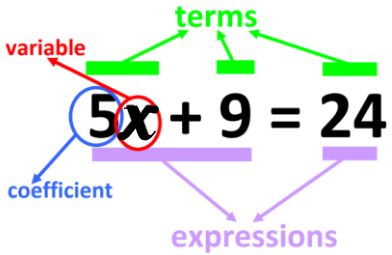
Year 9 Foundation Topic 4 Equations Student Knowledge Organiser

Key words and definitions

Variable – A symbol for an unknown value. Usually a letter, such as a, x or y
Constant – A number on its own
Coefficient – A number that is multiplied by a variable
e.g. 8y -> 8 is the coefficient and y is the variable
Term – Either a single number, a variable, or number and/or variables multiplied together
Expression – A term or a combination of terms
Equation – A mathematical sentence starting that two expressions are equal



Solving Linear Equations

Solve the equation $4y + 5 = -3$.

$4y + 5 = -3$

Subtract 5 from each side:

$4y + 5 - 5 = -3 - 5$

Simplify:

$4y = -8$

Get y by itself by dividing both sides by 4:

$4y \div 4 = -8 \div 4$

$y = -2$

Solve the equation $5(2c - 3) = 19$.

Expand the bracket:

$5 \times 2c - 5 \times 3 = 19$

$10c - 15 = 19$

Isolate $10c$ by adding 15 to each side:

$10c - 15 + 15 = 19 + 15$

$10c = 34$

Isolate c by dividing by 10:

$10c \div 10 = 34 \div 10$

$c = \frac{34}{10} = \frac{17}{5}$ or 3.4

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Rearranging Formulae

The **subject** of a formula is the variable that is being worked out. It can be recognised as the letter on its own on one side of the equals sign.

For example, in the formula for the area of a rectangle $A = bh$ (***area = base × height***), the subject of the formula is A.

Rearrange the formula $v = u + at$ to make t the subject of the formula.

$$\begin{array}{rcl} v & = & u + at \\ -u & & -u \\ v - u & = & at \\ \div a & & \div a \end{array}$$

$$\frac{v - u}{a} = t$$

The letter t is now isolated, so t is now the subject of the formula.

Inequalities

$>$	Greater Than	$<$	Less Than
$\geq$	Greater Than or Equal To	$\leq$	Less Than or Equal To

Writing inequalities on a number line :

- Place dot on the numbers given in the inequality
- Colour in dot if your sign is a greater/less than or equal to
- Draw the line to satisfy the inequality

e.g.

$x < 2$

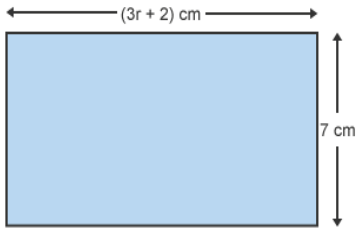
$-5 \leq x < 4$

The process to solve inequalities is the same as the process to solve equations.

$$\begin{array}{rcl} 3m + 2 & > & -4 \\ -2 & & -2 \\ 3m & > & -6 \\ \div 3 & & \div 3 \\ m & > & -2 \end{array}$$

Forming and Solving Equations

The area of this rectangle is 56 cm^2. Find the value of r.



Area of a rectangle = base × height. This means $3r + 2$ will all be multiplied by 7. To show this in algebra, use a bracket for $3r + 2$ to show that both terms are being multiplied by 7.

7 multiplied by $(3r + 2)$ can be written as $7(3r + 2)$ as multiplication signs are not used in algebra.

Area = base × height

Area = $7(3r + 2)$

The area of the rectangle has been given in the question as 56 cm^2:

$56 = 7(3r + 2)$

Expand the bracket:

$56 = 7 \times 3r + 7 \times 2$

$56 = 21r + 14$

Isolate $21r$ by subtracting 14 from both sides:

$56 - 14 = 21r + 14 - 14$

$42 = 21r$

Isolate r by dividing both sides by 21:

$42 \div 21 = 21r \div 21$

$2 = r$

Hegarty Maths Links

Solving equations 177,178,179,180,181,182,183,184,185,186,187

Forming and solving equations 176,188

Rearranging Formulae 280,281, 282, 283, 284,285,286,287

Simultaneous Equations 190,191,192,193,194,195

Year 9 Foundation Topic 4 Equations Student Knowledge Organiser

Solving linear equations

Solve

(a) $2x + 3 = 9$ (b) $3w - 1 = 14$ (c) $7y + 2 = 30$

$3(2a + 1) = 21$ $5(4a - 3) = 65$

(a) $\frac{x+1}{2} = 9$ (b) $\frac{x-3}{4} = 8$ (c) $\frac{m-8}{5} = 3$

(a) $4x + 15 = x + 3$ (b) $8x + 40 = 3x + 5$ (c) $9x + 7 = 11x + 20$

(d) $7x + 9 = 2x - 16$ (e) $9x - 70 = 2x - 91$ (f) $4 - 5x = 3x + 28$

Rearranging formulae

Make x the subject

(a) $4x + c = w$ (b) $dx - t = 8$ (c) $x^2 + 3 = h$

(d) $2x + 2y = P$ (e) $s = x^2 - 3$ (f) $y = xz + s$

(j) $3y = 4x + 1$ (k) $x^2 + a = v$ (l) $x^3 - 4 = 5y$

(m) $\frac{x+t}{m} = 2c$ (n) $\frac{w+x}{u} = 3z$ (o) $A = \pi x^2$

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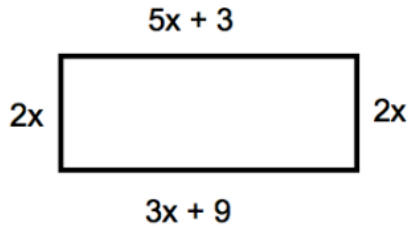
Forming and solving equations

Fiona is x years old. Thomas is 3 years older than Fiona. Cara is twice as old as Fiona. The sum of their ages is 51.
(a) Form an equation in terms of x and solve the find their ages



a) Form an equation and solve to find x
b) Find the area of the rectangle

Inequalities

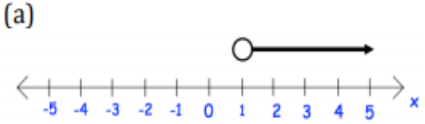
Solve

(a) $2x + 1 \leq 9$ (b) $3x - 5 > 16$ (c) $4x + 8 < 32$

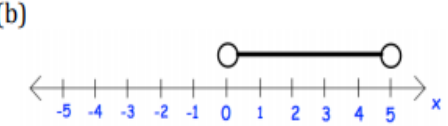
(d) $4(x - 2) < 18$ (e) $2(2x - 9) \geq 22$ (f) $3(2x + 7) \leq 9$

Write down the inequality shown on the number line

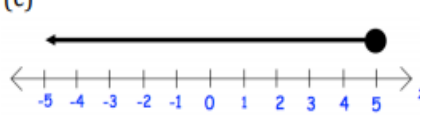
(a)



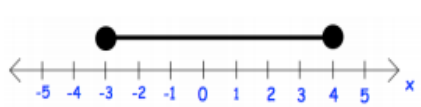
(b)



(c)



(d)

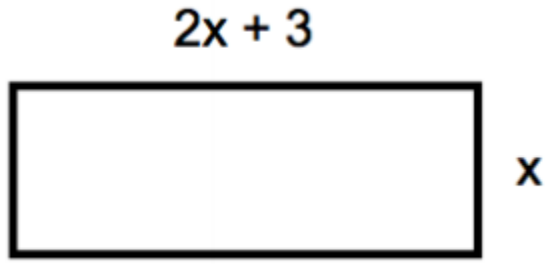


Applying Knowledge

The sum of each row is given.
Find a, b, c and d.

a	a	a	a	24
a	a	b	b	28
b	c	c	c	29
a	b	c	d	31

Below is a rectangle, with width x cm and length 2x + 3 cm. The perimeter of the rectangle is 72cm. Calculate the area.



Write down all the integer values of x that satisfies $-2 \leq 2x < 6$

x is an integer.
Write down all the solutions of the inequality
$3 < 2x + 1 < 13$

Year 9 Foundation Topic 5 Charts and averages Student Knowledge Organiser

Key words and definitions

Frequency – How many times a value occurs

Cumulative Frequency – Frequency added together

Ascending – Going up from smallest to biggest

Median – Middle value in an ascending list of data

Mode/Modal value – most common value in the data

Mean - The total of the numbers divided by how many numbers there are.

Range – Biggest number – smallest number

Sum - addition of values

Averages from lists

7 babies weigh the following amounts:
2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

- $mean = \frac{2.5+3.1+3.4+3.5+3.5+4+4.1}{7} = \frac{24.1}{7} = 3.44$ (2 dp)
- 2.5 kg, 3.1 kg, 3.4 kg, **3.5 kg**, 3.5 kg, 4 kg, 4.1 kg
  The median weight of these babies is 3.5 kg.
- 2.5 kg, 3.1 kg, 3.4 kg, **3.5 kg**, **3.5 kg**, 4 kg, 4.1 kg
  The modal weight is 3.5 kg.

Hegarty Maths Links

Pie charts - 427, 428, 429

Averages – 413, 419, 417,418, 416, 415, 404, 409, 406

Scatter Graphs – 453, 454

Averages from table

	Number of Goals	Frequency	Cumulative Frequency
	0	2	2
	1	3	5
	2	5	10
	3	1	11
Total		11	

Mode = category with biggest frequency = **2 goals**

Median = value in the $\frac{Total+1}{2}$ position = 6th position = **2 goals**

Mean = $\frac{Sum\ of\ frequency \times number\ of\ goals}{Total}$ = $\frac{0\times2+1\times3+2\times5+3\times1}{11}$

= $\frac{16}{11}$ = **1.5 goals** (1.d.p)

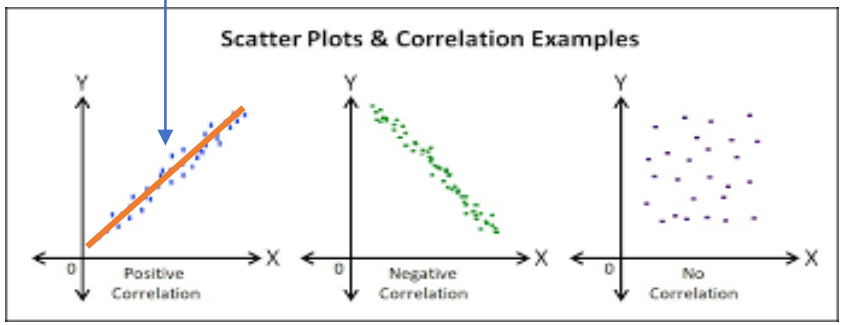
For grouped data,

$0 \le m < 4$	12

use the middle value when multiplying the data by the frequency when calculating the mean.

Scatter Graphs

Use a line of best fit to show correlation and to estimate values using the scatter graph



Reverse mean

The mean height jumped by a high jumper after 10 jumps is 1.81m. He jumps another jump at 1.73m, what is his new mean height?

1.81 x 10 = 18.1m = Sum of all 10 jumps

Mean of 11 jumps = $\frac{Sum\ of\ 11\ jumps}{Total\ no.of\ jumps}$

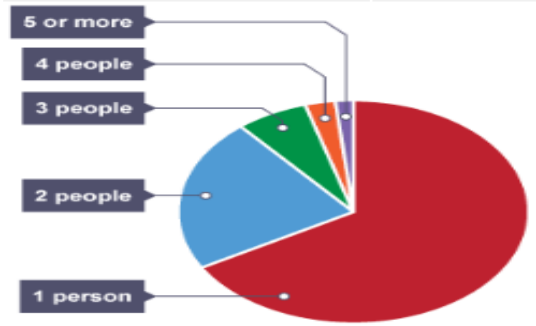
$= \frac{18.1+1.73}{11}$ = 1.80m (2.d.p)

Pie Charts

To draw a pie chart, find the proportion of 360° :

1 item/frequency = $\frac{360°}{Total\ Frequnecy} = \frac{360°}{180} = 2°$

People travelling in a vehicle	Frequency	Calculation	Angle
1 person	120	2×120	240°
2 people	40	2×40	80°
3 people	13	2×13	24°
4 people	5	2×5	10°
5 or more people	2	2×2	4°
Total	**180**		



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Year 9 Foundation Topic 5 Charts and averages Student Knowledge Organiser

Averages from lists

Here are 12 test scores of Jessica.

8 9 8 7 9 6 5 5 8 7 5 8

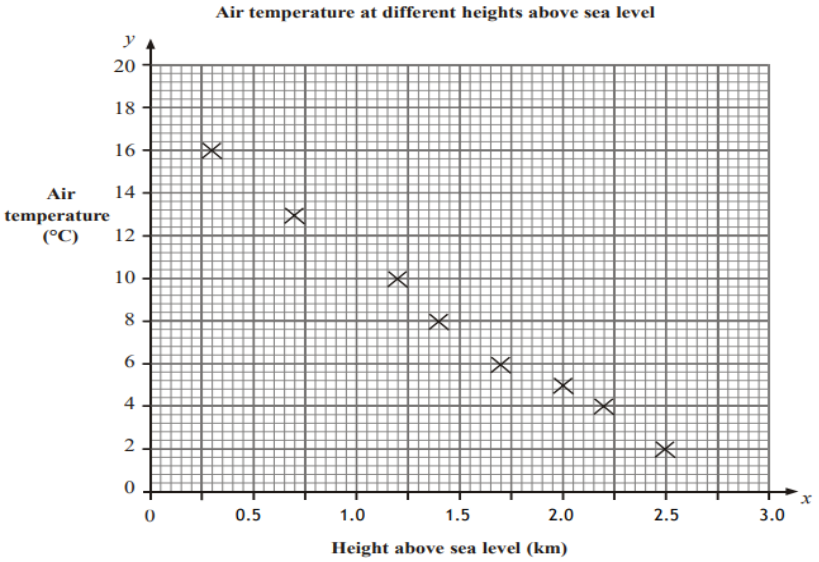
a) Find the mean

b) Find the median

c) Find the mode

d) Find the range

Scatter Graphs



a) Draw a line of best fit

b) State the type of correlation between the air temperature and height above sea level.

c) Estimate the value of the air temperature at a height of 1.8m above sea level

Pie Charts

The table gives information about the numbers of fish in a lake.

Fish	Frequency	
Perch	10	
Bream	23	
Carp	39	

Draw an accurate pie chart to show this information.

Averages from tables

Number of drawing pins	Frequency	
29	2	
30	5	
31	2	
32	1	

Time taken (m minutes)	Frequency
$0 < m \leq 10$	3
$10 < m \leq 20$	8
$20 < m \leq 30$	11
$30 < m \leq 40$	9
$40 < m \leq 50$	9

For each table above, calculate

a) Mean b) Median c) Mode

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Reverse means

Q1. The mean number of goals scored by 3 players is 18. Another player joins, having scored 6 goals. What is the mean number of goals scored by the 4 players?

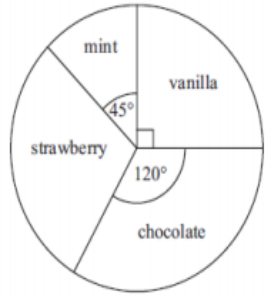
Q2. The mean of 9 numbers is 1.5. Another number is added. The mean is now 1.6.
What number was added?

Applying Knowledge

Q1. Four numbers have a mean of 8 and a median of 8, but none of the numbers is 8. Give an example of what the four numbers could be.

Q2.

Some children were asked to name their favourite flavour of ice cream.
The pie chart and table show some information about their answers.

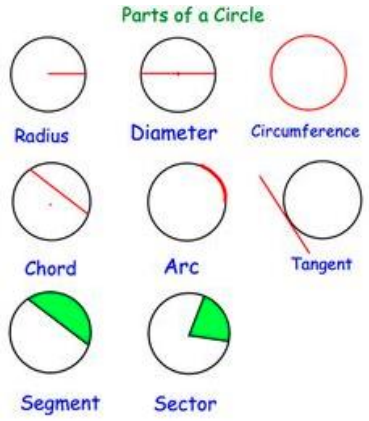


Use the pie chart to complete the table.

Flavour	Number of children	Angle of sector
vanilla	12	90°
mint	.....	45°
strawberry	14	.....
chocolate	.....	120°

Year 9 Foundation Topic 6 Area and volume Student Knowledge Organiser

Key words and definitions



Volume
A measure of the amount of space occupied by an object.

Surface area
The area of all the faces in a 3D shape added together.

Compound shape
A shape made up of two or more basic shapes.

Prior Knowledge

Understand what is meant by area of a shape.

Understand what is meant by perimeter of a shape.

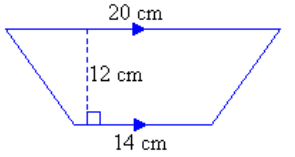
Calculate the area of a rectangle.

Calculate the area of a triangle.

Calculate the volume of a cuboid.

Calculate the volume of a prism.

Area



$a = 20$ cm, $b = 14$ cm, $h = 12$ cm

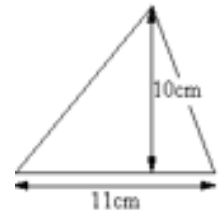
$A = \frac{1}{2}(a+b)h$

$= \frac{1}{2}(20+14)\times 12$

$= \frac{1}{2}\times 34\times 12$

$= 204$

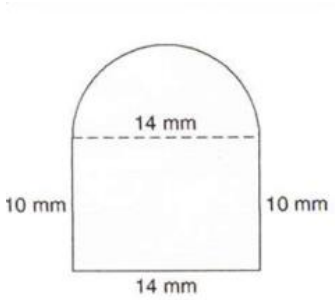
So, the area of the trapezium is 204cm²



Area of tringle
$= \frac{bh}{2}$
$= \frac{11\times 10}{2}$
$= 55cm^2$

Parallelogram
Area = bh
Area = 3.2m x 3.7m
Area = 11.84m²

Compound area



This figure can be separated into a rectangle and a semicircle. Find the area of each.

Rectangle: $A = L \times W$

$A = 10 \times 14$

$A = 140mm^2$

Semicircle: $A = \frac{\pi \times r^2}{2}$

$A = \frac{3.14\times 7^2}{2}$

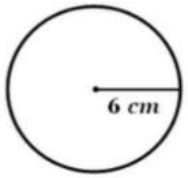
$A = \frac{3.14\times 49}{2}$

$A = 76.93mm^2$

Area = 140 + 76.93

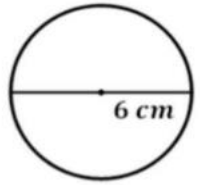
Area = 216.93mm^2

Circumference and area of a circle



$A = \pi r^2$
$= 3.142 \times 6^2$
$= 3.142 \times 36$
$= 113.11\ cm^2$

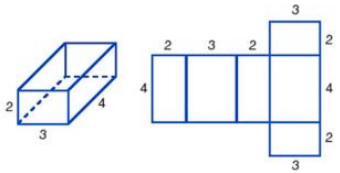
In terms of π
$= \pi \times 6^2$
$= 36\ \pi$



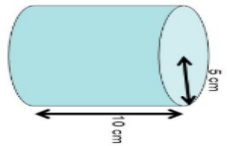
$C = \pi d$
$= 3.142 \times 6\ cm$
$= 18.85\ cm$

In terms of π
$= \pi \times 6$
$= 6\ \pi$

Surface area of a prism



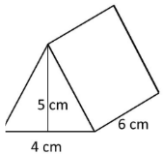
S.A. = 2(2 x 4) + 2(3 x 4) + 2(2 x 3)
S.A. = 2(8) + 2(12) + 2(6)
S.A. = 16+ 24+ 12
S.A. = 52



- Area of rectangle = 2πrh = 2 x 3.14 x 5 x 10 = 314 cm²
- Area of two ends = 2πr² = 2 x 3.14 x 5 x 5 = 157 cm²
- Total surface area is 2πrh + 2πr²
- Total surface area = 314 + 157 = 471 cm²

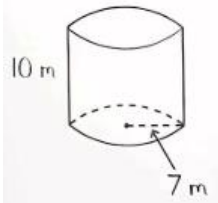
Volume of a prism

Volume of prism: $V = area\ cross\ section \times length$



Area of triangle = ½ x 5 x 4
= ½ x 20
= 10 cm²

Volume = area x length
= 10 X 6
= 60 cm³



$V = Bh$
$V = \pi r^2 h$
$= \pi(7m)^2(10m)$
$= \pi(49m^2)(10m)$
$= 490\pi\ m^3$

Hegarty Maths Links

Area of triangle	557, 558
Area of parallelogram	556
Area of trapezium	559
Circumference of circle	534, 535
Area of circle	539, 540
Volume of prism	570, 571, 572, 573, 574
Surface area of prism	585
Compound shapes	555

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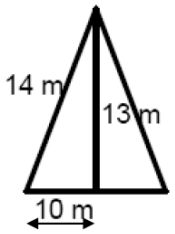
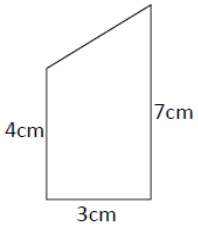
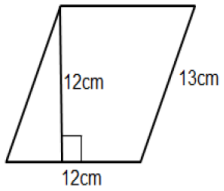
Year 9 Foundation Topic 6 Area and volume Student Knowledge Organiser

Area

Calculate area of the following shapes.

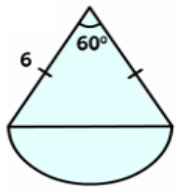






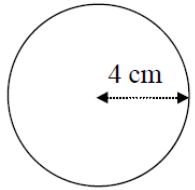
Compound area

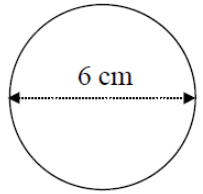
Calculate area of the shape.



Circumference and area of a circle

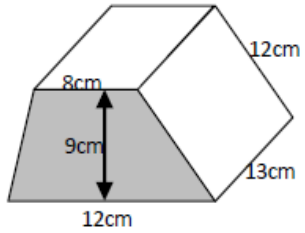
Calculate the circumference and area of the circles.





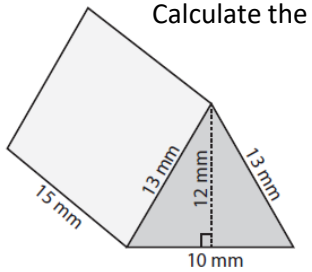
Volume of a prism

Calculate the volume of the trapezoid prism.



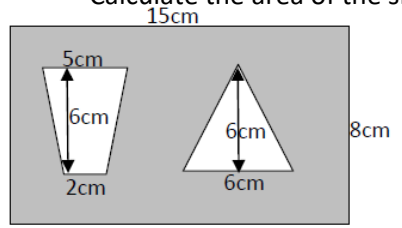
Surface area of a prism

Calculate the surface area of the triangular prism.



Applying knowledge

Calculate the area of the shaded area.



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Year 9 Topic 7 Fractions, decimals and percentages Student Knowledge Organiser

Key words and definitions

Numerator - the top number of a fraction.
Denominator – the bottom number of a fraction, represents the number of parts to make one whole.
Equivalent – worth the same amount.
Simplify – reducing a fraction to an equivalent fraction with the lowest possible numerator and denominator.
Reciprocal – is one of a pair of numbers that when multiplied together gives the answer equal to 1.
Depreciation – the decrease in the value of something over time.
Interest - is money that is paid regularly at a particular percentage, usually when money has been lent or borrowed.

Multiply, divide, add and subtract fractions

$$\frac{2}{3} \times \frac{3}{5} = \frac{6}{15} = \frac{2}{5}$$

Simplify first?
Multiply numerator
Multiply denominator
Simplify?

$$\frac{2}{15} \div \frac{4}{5} = \frac{2}{15} \times \frac{5}{4} = \frac{1}{6} = \frac{10}{60}$$

Flip the second fraction (reciprocal) and change to x
Multiply the fractions
Simplify?

$$\frac{2}{7} + \frac{3}{5} = \frac{10}{35} + \frac{21}{35} = \frac{31}{35}$$

Make common denominator
Do same to numerator as the denominator
Add/subtract numerators – keep the same denominator
Simplify?

$$\frac{7}{9} - \frac{3}{4} = \frac{28}{36} - \frac{27}{36} = \frac{1}{36}$$

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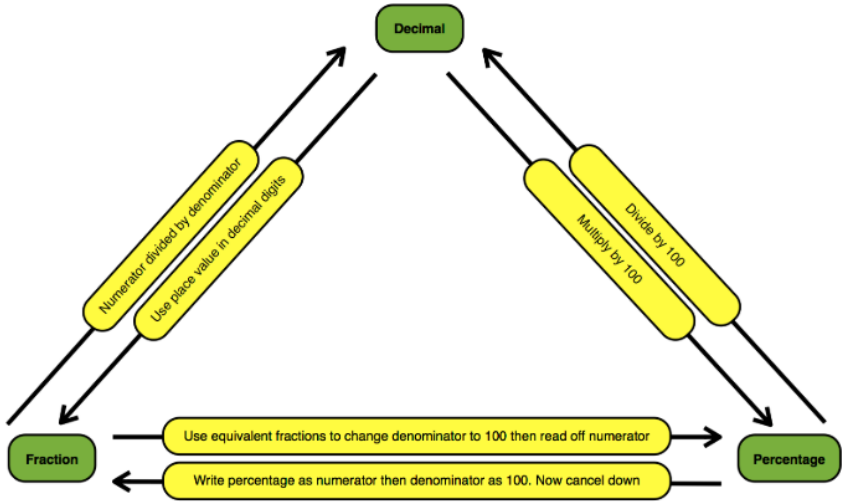
Equivalent fractions, decimals and percentages



Percentage increase and decrease and percentage change.

Increase £240 by 15%

100% of £240
15% of £240 +
115% of £240
= 240 × 1.15
= £276

Or multiply by 1.15

Decrease £90 by 12%

100% of £90
12% of £90 −
88% of £90
= 90 × 0.88
= £79.20

Or multiply by 0.88

$$\%\ change = \frac{change}{orig\ value} \times 100$$

Equivalent Fractions

Fractions that have the same value, eg → $\frac{2}{5} = \frac{20}{50}$

"What I do to the top, I do to the bottom"

Place the following in order $\frac{3}{8}$ $\frac{2}{5}$ $\frac{1}{4}$

Equivalent fractions with a common denominator are $\frac{15}{40}$ $\frac{16}{40}$ $\frac{10}{40}$

Answer $\frac{1}{4}$ $\frac{3}{8}$ $\frac{2}{5}$

Reverse Percentages

The cost of a television is £540 including a 20% sales tax. Work out the cost of the television without tax.

original price × 1.2 = 540
original price = 540 ÷ 1.2
original price = £450

The cost of a holiday is reduced by 15% to £833. What was the original price of the the holiday?

original price × 0.85 = 833
original price = 833 ÷ 0.85
original price = £980

Hegarty Maths Links

Adding, subtracting,	65, 66
Multiplying and dividing fractions	68, 69, 70
FDP	73, 74, 75, 76, 82, 83, 149
Equivalent fractions	59
Percentage increase and decrease	88, 89, 90
Percentage change	97
Reverse percentages	96

Year 9 Foundation Topic 7 Fractions, decimals and percentages Student Knowledge Organiser

Multiply, divide, add and subtract fractions

1. $\frac{3}{8} \times \frac{3}{4}$
2. $\frac{4}{5} \div \frac{2}{10}$
3. $\frac{2}{9} + \frac{4}{6}$
4. $\frac{3}{4} - \frac{3}{10}$
5. $4\frac{1}{4} \times \frac{1}{5}$
6. $3\frac{9}{10} \div 2\frac{2}{3}$
7. $6\frac{2}{5} + 2\frac{2}{3}$
8. $4\frac{5}{11} - 1\frac{1}{2}$

Equivalent fractions, decimals and percentages

In each of the following, four of the values are equal to each other. Which are they?

a) $\frac{7}{10}$	0.375	$\frac{7}{20}$	0.720	$\frac{3}{8}$	$37\frac{1}{2}\%$
71%	$\frac{17}{20}$	38%	56%	0.3750	27%
b) $\frac{3}{5}$	0.035	37%	$\frac{3}{7}$	73%	0.731
65%	0.600	$\frac{1}{60}$	60%	0.6	$\frac{1}{6}$
c) $\frac{2}{7}$	0.071	0.27	$\frac{27}{100}$	0.654	27%
$\frac{54}{200}$	54%	0.876	0.027	$\frac{6}{54}$	$2\frac{7}{10}\%$
d) 63%	$\frac{3}{16}$	0.603	$\frac{6}{13}$	36%	0.72
$\frac{9}{25}$	0.925	0.036	0.36	$\frac{18}{50}$	40%

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Percentage increase and decrease and percentage change.

Increase £20 by 52%

Increase £32.10 by 17%

Increase 92kg by 110%

Decrease 21 kg by 7%

Decrease 110 lbs by 53%

Increase £110 by 7%, then reduce by 5%

Increase £400 by 6%, then by 6% again

1 Find the percentage increase when:

a) a price of £10 is increased to £12.

b) a price of £20 is increased to £52.

2 Find the percentage decrease when:

a) a price of £10 is decreased to £8.

b) a price of £25 is decreased to £22.

Equivalent Fractions

Find the missing numbers to make equivalent fractions

(a) $\frac{6}{7} = \frac{42}{\square}$ (b) $\frac{9}{20} = \frac{63}{\square}$ (c) $\frac{5}{12} = \frac{35}{\square}$ (d) $\frac{7}{8} = \frac{\square}{64}$

Arrange the fractions in order, smallest first.

(a) $\frac{3}{4}, \frac{2}{3}, \frac{5}{6}, \frac{1}{3}$ (b) $\frac{1}{4}, \frac{3}{8}, \frac{1}{6}, \frac{5}{12}$

Reverse Percentages

1: 20% of all the children in a class are left handed.
4 children are left handed.
How many children are there in the class altogether?

2: 30% of the members of a tennis club are pensioners.
36 members are pensioners.

(a) How many members are there in total?
(b) How many members are not pensioners?

Applying Knowledge

Shown below is a "magic square"
Each column, row and diagonal has the same total.
Work out the missing fractions.

$\frac{1}{10}$		$\frac{3}{10}$
$\frac{9}{20}$		
$\frac{1}{5}$	$\frac{3}{20}$	

Leonie bought a hat and a coat.
The hat cost £6
She sold both items for a total of £45
Leonie made 300% profit on the hat and 125% profit on the total cost.
Work out her percentage profit on the cost of the coat.

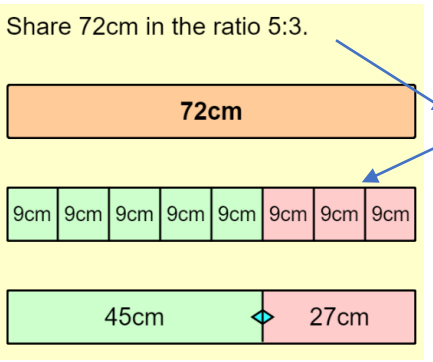
Year 9 Foundation Topic 8 Ratio Student Knowledge Organiser

Key words and definitions

Ratio – ratio compares the size of one part to another part.
Proportion – compares the size of one part to the size of the whole.
Speed – the rate at which something moves.
Density – the mass of a substance per unit volume.
Pressure – the force per unit area exerted on an object.

Sharing in a ratio

Share 72cm in the ratio 5:3.



Draw a bar model to calculate how much one part is worth.

5 + 3 = 8 parts
72cm ÷ 8 = 9cm per part

5 parts x 9cm = 45cm

3 parts x 9cm = 27cm

Simplifying a Ratio

Ratios can be simplified, similar to fractions, by dividing each number in the ratio by their highest common factor (HCF).

Simplify the Ratio 6 : 15

Divide both our number values by **HCF (3)**

3 ↺ 6 : 15 ↻ 3
2 : 5

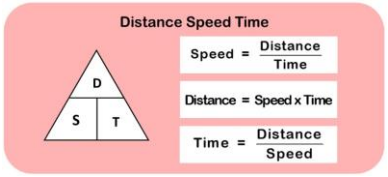
The simplified Ratio Answer is 2 : 5 ✓

Proportion Problems - Recipes

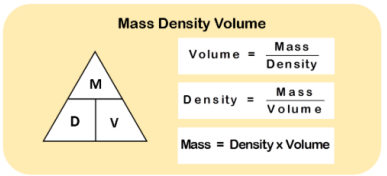
When solving recipe problems, find out how many ingredients are needed to make 1 of something, then multiply by how many you need.
Eg. To make 3 sponge cakes…

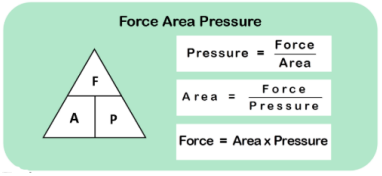
To make 2 sponge cakes		÷2	x3
½ pint	milk	1 cake ¼ pint	3 cakes ¾ pint
2 lb	plain flour	1 lb	3 lb
4	eggs	2	6
20 ounces	sugar	10 oz	30 oz
20 ounces	butter	10 oz	30 oz

Speed, Density and Pressure



Using each triangle, cover the measurement that you are trying to find. This will derive the given formulae.





Timetables

The table shows part of a bus timetable from Shotton to Alton.

Shotton	07 30	08 00	09 00	10 00	11 00
Crook	07 45	08 15	09 15	10 15	11 15
Prudhoe	07 58	08 28	09 28	10 28	11 28
Hexham	08 15	08 45	09 45	10 45	11 45
Alton	08 30	09 00	10 00	11 00	12 00

Serena lives in Crook. She has to be in Hexham by 11:15.
What is the time of the latest bus she can catch from Crook to arrive in Hexham by quarter past 11?
The bus, which arrives in Hexham at 10:45, leaves Crook at 10:15.

Ratio Problems - Maps

When solving problems with map scales, label the ratio "map : real life" and scale up/down as needed.
Eg. If the scale is 1cm : 200m, what is the distance from the golf club to the cricket club?

Map : real life
x2 ↺ 1cm : 200m ↻ x2
2cm : 400m

Hegarty Maths Links

Ratio: 328-338
Proportion: 339-342
Recipe Problems: 739-742
Scale Diagrams: 864-871
Speed, Density and Pressure: 716-738

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Year 9 Foundation Topic 8 Ratio Student Knowledge Organiser

Simplifying a Ratio

Write out and simplify the following ratios:

For every 6 women,
the school employs 8 men.

women : men

..... : .....

red squares: green circles

15cm to 75cm

400m to 1.5km

Ellie is making a cake.
The instructions say that the ratio of sugar to flour should be 1 : 3
Ellie uses 250g of sugar and 650g of flour.
Has Ellie used the correct ratio of sugar to flour?

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Sharing in a Ratio

Share £60 in the ratio 5:1.
Divide £48 in the ratio 5:3.
Share £72 in the ratio 4:5.
Divide £40 in the ratio 3:5.
Share £132 in the ratio 8:3.

- The angles in a triangle are in the ratio 1:5:6. Work out the angles in degrees.
- The ratio of boys to girls in a class is 3:5.

  Explain why there could not be 30 pupils in the class.
- William has a collection of coins. Each of the coins is either silver or bronze.

  The ratio of the number of bronze coins to the number of silver coins is 4 : 1.

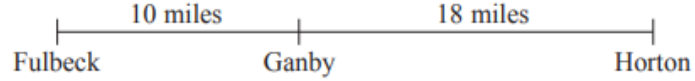
  William has 12 **more** bronze coins than silver coins. Work out the total number of coins in his collection.
- Over the course of a season, a football team won, drew and lost matches in the ratio 2 : 1 : 5.

  The team lost 12 **more** matches than they won.

  Work out how many matches the team drew in the season.

Speed, Density and Pressure

- A bus travels 222 miles in 6 hours.
  What was the average speed of the bus?
- Mr Jenkins catches the 11:45am bus from London to Glasgow.
  The distance between the two cities is 407 miles.
  The bus travels at an average speed of 55mph.
  What time should he arrive in Glasgow?
- The distance from Fulbeck to Ganby is 10 miles.
  The distance from Ganby to Horton is 18 miles.



  Raksha is going to drive from Fulbeck to Ganby.
  Then she will drive from Ganby to Horton.
  Raksha leaves Fulbeck at 10 00
  She drives from Fulbeck to Ganby at an average speed of 40mph.
  Raksha wants to get to Horton at 10 35
  Work out the average speed Raksha must drive at from Ganby to Horton.
- A cube of ice has side length of 5cm.
  The mass of the cube of ice is 114.5g.

  Find the density of ice.
  Give your answer in g/cm^3
- A box is placed on the floor.

  The area of the box in contact with the floor is $2.4m^2$
  Pressure exerted on the floor 16 newtons/m^2

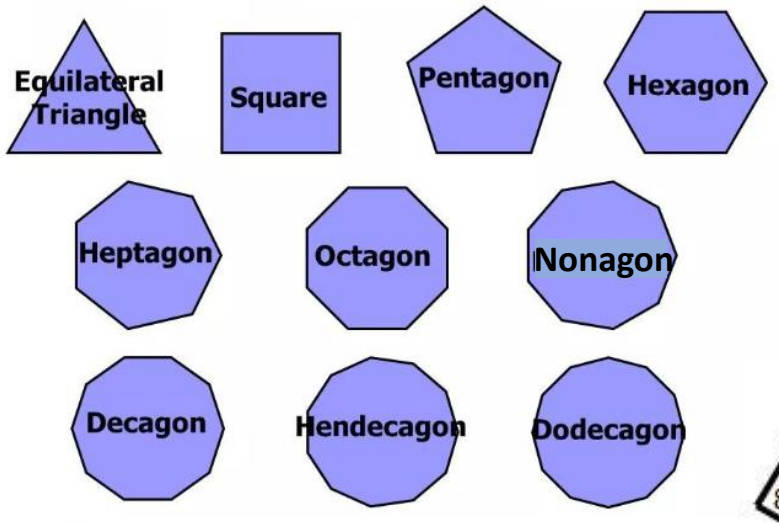
  Work out the force exerted by the box on the floor.

Year 9 Foundation Topic 9 Shapes and angles Student Knowledge Organiser

Key words and definitions

Polygon – a plane figure with at least three straight sides and angles, and typically five or more.
Quadrilateral – 4 sided shape.
Pentagon – 5 sided shape.
Hexagon - 6 sided shape.
Heptagon – 7 sided shape.
Octagon – 8 sided shape.
Nonagon – 9 sided shape.
Decagon - 10 sided shape.
Hendecagon – 11 sided shape.
Dodecagon – 12 sided shape.

Polygons



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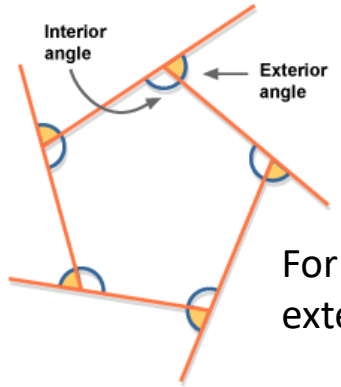
Prior Knowledge

Angles on straight lines/internal angle sums in polygons
Angles in parallel lines

Interior and exterior angles of polygons

***Sum of interior angles* = $180^o \times (n - 2)$**

n = number of sides

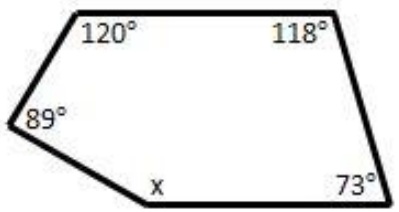


For all polygons the exterior angles total 360°

A regular polygon has an exterior angle of 20°.

How many sides does it have?

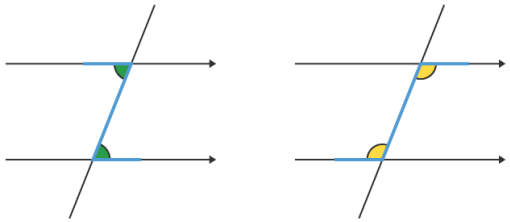
Number of sides
= 360° ÷ 20°
= 18 sides



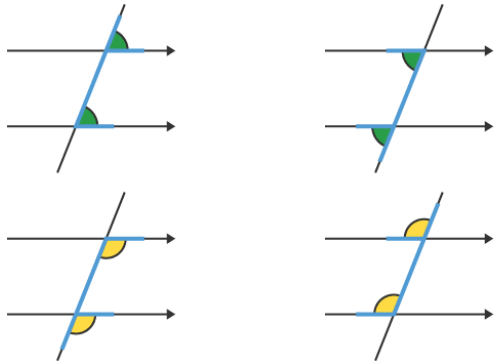
Sum of angles
= 89°+120°+118°+ 73°
= 400°
Sum of interior angles
= 180° x (5-2)
= 540°
x = 540° - 400°
= 140°

Angles in parallel lines

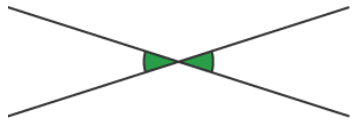
Alternate angles are equal



Corresponding angles are equal



Vertically opposite angles are equal



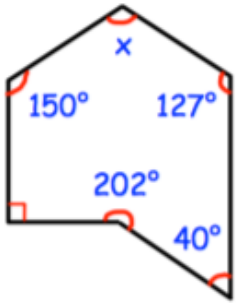
Hegarty Maths Links

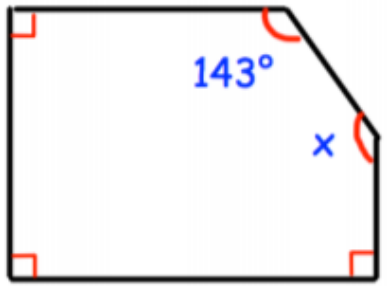
Angles in polygons	561, 562, 563, 564, 565
Vertically opposite angles	480
Alternate angles	481
Corresponding angles	483

Year 9 Foundation Topic 9 Shapes and angles Student Knowledge Organiser

Interior and exterior angles of polygons

Find the missing angle in each irregular polygon

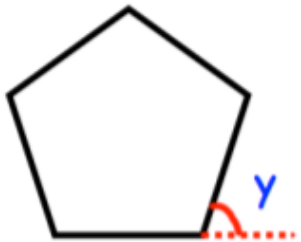




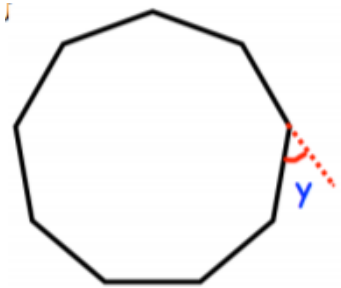
Work out the number of sides of polygons with these sum of interior angles

(a) 1260° (b) 2880° (c) 3960°

Each of the polygons below are regular.
Calculate the size of each exterior angle, y.



regular pentagon



regular nonagon

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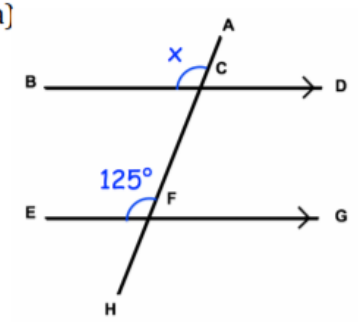
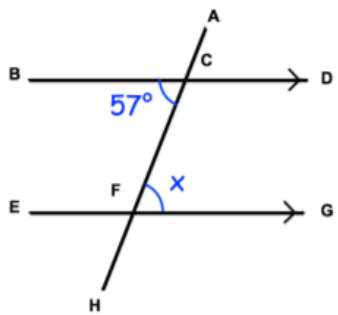
Angles in parallel lines

Find the angle x in each question below.
Give reasons for your answer.

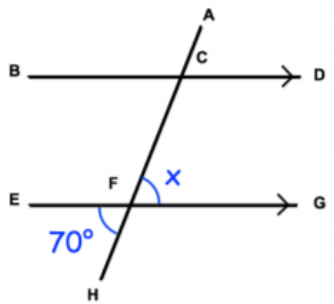
(a)



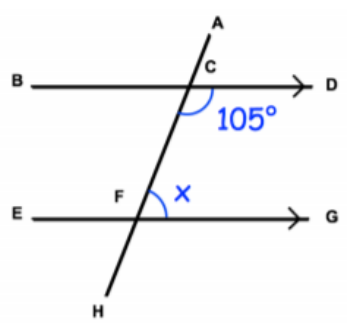
(b)



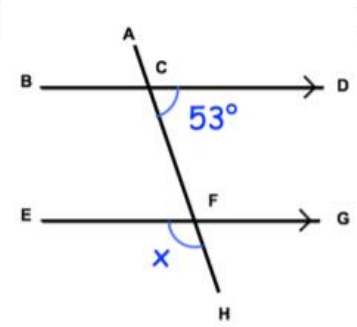
(c)



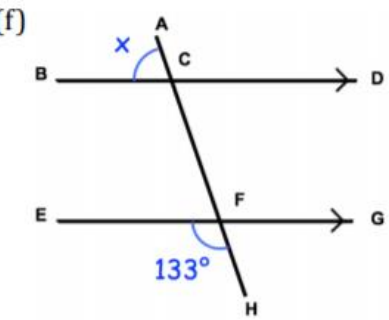
(d)



(e)

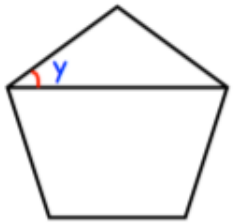


(f)

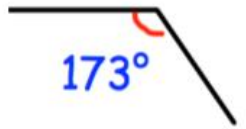


Applying knowledge

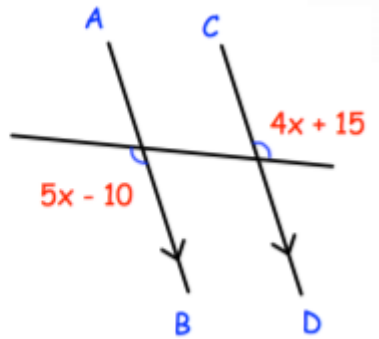
Shown is a regular pentagon.
Find y.



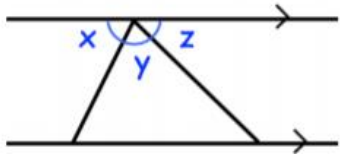
Explain why this cannot be an interior angle from regular polygons.



Find x



Matilda is proving that the angles in a triangle add up to 180°.
She has started with this diagram.
Complete her proof.



Year 9 Foundation Topic 10 Pythagoras and trigonometry Student Knowledge Organiser

Key

Formula

$$a^2 + b^2 = c^2$$

a = side of right triangle
b = side of right triangle
c = hypotenuse

The **hypotenuse** (h) is the longest side. It is opposite the right angle.

The **opposite side** (o) is opposite the angle in question (x).

The **adjacent side** (a) is next to the angle in question (x).

Trigonometric Formula

What are the formulas for sin cos and tan?

- $\sin x = \frac{opposite}{hypotenuse}$
- $\cos x = \frac{adjacent}{hypotenuse}$
- $\tan x = \frac{opposite}{adjacent}$

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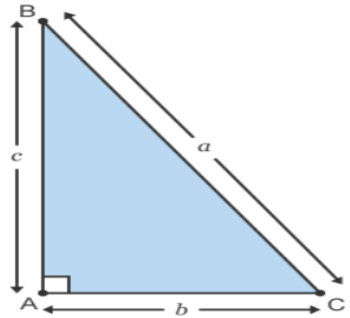
Pythagoras

Right-angled triangles

Pythagoras' theorem states that for all right-angled triangles, **'The square on the hypotenuse is equal to the sum of the squares on the other two sides'**. The hypotenuse is the longest side and it's always opposite the right angle.

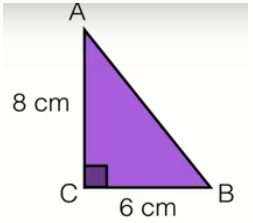


In this triangle $a^2 = b^2 + c^2$ and angle A is a right angle.

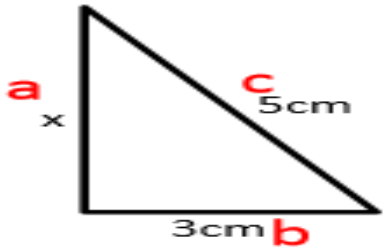
Pythagoras' theorem only works for right-angled triangles, so you can use it to test whether a triangle has a right angle or not.

In the triangle above, if $a^2 < b^2 + c^2$ the angle A is acute.

In the triangle above, if $a^2 > b^2 + c^2$ the angle A is obtuse.

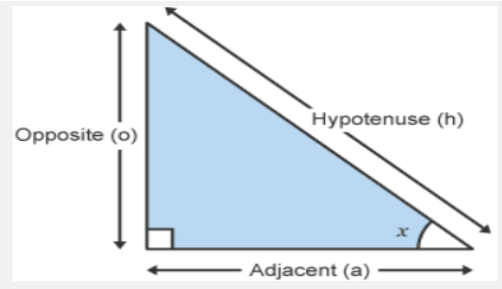


$AB^2 = BC^2 + AC^2$
$AB^2 = 6^2 + 8^2$
$AB^2 = 36 + 64$
$AB^2 = 100$
$AB = \sqrt{100}$
$AB = 10$ cm



$a^2 + b^2 = c^2$
$x^2 + 3^2 = 5^2$
$x^2 + 9 = 25$
$x^2 = 25 - 9$
$x^2 = 16$
$x = \sqrt{16}$
$x = 4$ cm

Trigonometry

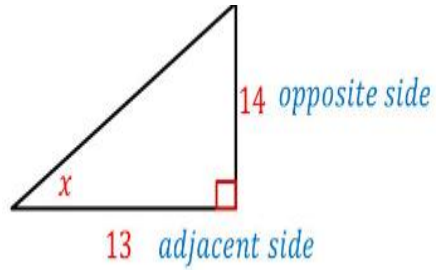


$\sin\theta = \frac{opp}{hyp}$

$\sin(64) = \frac{17.3}{y}$

$y = \frac{17.3}{\sin(64)}$

$y = 19.24801...$



Use tangent ratio $\tan x = \frac{O}{A}$

Use inverse tangent $x = \tan^{-1}\left(\frac{14}{13}\right)$

Solve for x using calculator $x = 47.1°$

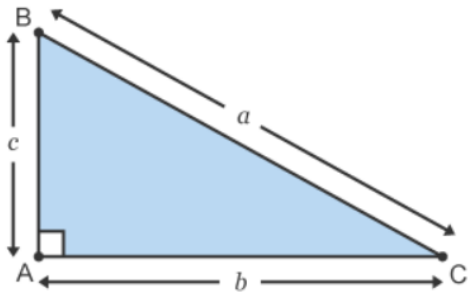
Hegarty Maths Links

Pythagoras: Videos 497-507

Right Angled Trigonometry: Videos 508-515

Year 9 Foundation Topic 10 Pythagoras and trigonometry Student Knowledge Organiser

Pythagoras

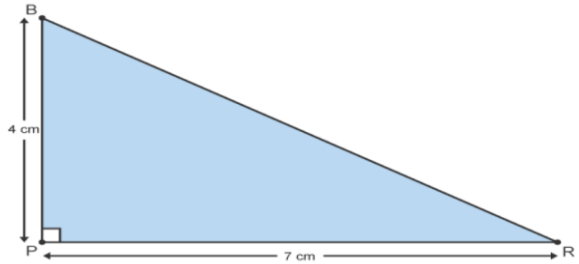


$$a^2 = b^2 + c^2$$

$$b^2 = a^2 - c^2$$

$$c^2 = a^2 - b^2$$

Work out the length of the line BR, correct to 1 decimal place.



A fireman has a ladder that is 13 metres long. If he wants to reach a window that is 12 metres above the ground, how far from the wall should he put the bottom of his ladder?

Peter's house is exactly 481m from school. To get home he walks 480m south and then he walks west. How far west does he have to walk?

A triangle has sides of length 23.8cm, 31.2cm and 39.6cm.

Is this a right-angled triangle?

Show how you decide.

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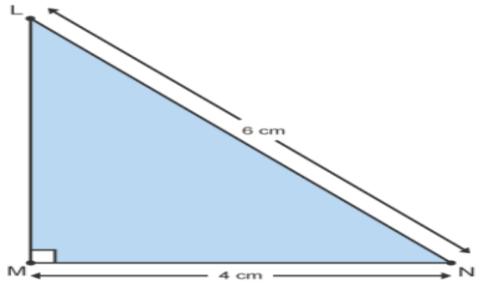
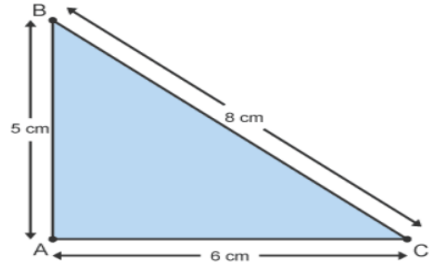
Pythagoras

Work out the length of the line LM, correct to 1 decimal place.



Which of the following triangles is right-angled?

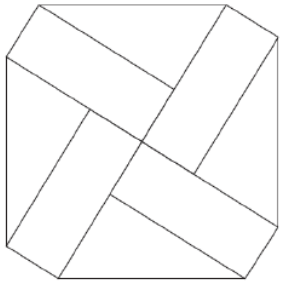
a)



b)

Here is a rectangle.

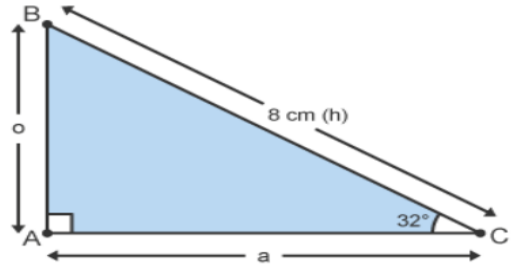
The 8-sided shape below is made from 4 of these rectangles and 4 congruent right-angled triangles.



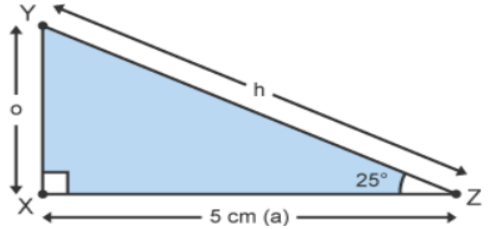
Work out the perimeter of the 8-sided shape.

Trigonometry

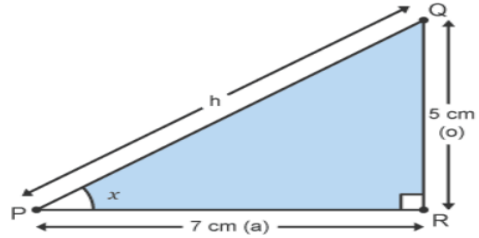
Calculate the length AB. Give the answer to one decimal place.

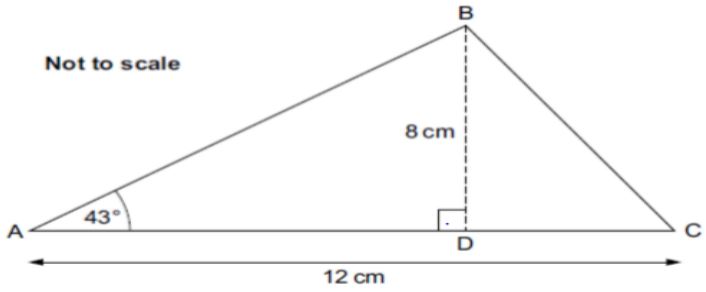


Calculate the length YZ. Give the answer to one decimal place.



Calculate the angle QPR. Give the answer to one decimal place.





Calculate angle BCA.

Year 9 Foundation Topic 11 Transformations Student Knowledge Organiser

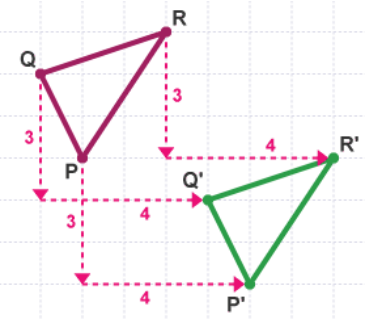
Key words and definitions

Centre of Enlargement- The point that a shape is enlarged from.
Centre of Rotation- The point that you place your pencil on the rotate a shape.
Enlargement- Making a shape bigger or smaller.
Rotation- Turning a shape around.
Reflection- Drawing the mirror image of a shape.
Scale Factor- How many times bigger or smaller you make a shape.
Transformation- Changing a shape.
Translation- Moving a shape.
Vector- A pair of numbers written one on top of the other that describe how a shape is translated.

Clockwise

Anti-clockwise

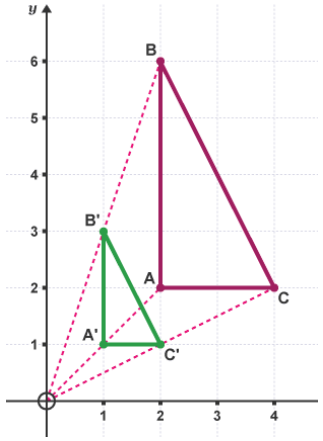
Translations



To translate a shape you move it a given number of squares, up down left or right.
These could be given as a vector, the first number in the vector saying how far left and right, and the second number saying how far up or down. Up and right as positive numbers, down or left are negative numbers.
E.g. In the diagram PQR has been translated to P'Q'R' by the vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$.

When describing a translation state the vector it has been translated by.

Enlargements



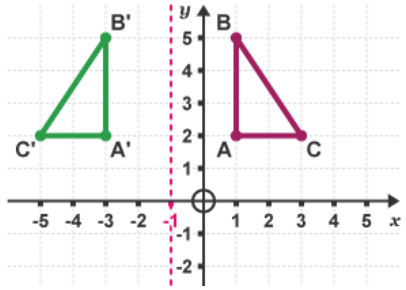
When enlarging a shape, you'll be given a **scale factor**, this is number that tells you how many times bigger a shape is getting. You will also be given a **centre of enlargement**, when you enlarge your shape the distance from the centre of enlargement is also enlarged.

If you get a fractional scale factor, it make the shape smaller not larger.
For example on the question above the shape ABC has been enlarged by ½ and has a centre of enlargement at (0,0).
If you've enlarged your shape correctly you should be able to draw a straight line from each corresponding corner to the centre of enlargement.

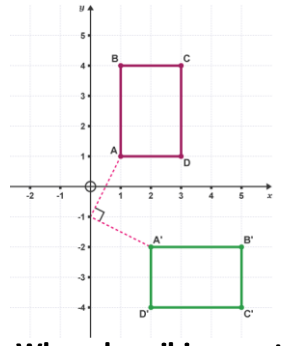
When describing an enlargement always state the scale factor and centre of enlargement, this can be found by drawing lines connecting the corresponding corners and seeing where they cross.

Reflection

To reflect a shape draw its mirror image on the opposite side of the reflection line, ensuring it's the same distance from the line as the original shape.
When describing a reflection always state the equation of the line it has been reflected.



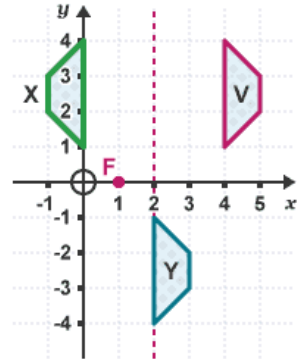
Rotations



To rotate a shape:
1) Draw your shape onto tracing paper
2) Use your pencil to pin your tracing paper to the page with the tip on the centre of rotation.
3) Rotate the shape round the correct number of degrees. Then, using this as reference, draw the shape in the correct position.

When describing a rotation always state how many degrees its rotated, whether its clockwise or anti-clockwise, and what the centre of rotation is.

Combined



Sometimes transformations can be combined.
For example in this question V has been reflected in the line x=2 to get X, then X has been rotated 180° around the point (1,0).
When doing multiple transformations do one part at a time, drawing each shape a long the way.

Hegarty Maths Links

Translations-637 and 638

Enlargements- 642-647

Reflections- 639-641

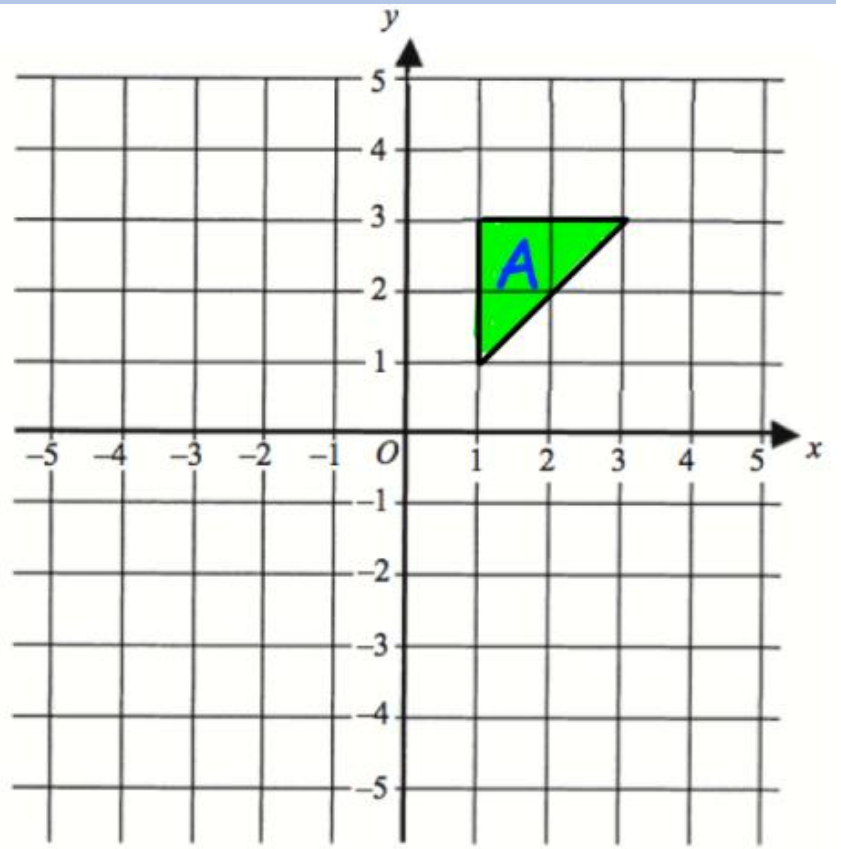
Rotations- 648-649

Describing Transformations- 650-654

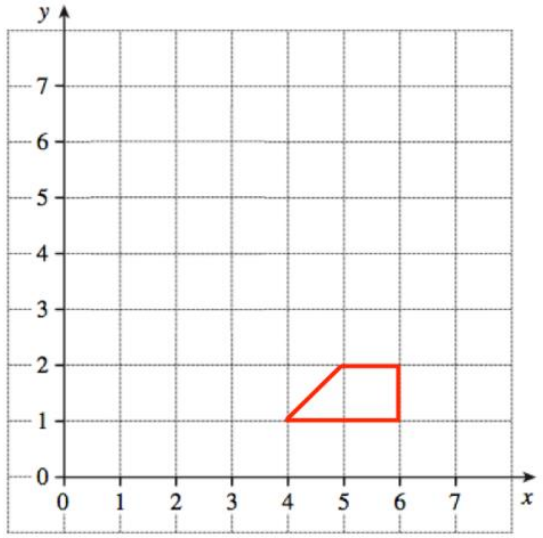
Combined Transformations- 656-657

Year 9 Foundation Topic 11 Transformations Student Knowledge Organiser

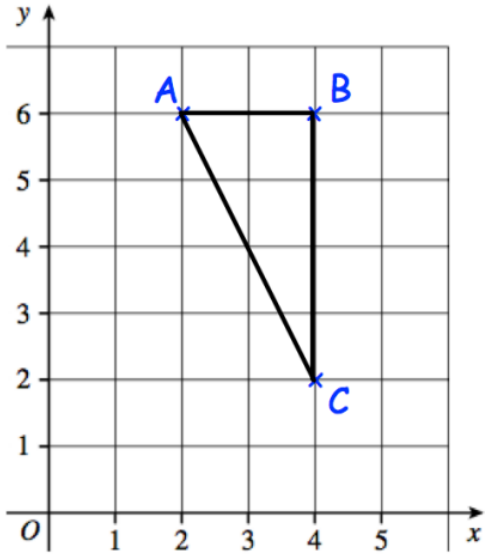
a) Translate shape A by the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$, name it shape B
b) Reflect shape A in the line y=-1, name it shape C
c) Rotate shape A 180° clockwise around (0,0), name it shape D



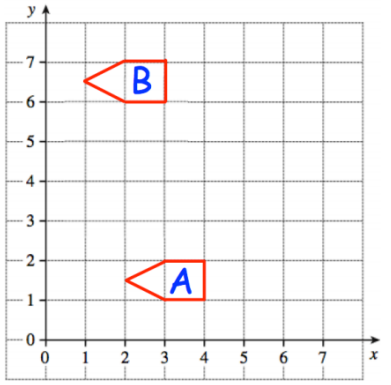
Enlarge the trapezium by a scale factor of 2, centre (7,0)



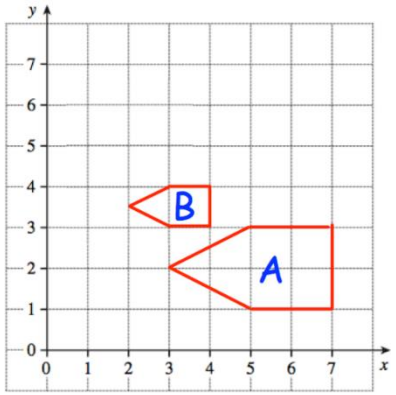
Enlarge the triangle by a scale factor of ½ , centre (0,0)



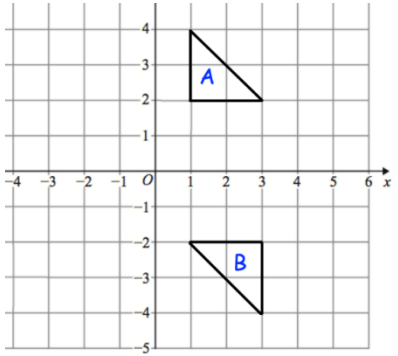
Describe the transformation of Shape A to Shape B



Describe the transformation of Shape A to Shape B



Describe the transformation of Shape A to Shape B



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Year 9 Foundation Topic 12 Probability Student Knowledge Organiser

Key words and definitions

Probability – the chance that a particular outcome will occur

Event – a single result of an experiment

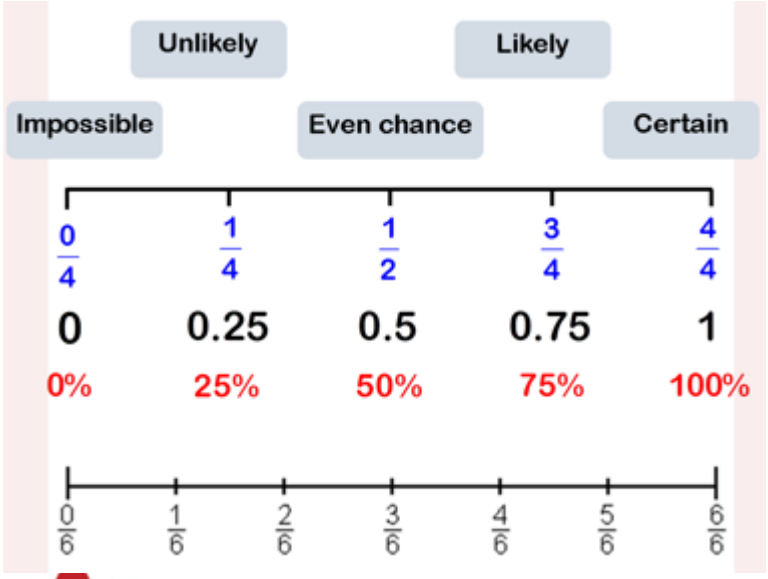
Outcome – one of the possible results of an experiment

Theroretical probability – the probability that an outcome will occur based on all possible outcomes

Experimental probability – derived from the results of an experiment. The total number of successes divided by the total number of trials

Sample space – all the outcomes of an event, presented in table form

Probability scales



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Prior knowledge

Convert between fractions, decimals and percentages

Represent information in a table

Simple Probability

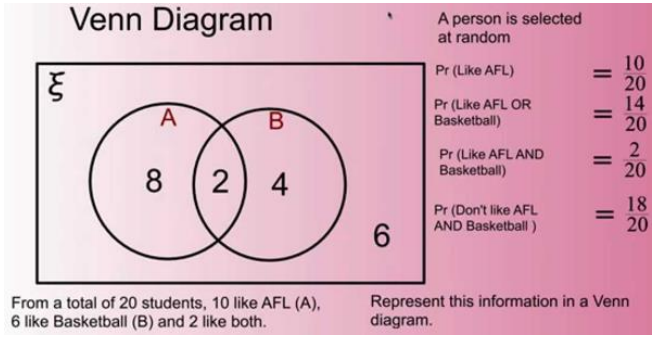
- The probability of an event, denoted P(E), is the likelihood of that event occurring.

The Probability of an Event =

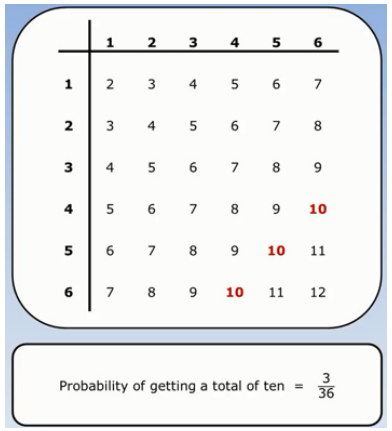
$$P(\text{Event}) = \frac{\text{the number of ways it can happen}}{\text{the number of possible outcomes}}$$

Example – when rolling a die,
P(4) = 1/6 as there is 1 4, and 6 numbers on the die

Venn diagram



Sample space

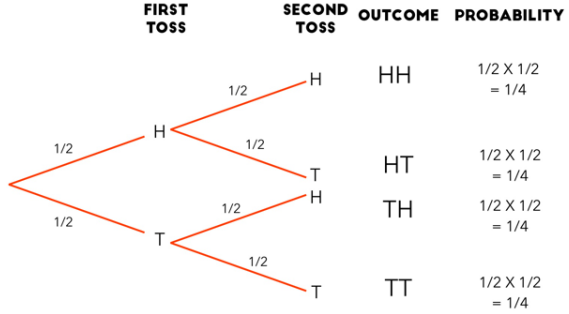


	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Probability of getting a total of ten = 3/36

When rolling 2 dice and adding the scores, the sample space diagram looks like this. The probability of an event can be calculate by counting the number of favourable outcomes and dividing by the total number of outcomes

Tree diagrams



Multiply as you move along the branches

Hegarty Maths Links

Probability of single events – 351, 352, 353

Sample space – 358, 359

Experimental probability – 356, 357

Venn Diagram – 372 – 382

Tree diagram – 361, 362, 363

Year 9 Foundation Topic 12 Probability Student Knowledge Organiser

Basic probability

1. The probability scale goes from 0 to 1. Write down what is meant by each of the following probabilities

   a. 0 Answer: _____

   b. ½ Answer: _____

   c. 1 Answer: _____

2. A bag contains 4 Red, 3 Blue, 2 Green and 1 Yellow marbles. You ask a friend to pick out one marble at random. Calculate the following:

   a. P(Red) =

   b. P(Blue) =

   c. P(Green) =

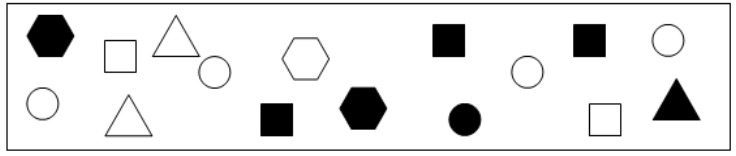
   d. P(Yellow) =

   e. P(Red or Green) =

   f. P(Not Green) =

   g. P(Black) =

3. A box contains the shapes shown below. You ask a friend to pick out one shape at random. Calculate the following:



   a. P(Black Square) =

   b. P(Square) =

   c. P(Circle) =

   d. P(White Hexagon) =

   e. P(Black) =

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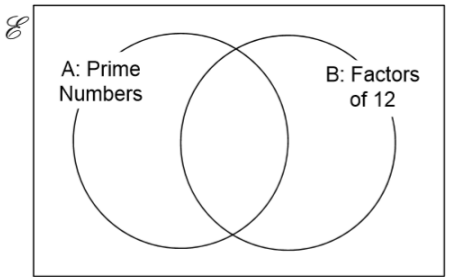
Venn diagrams

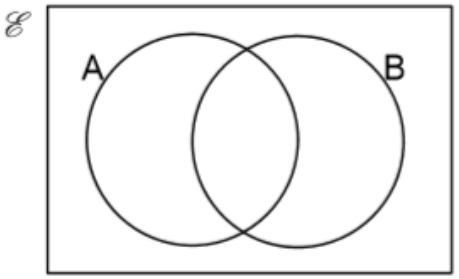
① **Place each element in the correct section of the Venn diagram.**

1 2 3 4 5 6
7 8 9 10 11 12

Elements $\mathscr{E}$



2. $\mathscr{E}$ = {8,9,10,11,12,13,14,15,16}
A = {even numbers}
B = {square numbers}
(a) Complete the Venn diagram.



(b) An element is picked at random. Work out:

P(A') =

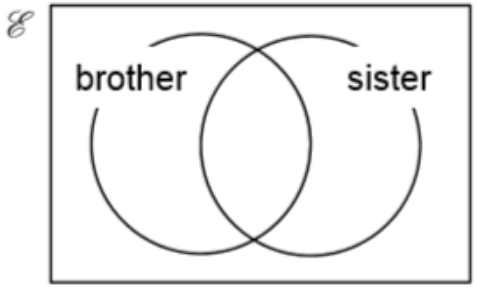
P(B') =

P(A ∩ B) =

P(A ∪ B) =

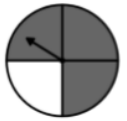
4. In a class of 32 pupils,
23 pupils have a brother,
14 pupils have a brother and a sister,
6 pupils have no brothers or sisters.

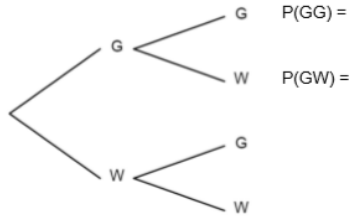
Write the number of pupils who belong in each section of the Venn diagram.



Tree diagrams

1. A spinner has four equally sized sectors: three grey and one white. The spinner is to be spun twice.
(a) Complete the tree diagram.

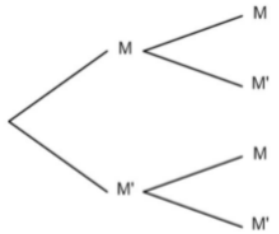




(b) Work out the probability that the spinner will land on the same colour on both spins.

(c) Work out the probability that the spinner will land on grey on at least one of the spins.

3. Angela is playing a game with two fair dice. She rolls both dice and wins a point for each die that lands on a multiple of 3.
(a) Complete the tree diagram, in which M stands for a multiple of 3.



(b) Work out the probability that Angela scores 2 points.

(c) Work out the probability that Angela scores at least 1 point.

(d) Work out the probability that Angela scores no points.

Popular Music

Common Instruments

Vocals

Keyboard/Piano/Synthesiser

Guitar (Electric and Acoustic

Bass Guitar

Drums

Common Features

Improvisation – making it up on the spot

Melismatic – lots of notes to one syllable

Syllabic – one note per syllable

Syncopation – off beat

Driving rhythms – push the music forward

Primary Chords – Chords 1, 4 and 5

Secondary Chords – the dominant chord of one of the other major or minor triads

Music Technology

Loop – an idea recorded and repeated over

Sample – a short clip of previously recorded music

Panning – making sound come from the left or right speaker

Phasing – an effect that combines an audio signal with a short delay to create phase differences. A bit like a place passing by!

Computer Generated Sounds – sounds made by a computer

Synthesised/Electronic – music produced by electronic means

Reverb – an effect that can be added to voices/instruments that makes them sound like they are in a concert hall (or bathroom!)

Echo – a delay effect by repeating the sound slightly after the original

Amplified – sounds made louder by means of electronic signal

Acoustic – natural sound

Common Structures

32 Bar Song Form – AABA, 8 bars each

Strophic – same melody, different lyrics

12 Bar Blues – 12 bars (1111, 4411, 5411)

Verse – repeated often with different words

Chorus – repeated after each verse

Riffs – a repeated phrase

Middle 8 – section in the middles of the song. Used to break it up between verses/chorus

Bridge – short contrasting section to transition

Fill – short drum solo

Instrumental Break – only instruments play

Intro/Outro – beginning/end of a song

Common Styles

Pop	Fusion	Soul
Rock	Reggae	Hip Hop
Rap	Minimalism	Ballad

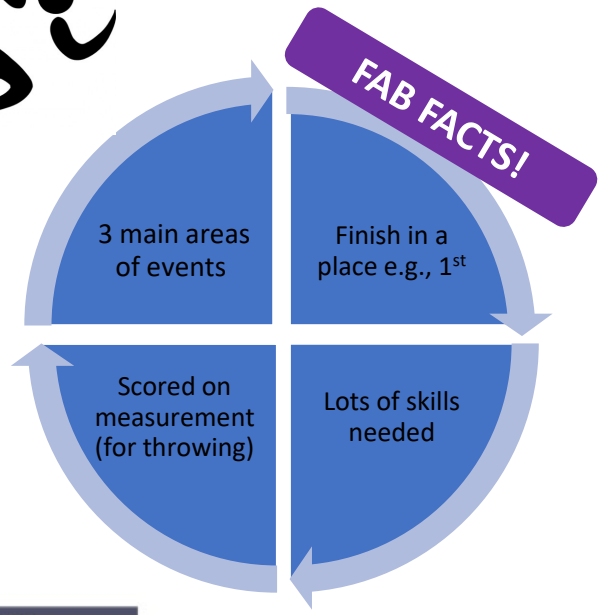
Knowledge Organiser - Athletics

What is Athletics?

- Athletics is a collection of sporting events across a number of disciplines, including running, jumping and throwing events.
- Athletics is a collection of sporting events that consist of three main areas:

•track events
•field events
•combined events

- Athletics is often associated with the Olympics. However, it is not just for elite athletes. Each week athletes also compete at national, county, school or club level events which can be held indoors or outdoors.
- Athletics events are very specialised and often do not require a full combination of fitness components, therefore offering something for everyone.



The Olympic games:

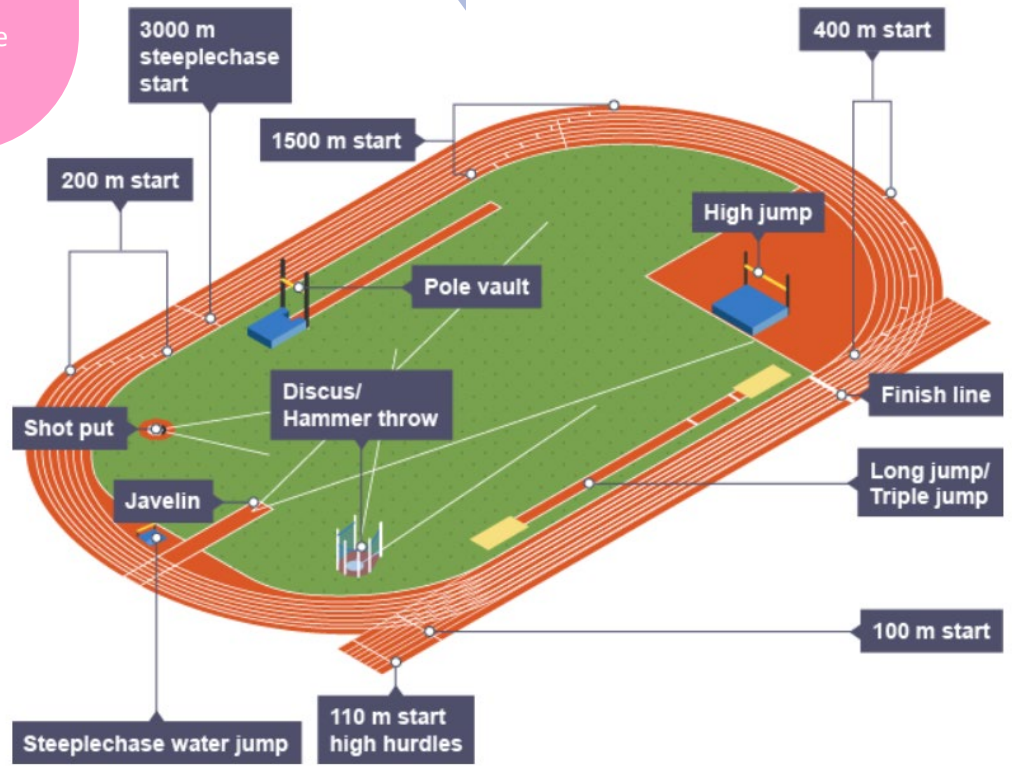
In 1896, the first Modern Olympic Games were held in Athens. It was a fantastic success and in 1912 the International Amateur Athletic Federation (IAAF) was established. The Olympic games are held every four years, including lots of new events as well as some traditional ones.

Did you know … We held the Olympic games in London 2012!

Officials

An athletics competition requires a large number of volunteers each day. These include:

•**starter** – this person starts all track events
•**starter's marshals** – these people line up competitors in correct order ready for starting
•**timekeepers** – these volunteers provide official times for all track competitors
•**place judges** – these helpers ensure the correct order of positions are given
•**field event judges** – these judges measure, record and let athletes know when it is safe to compete
•**relay judges** – these make sure runners at change-overs are in the correct lane and within the change-over box



Scoring

Success in athletics is not judged on points or goals, but rather on times and distance.

Track events – these races are started with an electronic pistol which is only sounded again on a false start. In races that are very close, officials use a digital line-scan camera across the finish line to give them a photo finish picture. The clock stops when an athlete has passed through the finish line.

Jumping events – these events are measured from the front edge of the take-off board to the first mark made in the sand by the athlete. The distance is always measured to the nearest centimetre and athletes will always be given a minimum of three jumps.

Throwing events – these events are measured from the front edge of the throwing line to the first mark made in the ground by the implement. The distance is always measured to the nearest centimetre and athletes will always be given a minimum of three attempts.

Knowledge Organiser - Athletics

Key Skills

Speed- Especially for running events e.g. 100m/200m/400m sprints and hurdles.
Cardiovascular endurance –Especially for long distance activities e.g. 1500m.
Strength – For throwing and jumping events.
Co-ordination – To be able to move different body parts in different events/ to be able to aim a throw in a certain direction
Power – To be able to put in power behind throwing events/excelling of the ground.
Muscular endurance – for all events to allow the muscles to keep working during an event to avoid them getting fatigued.

Athletics for beginners

Health and safety in Athletics:

Throwing events:
- Keep well away from a person throwing.
- Stand to the side when a person throwing NOT behind!
- Wait until everyone has thrown collect your equipment.
- Do not walk past a person who has throwing equipment in their hand.
- Always hold a Javelin vertically.

Running events:
- Ensure the track is fully clear before running
- Ensure that shoe laces are ALWAYS tied before running

General Safety:
- Ensure that all Jewellery is removed before performing any event.
- Ensure that correct kit is always worn – including the correct footwear.
- Ensure you are always warmed up before participating in any athletics activities.

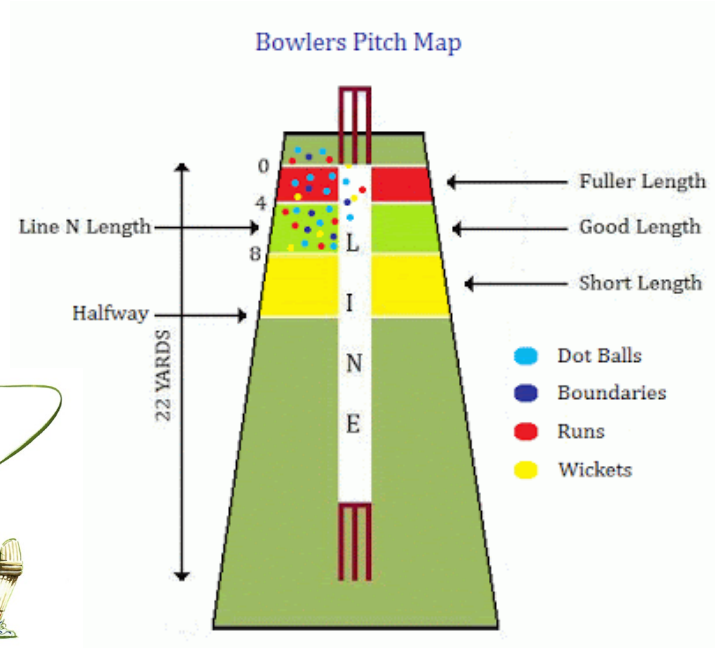
Rules and Regulations

Athletics has a set of rules for competition and a series of official notification periods for proposed changes to them.
UK Athletics (UKA) is the governing body for the sport of athletics in the United Kingdom. Its responsibilities include overseeing the governance of athletics events in the UK as well as athletes, their development, and athletics officials. UK Athletics governs the rules for competition for the following disciplines:
•track and field competition
•road running competition
•cross country running
•fell and hill running
•race walking
•trail running
The UK Athletics Rules for Competition are published every two years.

Knowledge Organiser - Cricket

What is Cricket?

- Cricket can be described as a sporting combination of strategy, skill and athleticism.
- The game is contested by two teams of 11 players and involves a bowler delivering a ball at a batsman, who attempts to hit it.
- From this simple premise comes a number of strategies, tactics and techniques to achieve overall success.
- Each team takes it in turns to bat, trying to score runs, while the opposing team fields.



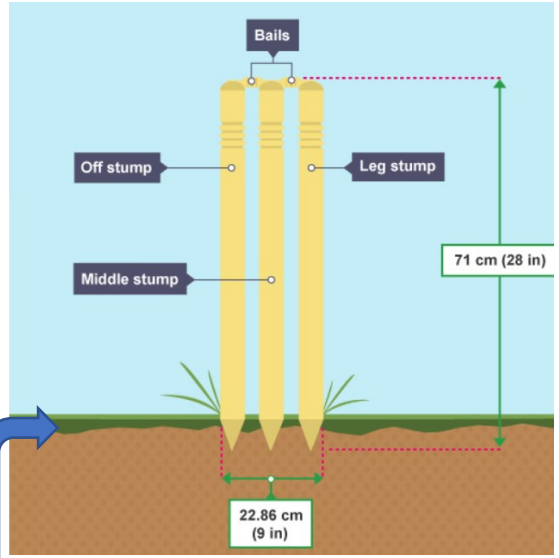
Players in Cricket

A cricket team consists of 11 players per side and one team bats while the other fields.
Unique to cricket, the captain of the fielding team has complete control of their team's fielding positions.
In all, there are 35 different fielding positions and the captain can utilise every one to try to stop the batter from scoring runs or to try to get them out.

Scoring in Cricket:

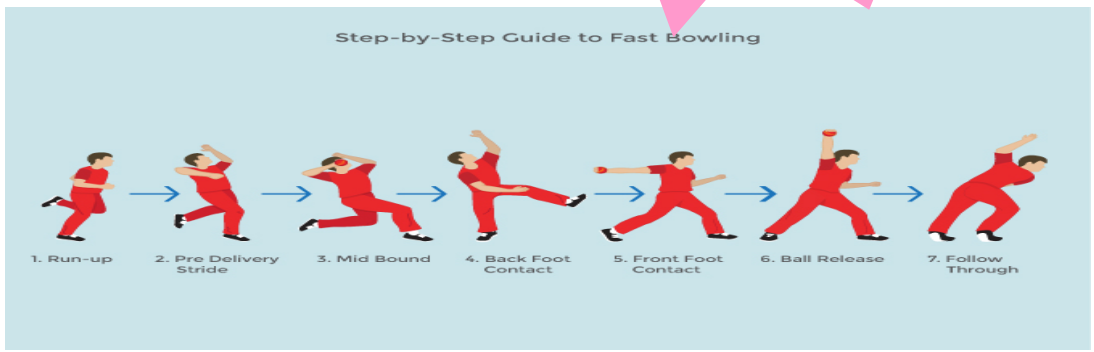
- The aim for the batter in cricket is to try to score as many runs as possible throughout their innings.
- To score a run requires the batter to strike the ball and run to the opposite end of the pitch while their batting partner runs in the other direction.
- To record the scoring run, both batters need to touch the floor behind the popping crease with either their bat or body. In situations where the fielding team has not recovered the ball, the batters return back to score two or more runs.
- It is also possible to score runs without running the length of the pitch, if a batter can hit the ball past the boundary line (four runs) or over the line without bouncing (six runs).

Knowledge Organiser - Cricket



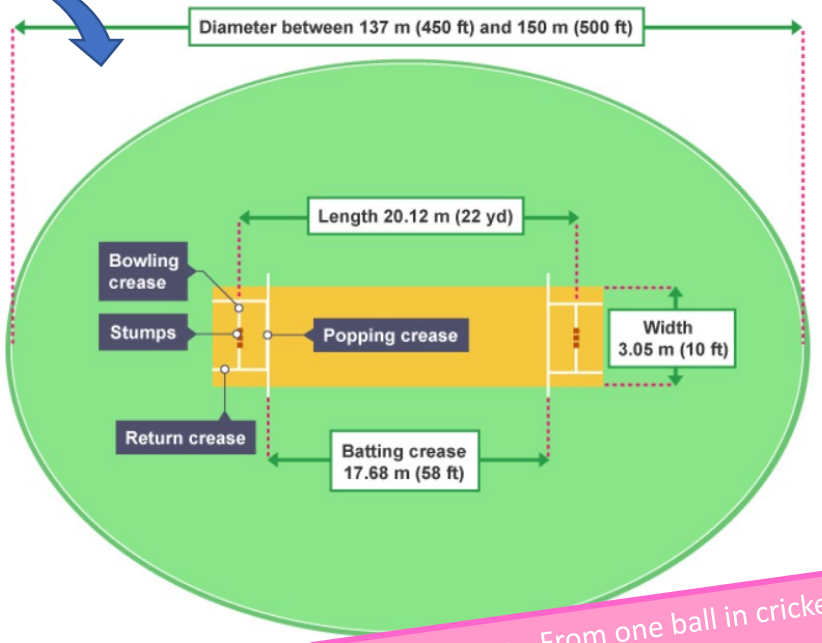
Bowling action

[Cricket for beginners]



Pitch dimensions

- **Popping crease** - a bowler must have part of their foot behind this line when the ball is delivered or the umpire will call 'no ball'.
- **Bowling crease** - in all competitive games of cricket the length of a pitch is 20.12 m (or, in imperial measurements, 1 chain or 22 yards) long and this is measured as the distance between the two bowling creases. The pitch is 3.05 m (10 ft) wide.
- **Wicket** - the two wickets are placed on each of the bowling creases and consist of three wooden stumps and two wooden bails. The bails are positioned on the stumps in grooves made along the top of each stump. The bails must be knocked off the stumps to bowl a batter out.
- **Stumps** - these each have their own name and when viewed from the front, the left stump is called the off stump, middle stump and the right stump is called the leg stump.



Did you know... From one ball in cricket the highest number of runs is 286?

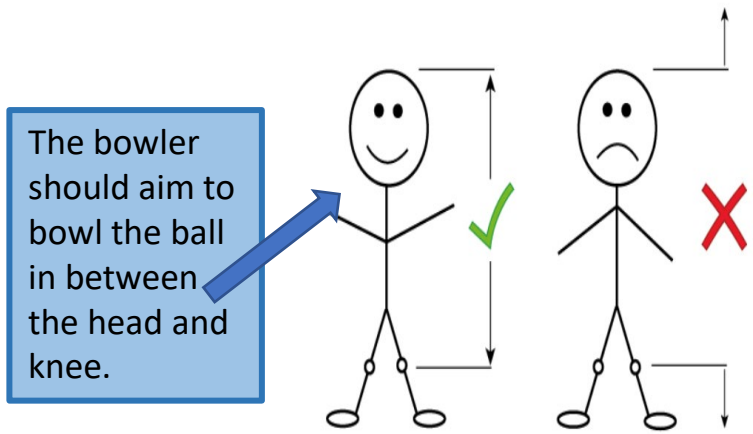
Rules and Regulations

- The winning team in cricket is the side that scores the most runs, although in some situations a draw is recorded if they both get the same number of runs.
- A cricket team consists of 11 players and they take it in turns to bat and bowl.
- The bowler must not throw the ball, but bowl the ball overarm at the stumps, which are at either end of a 22-yard area called a wicket.
- A batter is declared out if the bowler knocks off the bails of the stumps with a delivery.
- A batter is declared out if a fielder or wicketkeeper catches the ball directly off the bat and before it hits the ground.
- A batter is declared out if the umpire believes that the bowler's ball would have hit the stumps if the batter had not obstructed the ball with their pads. This is known as leg before wicket (or LBW).
- A batter is declared run-out when they are going for a run but do not make the batting crease before fielding team knocks off the cricket stumps.
- A batter is declared out if the wicketkeeper stumps them.
- A batter is declared out if they knock over their stumps while playing a shot or avoiding a delivery.
- There are other, less common ways of being out in cricket, but these are quite rare.
- A batter is declared out if the umpire believes the batter has purposely obstructed a fielder who is about to take a catch or attempt a run-out.
- The end of an innings is called when 10 of the 11 batting team are given out. At this point, both teams swap over. In competitive games, teams can have one or two innings.

Knowledge Organiser - Rounders

What is Rounders?

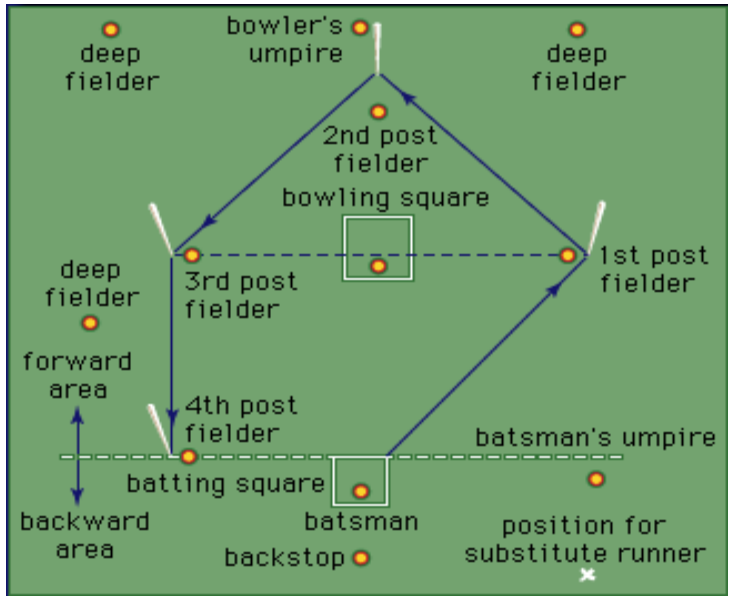
- Rounders is a game where 2 teams play against each other to get as many players from the opposite side out at the same time as trying to score as many rounders as they can.
- Games are played between two teams. Each team has a maximum of 15 and a minimum of 6. No more than 9 may be on the field at any one time.
- Players once substituted may return during the game, but batters only in the position of their original number.
- A rounders match normally consists of two innings which is over when all players are out. An inning is equal amount of turns both sides have to bat and score.



FAB FACTS!

- ½ or 1 rounder can be scored by every batter
- Fielding and batting team
- 9 per team on the field
- Batters have a specific batting position

Fielding positions



Scoring in rounders

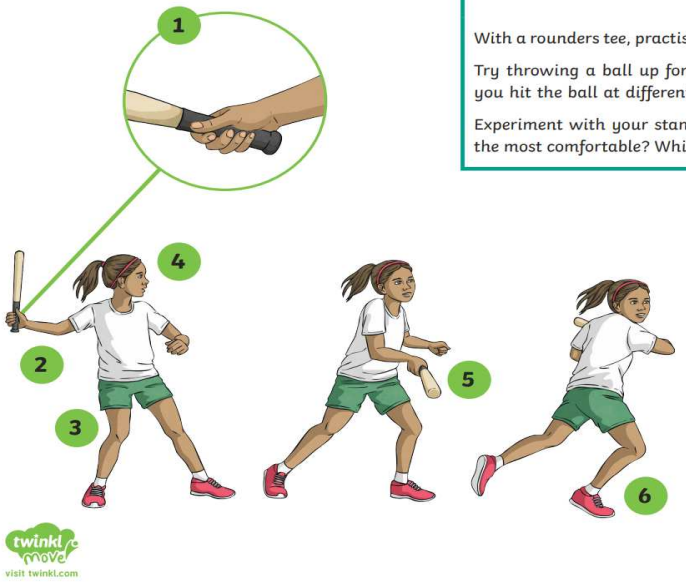
- 1 Rounder if ball is hit and 4th post is reached and touched before next ball is bowled 1 Rounder if ball is hit and 4th post reached on a no ball (you can't be caught out)
- ½ Rounder if 4th post reached without hitting the ball
- ½ Rounder if ball is hit and 2nd post reached and touched before next ball is bowled - but if you continue this run and are put out before reaching 4th post, the score will be nullified
- Penalty ½ Rounder for an obstruction by a fielder
- Penalty ½ rounder for 2 consecutive no balls to same batter 1 Rounder for a backward hit if 4th post reached (you stay at 1st while ball is in the backward area)

Key Words

- **A rounder -** the ball is hit, even if a no ball was thrown, and the batter touches the 4th post before the post is stumped or the ball is back with the bowler in the bowlers square.
- **½ Rounder** - 1/2 rounder can be scored if a player reaches the 2nd or 3rd post in one hit.
- **Backwards hit** - If the ball is hit backwards the player must stay at the first post until the ball is thrown forwards. If the player then makes it to the 4th post before it is stumped a rounder is scored.
- **Obstruction** - Penalty 1/2 rounders can be scored if a fielder obstructs where the batter is running or if the bowler throws 2 consecutive no balls to the next player.
- **No ball** – this is called when the bowler does not bowl the ball between the head and knee or is too far wide.

Knowledge Organiser - Rounders

Batting the ball Skill Card



Skills Practice

With a rounders tee, practise hitting a static ball using the correct technique.

Try throwing a ball up for yourself and hit them as best as you can. Can you hit the ball at different heights?

Experiment with your stance and holding position. Which one do you find the most comfortable? Which one helps you connect with the ball the most?

Technique

1. Hold the bat with either one or two hands, using the 'handshake' grip.
2. Stand side-on to the bowler, holding the bat behind you.
3. Keep your weight over your back leg.
4. Watch the ball throughout.
5. As the ball gets closer, begin to swing your bat forward.
6. Transfer your weight to your front leg, leaning into the swing as you make contact with the ball.

Rounders for beginners

How do you get out in rounders?

- A fielder catches the ball (Caught)
- Foot over front/back line of batting square before hitting or missing a good ball
- Running inside post (unless obstructed)
- The post you are running to is stumped
- You lose contact with post during bowlers action when he has possession in the square
- You overtake
- You obstruct (you have right of way on track only)

Key Skills

Speed- to run around the pitch before a fielder stumps you out **Strength –** to apply great force when batting the ball

Agility – to rapidly change your position with precise control to run around the pitch.

Power – To hit the ball as hard as you can.

Co-ordination – To be able to bowl the ball to the batter.

Rules and Regulations

The batter:

- Wait in the backward area well away from 4th post
- If out, wait in the backward area well away from 1st post
- You will have one good ball bowled to you
- No ball if: - Not smooth underarm action - Ball is above head - below knee - Ball bounces on way to you - Is wide or straight at body - The bowlers foot is outside the square during the bowling action - You can take or run on a no ball, but once you reach 1st post you cannot re turn. You score in the normal way.

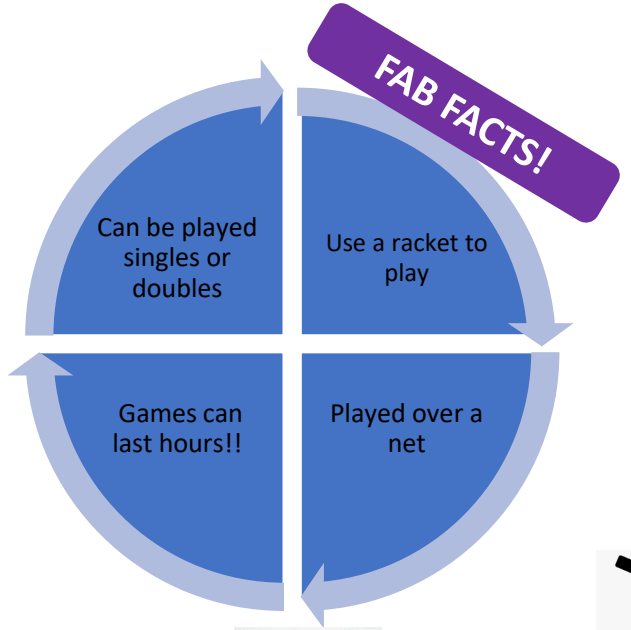
Running around the track:

- If you stop at a post you must keep contact with the post, with hand or bat. If you don't the fielding side can stump the following post to put you out
- You can run on to a post even if it has been previously stumped (you don't score if the post immediately ahead has been stumped)
- When the bowler has the ball in his square you cannot move on, but if you are between posts you can carry on to the next
- You cannot have two batters at a post. The Umpire will ask the first to run on when the second one makes contact
- At a post you do not have to move on for every ball bowled

Knowledge Organiser -Tennis

What is Tennis?

- Tennis is a racket sport played in singles or doubles formats.
- Players aim to hit a tennis ball over the net and into their opponent's court without their opponent being able to return the ball back
- The aim of the game is to win points by hitting a tennis ball across the net and into your opponent's court to force your opponent to make an error and be unable to return the ball back.
- The simple rules, physical requirements and enjoyable nature of the game have made tennis very popular throughout the world and enjoyed by all ages and abilities.



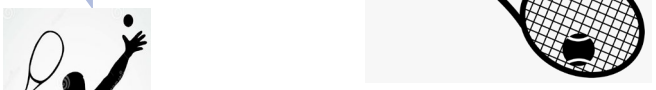
Players

A tennis match can have either two or four players on a court at a given time. Singles has one player on each side, while doubles has two players on each side.

In a game of doubles, after a service is returned, both players are then able to hit the ball and are not required to take it in turns.

Competitive tennis games have five different types of matches. These are:

1.men's singles
2.women's singles
3.men's doubles
4.women's doubles
5.mixed doubles (each team is made up of a man and a woman)



Court markings:

•A competitive tennis court is a large rectangle that can be played on grass, clay and hard courts, which can be of concrete or rubber composition. All courts are marked out to play both singles and doubles. Recreational courts can also be artificial, carpet-based surfaces.

•A tennis court is 23.77 m (78 ft) long. For singles matches, it is 8.23 m (27 ft) wide and for doubles it is 10.97 m (36 ft) wide. Additional lines accommodate both singles and doubles play.

•The tennis net should stretch 91.4 cm (3 ft) past the doubles court, stand 1.07 m (3 ft 6 in) high at the ends and drop to 91 cm (3 ft) in the middle of the net.

Scoring in Tennis

At the beginning of a game both players begin with 'love' (zero) points. Unlike other racket sports, the points do not increase in standard increments, instead they follow the set system below:

•No points – 'Love'
•First point – '15'
•Second point – '30'
•Third point – '40'
•Fourth point – 'Game'

To win a game, a player must beat their opponent by two clear points. However, it is very common for both players to reach 40-40 (40-all) - this is called "deuce".

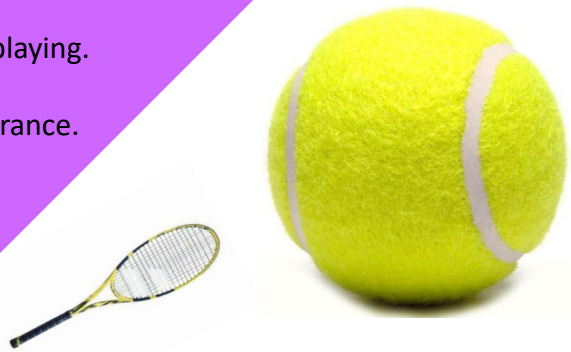
At deuce, a player is still required to win by two more points. Therefore, if the server wins the next point the score is "advantage server". If the player with "advantage" wins the next point they win the game, but if the player without "advantage" wins the next point, the score reverts to "deuce". There is no limit to the number of times a game can go to deuce and, as a result, a game can go on for an extended period of time.

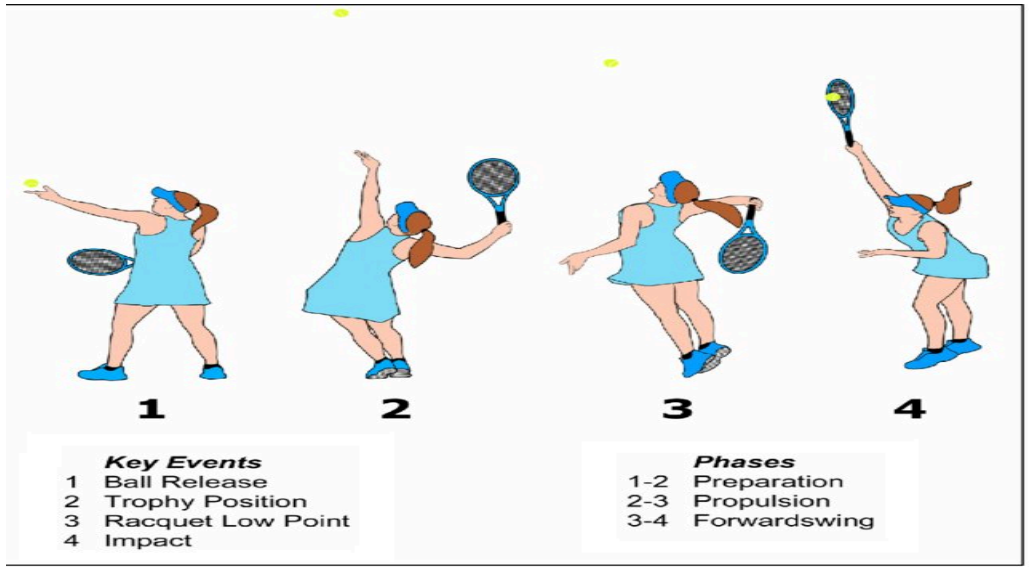
Knowledge Organiser -Tennis

Tennis for beginners

Key Skills

Speed-to move around the court as quickly as possible to ensure you return the tennis ball.
Strength – to apply great force when hitting the tennis ball with your racket.
Agility – to rapidly change your position with precise control to reach the tennis ball at different areas on the court.
Footwork -Making sure that you are always on your toes so you can move back and forward and side to side to reach the tennis ball.
Co-ordination – To be able to serve the ball and be able to also return the ball when playing.
Power – To be able to hit powerful shots during a game.
Muscular endurance – A tennis game can last a long time so requires muscular endurance.





Top tip:
Aim to hit the ball at waist height. It's easier to hit the ball after it has bounced and is on its way down after it's reached the highest point in the air.

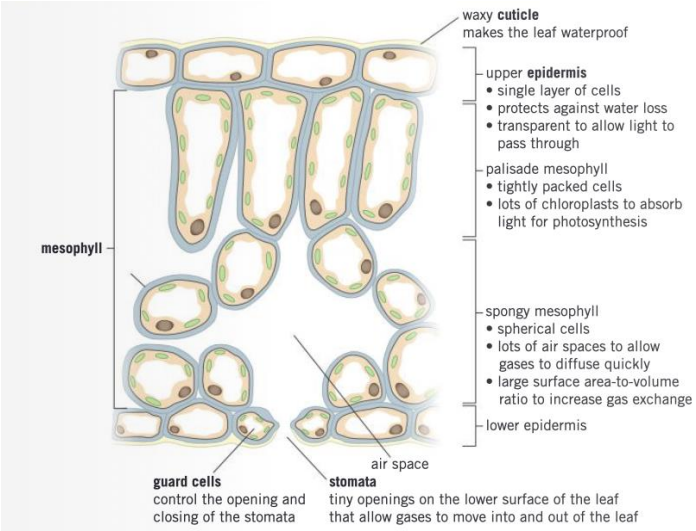
Rules and Regulations

- A match must start with a coin toss to decide who serves first and which side they want to serve from.
- After each point, the server will alternate either side on the baseline.
- The server must hit their serve from behind their baseline.
- If the first serve is called out, then the server may take advantage of a second serve. If the second serve fails then a 'double fault' is called and the point is lost.
- If the serve hits the net but travels over and into the service area, then a 'let' is called and the server may take the serve again without penalty.
- To receive a serve, the player is allowed to stand where they wish but they must allow the ball to bounce once first.
- If a player touches the net, distracts their opponent or impedes them in any way, the umpire will award the point to the other player.
- Throughout a game, the ball is allowed to hit the lines to be awarded in. Anything outside of the lines and the ball is out.
- In competitive games, new tennis balls are introduced after the first seven games and then every nine games after that.

Photosynthesis and cellular respiration
Knowledge Organiser

Tissues in a leaf

Leaves are organs because they contain many tissues that work together to perform photosynthesis.



Stomata

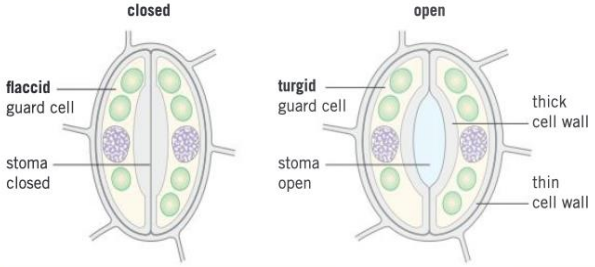
Stomata are tiny openings in the undersides of leaves – this placement reduces water loss through evaporation.

They control gas exchange and water loss from leaves by:

- Allowing diffusions of carbon dioxide into the plant for photosynthesis
- Allowing diffusion of oxygen out of the plant

Guard cells are used to open and close the stomata.

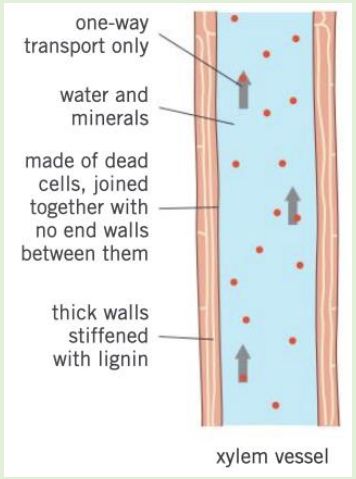
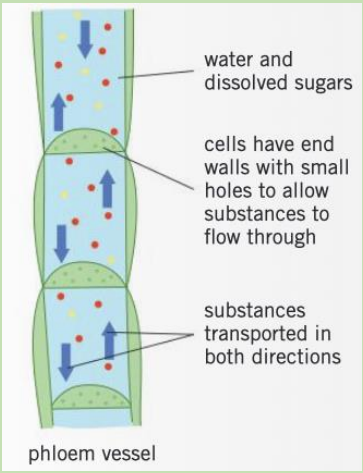
When a plant has plenty of water, the guard cells become turgid. The cell wall on the inner surface is very thick, so it cannot stretch as much as the outer surface. So as the guard cells swell up, they curve away from each other, opening the stoma.



Key terms

cuticle epidermis flaccid mesophyll stomata phloem xylem turgid translocation transpiration guard cell

Transportation in plants

	Transpiration	Translocation
Description	Water is lost through the stomata by evaporation. This pulls water up from the roots through the xylem and is called transpiration. The constant movement of water up the plant is called the transpiration stream.	The movement of dissolved sugars from the leaves to the rest of the plant through the phloem.
Importance	Provides water to cells to keep them turgid. Provides water to cells for photosynthesis Transports mineral ions to leaves.	Moves dissolved sugars made during photosynthesis to other parts of the plant. This allows for respiration, growth and glucose storage.
Specialised Tissues		

Factors affecting the rate of transpiration

Factor	Effecton transpiration	Because…
temperature	higher temperatures increase the rate of transpiration	water evaporates faster at higher temperatures
humidity	lower humidity increases the rate of transpiration	the drier the air the steeper the concentration gradient of water molecules between the air and the leaf
wind speed	more wind increases the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	Higher light intensity increases the rate of transpiration	stomata open wider to let more carbo dioxide into the leaf for photosynthesis

Photosynthesis
Knowledge Organiser

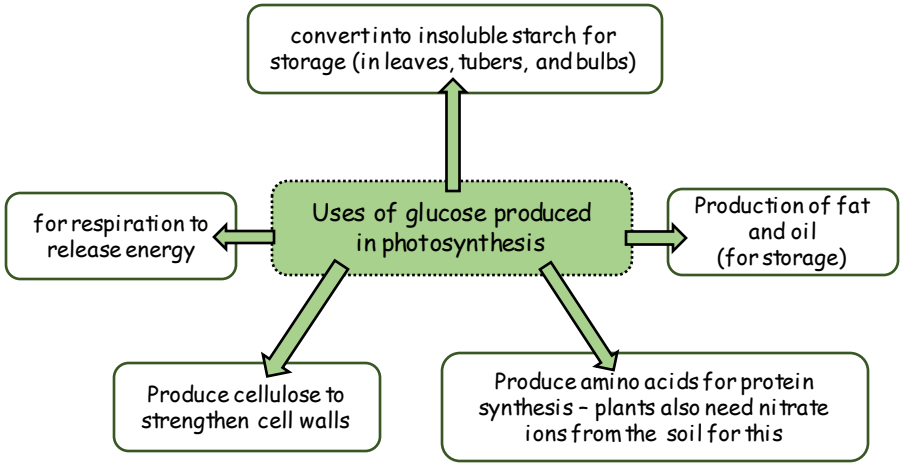
Photosynthesis reaction

Photosynthesis is a chemical reaction in which energy is transferred from the environment as light from the Sun to the leaves of a plant. This is an endothermic reaction.

Chlorophyll, the green pigment in chloroplasts in the leaves, absorbs the light energy. Leaves are well adapted to increase the rate of photosynthesis when needed.

carbon dioxide + water $\xrightarrow{\text{light}}$ **glucose** + oxygen

$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$



Inverse square law

As the distance of a light source from a plant increases, the light intensity decreases – this is called an inverse relationship. This relationship is not linear, as light intensity varies in inverse proportion to the square of the distance:

$$\text{light intensity} \propto \frac{1}{\text{distance}^2}$$

For example, if you double the distance between a light source and a plant, light intensity falls by three quarters.

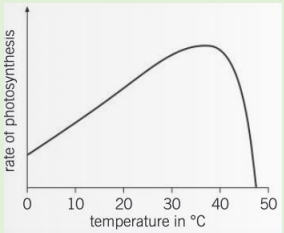
Rate of photosynthesis

A limiting factor is anything that limits the rate of a reaction when it is in short supply.

The limiting factors for photosynthesis are
- Temperature
- Carbon dioxide concentration
- Light intensity
- Amount of chlorophyll

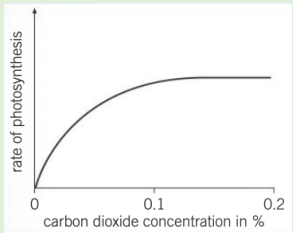
Less chlorophyll in the leaves reduces the rate of photosynthesis. More chlorophyll may be produced by plants in well-lit areas to increase the photosynthesis rate.

Limiting factors and photosynthesis rate



At low temperatures the rate of photosynthesis is low because the reactant molecules have less kinetic energy.

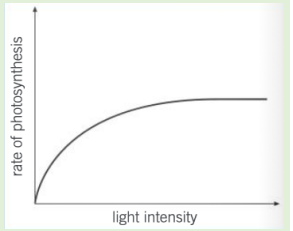
Photosynthesis is an enzyme-controlled reaction, so at high temperatures the enzymes are denatured and the rate quickly decreases.



Carbon dioxide is used up in photosynthesis, so increasing carbon dioxide concentration increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Carbon dioxide is often the limiting factor for photosynthesis.



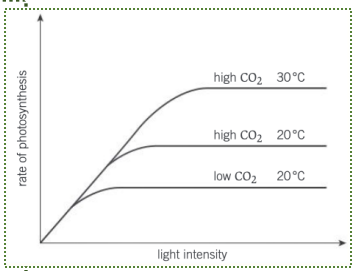
Light energy is needed for photosynthesis, so increasing light intensity increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Photosynthesis will stop if there is little or no light.

Interaction of limiting factors

Limiting factors often interact, and any one may be limiting photosynthesis.
For example, on the graph the lowest curve has both carbon dioxide and temperature limiting photosynthesis. Temperature is limiting for the middle curve, and the highest curve shows photosynthesis rate increases when both temperature and carbon dioxide are increased until another factor becomes limiting.



Greenhouse economics

Commercial greenhouses control limiting factors to get the highest possible rates of photosynthesis so they can grow plants as quickly as possible or produce the highest yields, whilst making a profit.

Key terms

carbon dioxide chlorophyll chloroplast endothermic glucose inverse square law limiting factor photosynthesis

Investigating Photosynthesis
Knowledge Organiser

Aim

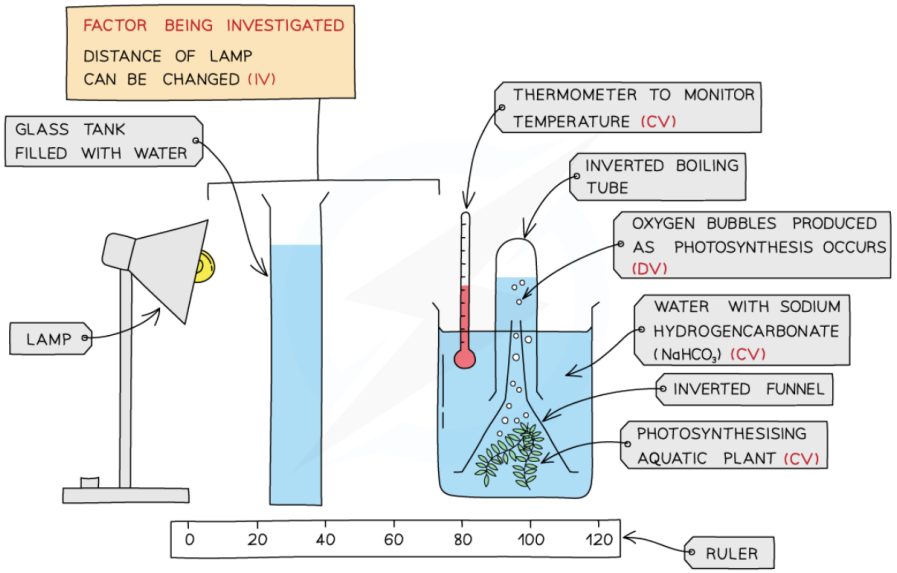
Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed

Variables

Dependent – The number of bubbles / volume of oxygen produced
Independent – Distance between light source and plant / light intensity.
Control – Temperature (can be controlled using and LED bulb or a heat shield, carbon dioxide concentration, type of plant, length of plant, mass of plant.

Method

Place a piece of pondweed (Elodea or Cabomba are often used), into a beaker of water
Use a light a set distance from the plant
Record the number of bubbles observed in three minutes
Repeat steps for different distances



Improvements

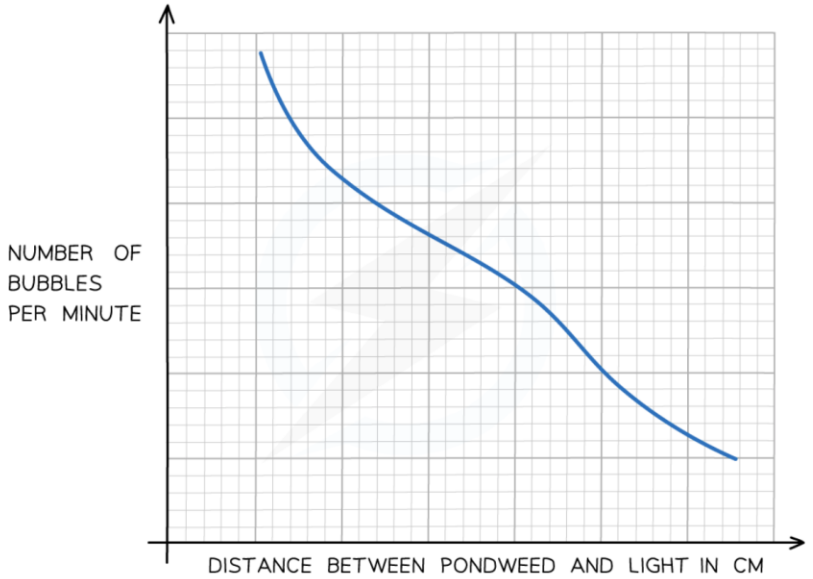
- Use a gas syringe to collect the volume of gas produced
- Repeat the experiment at least twice for each distance and calculate the mean number of bubbles
- Use of a glass tank between lamp and plant to prevent heating of the plant, or using an LED bulb that releases very little heat energy

Changing the Independent Variable

- To investigate the impact of carbon dioxide concentration the concentration of sodium hydrogen carbonate can be changed.
- Use different temperatures of sodium hydrogen carbonate solution.

Results

- As the distance between the plant and light source increases the number of bubbles decreases. This shows that the rate of photosynthesis decreases at lower light intensities.



Key terms

carbon dioxide chlorophyll chloroplast endothermic glucose inverse square law limiting factor photosynthesis

Respiration
Knowledge Organiser

Cellular respiration

Cellular respiration is an exothermic reaction that occurs continuously in the mitochondria of living cells to supply the cells with energy.

The energy released during respiration is needed for all living processes, including

- chemical reactions to build larger molecules, for example, making proteins from amino acids
- muscle contraction for movement
- keeping warm

Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen).

Type of respiration	Oxygen required?	Relative amount of energy transferred
aerobic	✔	Complete **oxidation** of glucose – large amount of energy is released
anaerobic	✘	Incomplete oxidation of glucose – much less energy is released per glucose molecule than in aerobic respiration

Aerobic respiration

glucose + oxygen → carbon dioxide + water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic respiration in muscles

glucose → lactic acid

$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$

Fermentation

Anaerobic respiration in plant and yeast cells is represented by the equation:

glucose → ethanol + carbon dioxide (energy transferred to the environment)

Anaerobic respiration in yeast cells is called fermentation.

The products of fermentation are important in the manufacturing of bread and alcoholic drinks.

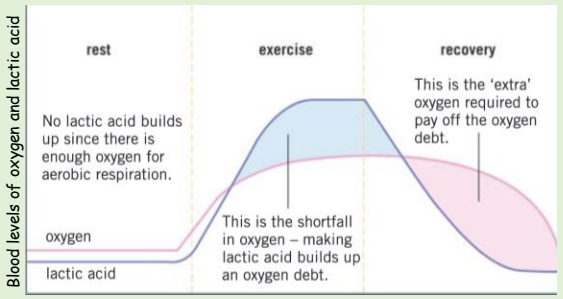
Response to exercise

During exercise the human body reacts to the increased demand for energy.

To supply the muscles with more oxygenated blood, heart rate, breathing rate, and breath volume all increase.

If insufficient oxygen is supplied, anaerobic respiration takes place instead, leading to the build up of lactic acid.

During long periods of vigorous exercise, muscles become fatigued and stop contracting efficiently.



After exercise, the lactic acid accumulated during anaerobic respiration needs to be removed. Oxygen debt is the amount of oxygen needed to react with the lactic acid to remove it from cells.

Removal of lactic acid

Lactic acid in the muscles

⇩

Transported to the liver in the blood

⇩

Lactic acid is converted back to glucose

Key terms

aerobic anaerobic exothermic fermentation lactic acid metabolism mitochondria oxidation oxygen debt respiration

Chemical Reactions 2
Knowledge Organiser

Reactivity series

Reaction with water	Reaction with acid	Reactivity series		Extraction method
		Metal	Reactivity	
Fizzes, gives off hydrogen gas	Explodes	Potassium	High reactivity	Electrolysis
		Sodium		
		Lithium		
	Fizzes, gives off hydrogen gas	Calcium		
Reacts very slowly		Magnesium		
		Aluminium (carbon)		
		Zinc		Reduction with carbon
		Iron		
No reaction	Reacts slowly with warm acid	Tin		
		Lead (hydrogen)		
	No reaction	Copper		
		Silver		Mined from Earth's crust
		Gold	Low reactivity	

Displacement reactions

In a **displacement reaction**, the **more** reactive element takes the place of the **less reactive** element.
For example, **Potassium is more reactive than calcium**, so potassium displaces the calcium in calcium chloride

Calcium chloride + Potassium → Potassium chloride + Calcium

$$CaCl_2 + 2K \rightarrow 2KCl + Ca$$

Acids and alkalis

Acids are compounds that release H^+ ions when in an aqueous form. The three acids are sulfuric acid, nitric acid and hydrochloric acid. They have a pH below 7.
Alkalis are compounds that release OH^- when in aqueous form. They have a pH above 7.
Neutral solutions have a pH of 7.
The pH scale is a measure of how acidic or alkaline a substance is. It is a scale from 1 to 14.
Indicators, such as **universal indicator or a pH probe** can be used to determine the pH of a solution.
When an acid and alkali react, **neutralisation can occur**.

Acid + alkali → metal salt + water

Reactions of acids

Reactions of acids with metals
Acids react with **metals** to form metal salts and **hydrogen gas**

Reaction of acids with metal oxides and hydroxides
Acids react with **metal hydroxides/oxides** to form metal salts and **water**

Reaction of acids with metal carbonates
Acids react with **metal carbonates** to form metal salts, **water** and **carbon dioxide**

Salts

Hydrochloric acid forms a **chloride salt** e.g. Sodium chloride (NaCl)
Sulfuric acid forms a **sulfate salt** e.g. Sodium sulfate (Na_2SO_4)
Nitric acid forms a **nitrate salt** e.g sodium nitrate ($NaNO_3$)

Metal extraction

Metals that are **more reactive** than carbon are extracted using a process called **electrolysis**.
Metals that are **less reactive** than carbon are extracted by reduction with carbon
Metals that are **unreactive** are found as pure metals and are mined from the Earth's crust.

Key terms

Acid alkali base crystallisation displacement metal neutralisation ore oxidation pH reactivity

Year 9 Physics current and static electricity 2

Key vocabulary:

Potential difference – the work done in moving one coulomb of charge from one point in the circuit to another.

Current – a flow of electrons.

Charge – the rate of flow of electrons.

Resistance – the opposing of a current.

Power – how much energy is transferred (work done) in a certain amount of time.

Series – all components in a circuit follow on directly from each other.

Parallel – the current has alternate pathways to possibly take in a circuit.

Free (or delocalised) electrons – electrons that are free to move through the conductor (eg metal).

Key Units:

Current–Amps **(A)**

Potential difference–volts **(V)**

Charge-coulombs **(C)**

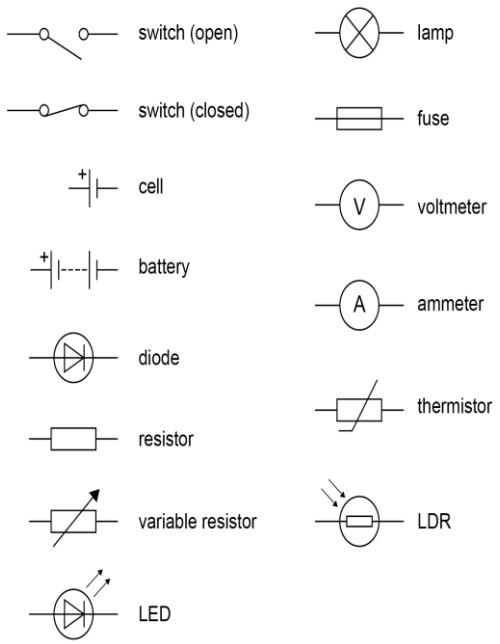
Resistance-ohms **(Ω)**

Power-watts **(W)**

Energy transferred-joules **(J)**

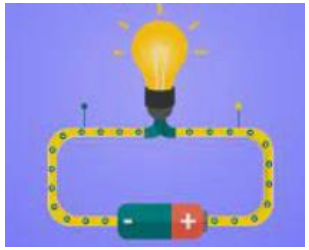
Energy transferred is the same as work done.

Circuit symbols



Electric current, voltage and resistance

Electrical current is the flow of charge, this charge comes from the negative electrons in the metal wire. These negative electrons move when there is a battery or cell is added. They can transfer energy as they move.



Resistance – caused by the collision between delocalised electrons and metal ions. The more collisions the greater the resistance and the smaller the current that flows.

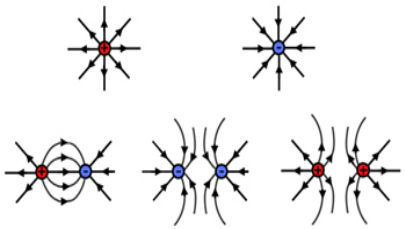
Electric fields

All charged objects have an **electric field** around them, which shows how they will interact with other charged particles.

Electric fields will always run from positive to negative – shown by arrows. The greater the number of arrows, the stronger the electric field.

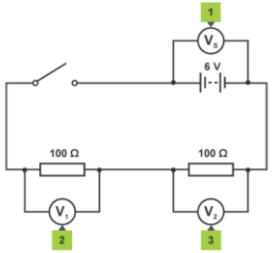
Like charges – the field lines show a gap in the electric field.

Unlike charges – filed lines move from + to -.



Series circuits

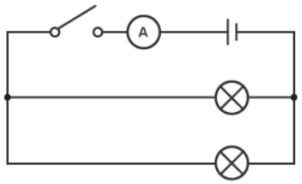
Series circuits – all components follow on directly from each other. The current only has one pathway to follow. The current is the same all the way around a series circuit. The potential difference is shared between the components in the circuit.



The series circuit has voltmeters in it. The voltmeter is used to measure potential difference and is in parallel which means it's across the component.

Parallel circuit – the electricity has more than one pathway to take. It has branches. The current will take the path of least resistance.

The current will be shared between the branches in the circuit. The potential difference will be the same across each component in the circuit.



The parallel circuit has an ammeter in it. The ammeter is used to measure current and is in series with the component, which means in the loop.

Static

Static is caused because of friction between two insulators resulting in the transfer of electrons.

Object gains electrons – object is negatively charged.

Object loses electrons – object is positively charged.

If there is a build-up of charge and the potential difference between two objects is great enough, a spark will 'jump' – this is a discharge of electricity.

The objects do not have to be touching – no contact needed for attraction / repulsion.