Year 10 Mathematics
Higher
HT 1

Factorising a quadratic expression

1.	Factorising a quadratic in the form of $ax^2 + bx + c$	Multiply to 5 Factorise $x^2 + 5x + 6$ ← Add to 6 2 and 3 add to 5 2 and 3 multiply to 6 $(x + 2)(x + 3)$ Check: $(x + 2)(x + 3) = x^2 + 5x + 6$	
2.	Difference of two squares	A special type of quadratic which only has two terms. One term is subtracted from the other $x^2 - 25 = x^2 - 5^2 = (x + 5)(x - 5)$ $y^2 - 49 = y^2 - 7^2 = (y + 7)(y - 7)$ $a^2 - 16 = a^2 - 4^2 = (a + 4)(a - 4)$	
3.	Factorising a quadratic in the form of $ax^2 + bx + c$ where $a > 1$	By inspection $4x^2 + 20x + 9$ $(4x + 9)(x + 1)$ $(4x + 3)(x + 3)$ $(2x + 9)(2x + 1)$ ✓ $(2x + 3)(2x + 3)$	Splitting the middle $4x^2 + 20x + 9$ $4x^2 + 2x + 18x + 9$ $\mathbf{2x}(2x + 1) + \mathbf{9}(2x + 1)$ $(2x + 1)(2x + 9)$

Solving quadratic equations/functions

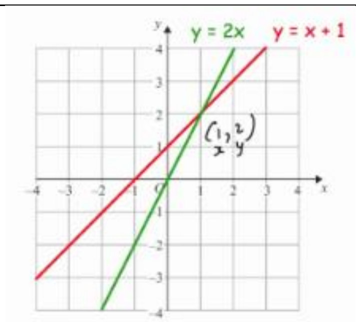
4.	By factorising	Take you factorised form and set each bracket equal to zero Solve each separate linear equation to find the solutions/roots	$x^2 + 4x + 3 = 0$ $(x + 3)(x + 1) = 0$ $x + 3 = 0$ So $x = -3$ $x + 1 = 0$ So $x = -1$
5.	The quadratic formula	A formula to find the solutions a quadratic equation in the form of $ax^2 + bx + c$	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

6.	Completing the square	x^2+bx+c can be written in the form $\left(x+\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$	If a is greater than 1 this will need to be factored out first!

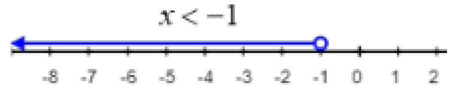
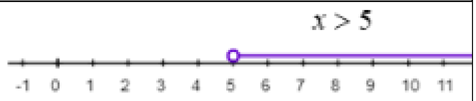
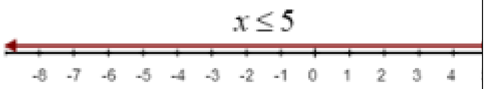
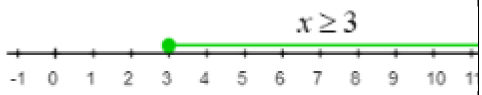
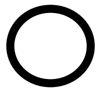
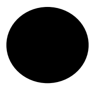
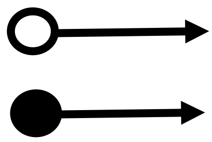
Simultaneous equations

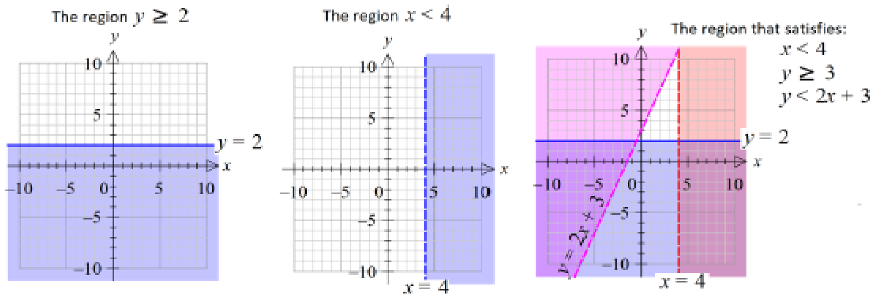
7.	Simultaneous equations	Two equations where there are two unknown which have the same value in each

Solving simultaneous equations

8.	Elimination	Add or subtract one equation from another to eliminate a variable	
		If the matching coeefieicents have the same sign then subtract the equations ✓ Same ✓ Subtract ✓ Substitute	If the matching coefficients have different signs then add the equations ✓ Different ✓ Add ✓ Substitute
9.	Substitution	Rearrange so the subject of one equation is a single variable	
		Substitute this into the second equation	
10.	Graphically	The points of intersection of two graphs are the solutions to the simultaneous equations	

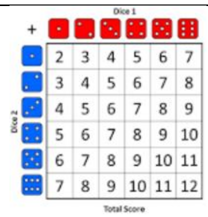
Inequalities

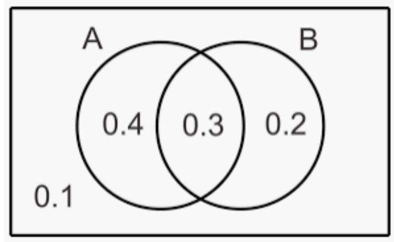
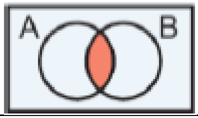
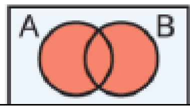
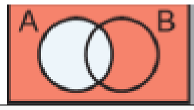
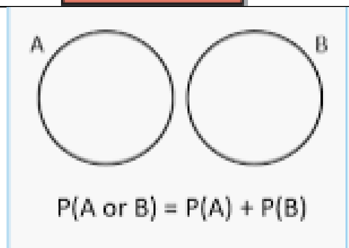
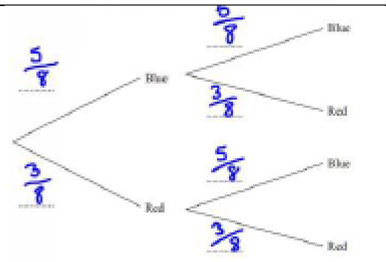
11.	Inequality	The relationship between two expressions that are not equal	
12.	=	Equal to	
13.	≠	Not equal to	
14.	<	Less than	
15.	>	Greater than	
16.	≤	Less than or equal to	
17.	≥	Greater than or equal to	
18.	Inclusive	Gives a finites rnage of solutions	e.g. $3 < x \leq 8$
19.	Exclusive	Gives an infinite range of solutions	e.g. $x > 5$ $-4 \leq x$
20.	Integer	A whole number that can be positive negative or zero	
21.	Solve	Inequalities are solved in the same way as solving equations	
		Only exception: if you multiply or divide by a negative number you must swap the sign e.g. less than to greater than	
22.	List integers solutions	Give the integers that satisfy the inequality	
		e.g. x > 6 integer solutions are 6, 7, 8….	
		e.g. -5 < x ≤ 5 integer solutions are -4, -3, -2, -1, 0, 1, 2, 3, 4, 5	
23.	Represent on a number line	An empty circle shows the value is not included	
		A shaded circle shows the value is included	
		An arrow shows that the solution continues to infinity	

<table>
<tr><td rowspan="3">24.</td><td rowspan="3">Inequalities on graphs</td><td>

The unwanted sections are shaded</td></tr>
<tr><td>Dashed lines are used to represent < or ></td></tr>
<tr><td>Solid line is used to represent $\leq or \ \geq$</td></tr>
</table>

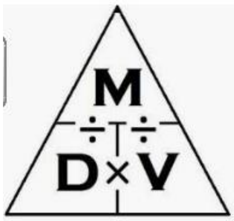
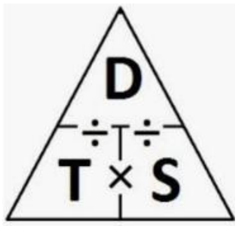
Probability - definitions

1.	Probability	The extent to which an event is likely to occur Written as a fraction, decimal or percentage	For equally likely outcomes the probability that an event will happen is $P = \frac{number\ of\ successful\ outcomes}{total\ number\ of\ possible\ outcomes}$
2.	Theoretical probability	Calculated without doing an experiment	
3.	Experimental probability	Probabilities based on the data collected during an experiment Also known as estimated probability The more trials you do the more reliable your set of results	$estimated\ probability = \frac{frequency\ of\ event}{total\ frequency}$
4.	P( ) notation	P( ) mean s the probability of the thing inside the brackets happening e.g. P(tails)	
5.	Experiment	A repeatable process that gives rise to a number of outcomes	
6.	Relative frequency	In an experiment, how often something happens as a proportion of the number of trials	Relative frequency = $\frac{how\ often\ something\ happens}{all\ outcomes}$
7.	Predictions	You can predict the number of outcomes you will get using relative frequency Predicted number of outcomes = probability x number of trials	
8.	Event	A collection of one or more outcomes	
9.	Independent	When one event has no effect on another	Here P(A and B) = P(A) x P(B)
10.	Dependent	When the outcome of one event, changes the probability of the next event	
11.	Exhaustive	Events are exhaustive if they cover all possible outcomes	
12.	Biased	Unfair	
13.	Unbiased	Fair	
14.	Sample space	The set of all possible outcomes	
15.	Sample space diagram	A diagram showing all possible outcomes from an experiment	
16.	Venn diagram	Can be used to represent events graphically	

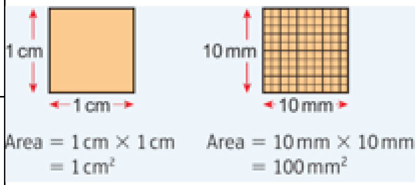
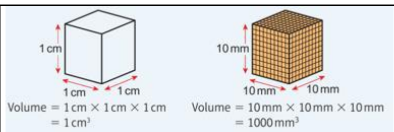
		Frequencies or probabilities can be placed in the regions		
17.	A ∩ B	A intersection B	All elements in A and B	
18.	A ∪ B	A union B	All the elements in A OR B OR both	
19.	A’	Complement of A	Not in A	
20.	Mutually exclusive	Events that have no outcomes in common Here P(A or B) = P(A) + P(B)		
21.	Tree diagram	Used to show the outcomes of two (or more) events happening in succession		
22.	AND rule	Multiply the probabilities		
23.	OR rule	Add the probabilities		
24.	Conditional probability	The probability of a dependent event The probability of a second outcome depends on what has already happened in the first outcome		

Year 10 Mathematics
Higher
HT 2

Multiplicative reasoning – definitions and formulae

1.	Proportion	Compares a part with a whole	
2.	Proportional	A change in one is always accompanied by a change in another	
3.	Ratio	A relationship between two or more quantities	
4.	Compound measure	Combine measures of two different quantities	
5.	Density	The mass of a substance contained in a certain volume Usually measured in g/cm^3 or kg/m^3 $density = \frac{mass}{volume}$	
6.	Velocity	Speed in a given direction	Usually measured in m/s
7.	Acceleration	The rate of change of velocity	Usually measured in m/s^2
8.	Speed	The distance travelled in an amount of time Usually measured in m/s, mph or km/h $speed = \frac{distance}{time}$	
9.	Pressure	The force applied over an area $pressure = \frac{force}{area}$ Usually measured in N/m^2	

10.	Units of time	Standard units of time are seconds, minutes, hours, days, years			
		60 seconds = 1 minute	60 minutes = 1 hour	24 hours = 1 day	365 days = 1 year
11.	Units of mass	Metric units of mass are milligrams, grams, kilograms and tonnes			
		1000mg = 1g	1000g = 1kg	1000kg = 1 tonne	

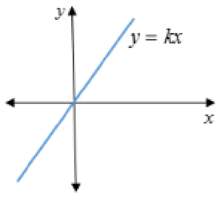
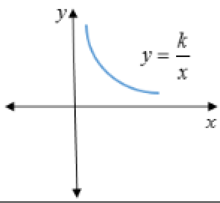
12.	Units of length	Metric units of length are millimetres, centimetres, metres and kilometres		
		10mm = 1cm	100cm = 1m	1000m = 1km
13.	Units of area	Metric units of length are millimetres^2, centimetres^2, metres^2 and kilometres^2		
		$1cm^2 = 100mm^2$		
		$1m^2 = 1000cm^2$		
14.	Units of volume	Metric units of length are millimetres^3, centimetres^3, metres^3 and kilometres^3		
		$1cm^3 = 1000mm^3$		
		$1m^3 = 1000000cm^3$		
15.	Units of capacity	Metric units of capacity are millilitres, centilitres and litres		
		$10ml = 1cl$	$1000ml = 100cl = 1l$	
16.	Capacity and volume conversions	$1cm^3 = 1ml$	$1000cm^3 = 1l$	

Percentages

17.	Percentage	Means 'out of 100'	
18.	Multiplier	A decimal you multiply by to represent a percentage	
		To use a multiplier to find a percentage, divide your percentage by 100, then multiply the amount by this value.	
19.	Percentage increase	Calculate the percentage and add onto the original	
		Or use a multiplier	$amount \times \frac{100 + \%\ increase}{100}$
20.	Percentage decrease	Calculate the percentage and subtract from the original	
		Or use a multiplier	$amount \times \frac{100 - \%\ increase}{100}$
21.	Percentage change	$\frac{Change}{Original} \times 100$	
22.	Express one number as a percentage of another	$\frac{Number\ 1}{Number\ 2} \times 100$	

23.	Reverse percentage	Use when asked to find the priginal amount after a percentage increase or decrease.	
		$\text{Original Value} \times \text{Multiplier} = \text{New Value}$ $\text{Original Value} = \dfrac{\text{New Value}}{\text{Multiplier}}$	
24.	Interest	A fee paid for borrowing money or money earnt through investing.	
25.	Simple interest	Interest that is calculated as a percentage of the original	I = Prt I – Interest P – Original amount r – interest rate t - time
26.	Compound interest	When interest is calculate on the original amount and any previous interest	$P\left(1+\frac{R}{100}\right)^n$ P – Original amount R – Interest rate n – the number of interest periods (e.g. yrs)
		Or $\quad Original \times Multiplier^{time}$	
27.	Tax	A financial charge placed on sales or savings by the government e.g. VAT	
28.	Loss	Income minus all expenses, resulting in a negative value	
29.	Profit	Income minus all expenses, resulting in a positive value	
30.	Depreciation	A reduction in the value of a product over time	
31.	Annual	Means yearly	
32.	Per annum	Means per year	
33.	Salary	A fixed regular payment, often paid monthly	

Proportion graphs

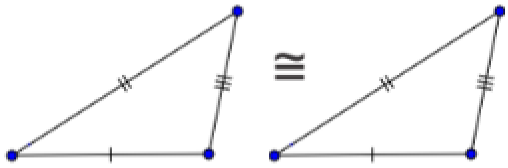
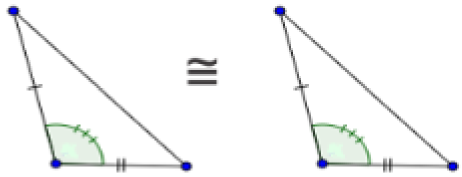
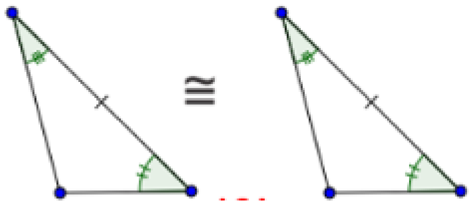
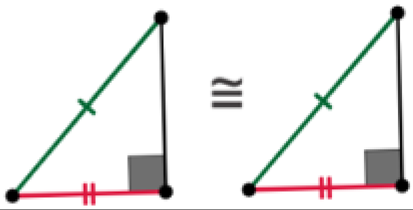
34.	Direct proportion	Two quantities increase at the same rate	$y \propto x$ $y = kx$ for a constant k 
		Graph is a straight line that goes through the origin	
35.	Inverse/indirect proportion	One variable increases at a constant rate as the second variable decreases	$y \propto \frac{1}{x}$ $y = \frac{k}{x}$ for a constant k 
36.	Constant of proportionality	Represented by k	
		Its value stays the same	

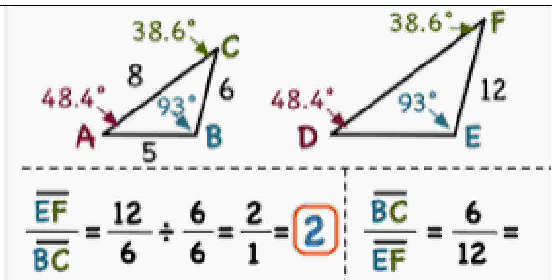
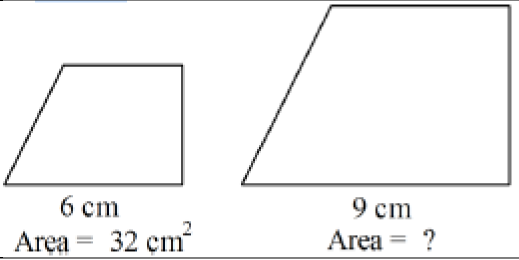
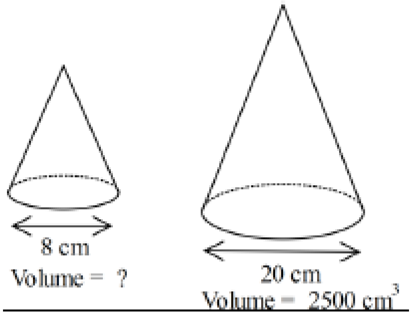
Year 10 Mathematics
Higher
HT 3

Similarity and Congruence in 2D and 3D

1.	Congruent	Exactly the same shape and size	
2.	Similar	Two shapes where one is an enlargement of another	
		Corresponding angles are equal	Corresponding sides are in the same ratio
3.	Scale factor	The proportion by which the dimensions of an object will increase or decrease by	
4.	Linear scale factor (LSF)	The scale factor/ratio of sides of two similar shapes	$LSF = \frac{length\ from\ large\ shape}{length\ from\ small\ shape}$
5.	Area scale factor (ASF)	The scale factor ratio of areas/surface areas of two similar shapes	$ASF = \frac{Area\ of\ large\ shape}{lArea\ of\ small\ shape}$
6.	Volume scale factor (VSF)	The scale factor/ratio of volumes of two similar shapes	$VSF = \frac{volume\ of\ large\ shape}{volume\ of\ small\ shape}$

Two triangles are congruent if...

7.	SSS	All 3 sides are equal	
8.	SAS	2 sides and the included angle are equal	
9.	ASA	2 angles and the corresponding side are equal	
10.	RHS	The right angle, hypotenuse and one other side are equal	

Similar shapes			
11.	Lengths		The scale factor from small to big is 2.
12.	Areas		LSF = 9÷6 =1.5 ASF = 1.5^2 So area of bigger shapes is 6 x 1.5^2
13.	Volumes		LSF = 20 ÷8 = 2.5 VSF = 2.5^2 So volume of smaller shape is 2500 ÷ 2.5^2

Graph transformations

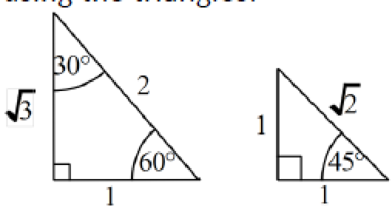
1.	$y = -f(x)$	Reflection in the x axis	y coordinates are multiplied by -1
2.	$y = f(-x)$	Reflection in the y axis	x coordinates are divided by -1
3.	$y = -f(-x)$	Reflection in the x axis and then in the y axis Equivalent to rotation of 180◦ about the origin	y coordinates are multiplied by -1 AND x coordinates are divided by -1
4.	$y = f(x) + a$	Translation by the vector $\begin{pmatrix} 0 \\ a \end{pmatrix}$	
5.	$y = f(x + a)$	Translation by the vector $\begin{pmatrix} -a \\ 0 \end{pmatrix}$	
6.	$y = af(x)$	Stretch by scale factor a in the vertical direction, parallel to the y axis	y coordinates are multiplied by a
7.	$y = f(ax)$	Stretch by scale factor $\frac{1}{a}$ in the horizontal direction, parallel to the x axis	x coordinates are multied by $\frac{1}{a}$

Exact Trig values

8. Exact Values

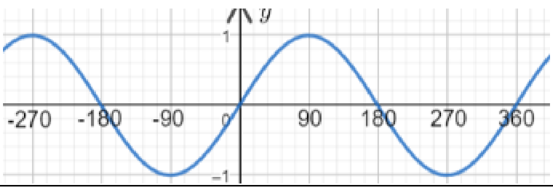
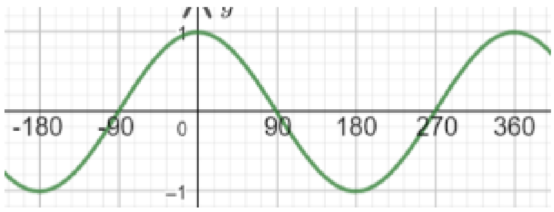
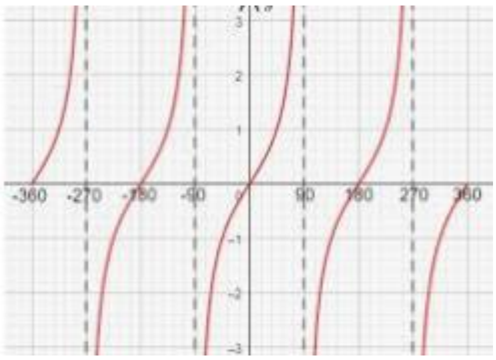
Θ	0°	30°	45°	60°	90°
Sin Θ	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
Cos Θ	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
Tan Θ	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	

These can be found using the triangles:

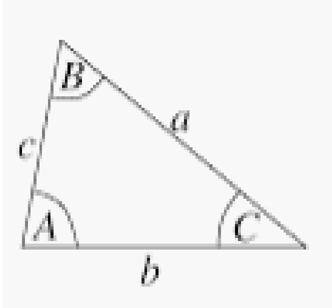


Trigonometric graphs

9.	Sine graph	Repeats every 360◦	

<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>Crosses the x-axis at -180◦, 0◦, 180◦, 360◦…</td><td rowspan="2">
</td></tr>
<tr><td>Maximum of 1 and minimum of -1</td></tr>
<tr><td rowspan="3">10.</td><td rowspan="3">Cosine graph</td><td>Repeats every 360◦</td><td rowspan="3">
</td></tr>
<tr><td>Crosses x-axis at -90◦, 90◦, 270◦, 450◦…</td></tr>
<tr><td>Maximum of 1 and minimum of -1</td></tr>
<tr><td rowspan="4">11.</td><td rowspan="4">Tangent graph</td><td>Repeats every 180◦</td><td rowspan="4">
</td></tr>
<tr><td>Crosses x-axis at -180◦, 0◦, 180◦, 360◦…</td></tr>
<tr><td>Has no maximum or minimum value</td></tr>
<tr><td>Has vertical asymptotes at x=-90◦, x=90◦, x=270◦…</td></tr>
<tr><td colspan="4"><h2>Non – right angled trigonometry</h2></td></tr>
<tr><td>12.</td><td>Cosine rule</td><td>Finding sides
$a^2 = b^2 + c^2 - 2bc\cos A$
$b^2 = a^2 + c^2 - 2ac\cos B$
$c^2 = a^2 + b^2 - 2ab\cos C$</td><td>Finding angles
$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$
$\cos C = \frac{a^2 + b^2 - c}{2ab}$</td></tr>
<tr><td>13.</td><td>Sine rule</td><td>Finding sides
$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$</td><td>Finding angles
$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$

Ambiguous case
Can sometimes produce two possible solutions for missing angles
$\sin\theta = \sin(180 - \theta)$</td></tr>
</table>

14.	**Area of a triangle**	$Area = \frac{1}{2}ab\sin C$ $Area = \frac{1}{2}bc\sin A$ $Area = \frac{1}{2}ac\sin B$	

Year 10 Mathematics
Higher
HT 4

<table>
<tr><th colspan="4">Collecting data</th></tr>
<tr><td>1.</td><td>Population</td><td colspan="2">The whole set of items that are of interest e.g. all the people in a school</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">Census</td><td colspan="2">Observes or measures every member of a population.</td></tr>
<tr><td>Advantages
Should give a completely accurate result</td><td>Disadvantages
Time consuming
Hard to process such large quantities of data
Cannot be sued when the testing process destroys the item</td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Sample</td><td colspan="2">A collection of observations taken from the subset of the population which is then used to find out information of the population as a whole</td></tr>
<tr><td>Advantages
Less time consuming and expensive than a census
Fewer people have to respond
Less data to process compared to a census</td><td>Disadvantages
Data may not be as accurate
Sample may not be large enough to give information about smaller sub groups in the population</td></tr>
<tr><td>4.</td><td>Sampling units</td><td colspan="2">Individual units of a population</td></tr>
<tr><td>5.</td><td>Sampling frame</td><td colspan="2">The list of people or items to be sampled</td></tr>
<tr><td>6.</td><td>Stratum</td><td colspan="2">A subset of the population which is being sampled</td></tr>
<tr><td>7.</td><td>Strata</td><td colspan="2">Plural of stratum</td></tr>
<tr><td>8.</td><td>Bias</td><td colspan="2">Prejudice for or against one group or opinion or result in a way that is unfair</td></tr>
<tr><th colspan="4">Random sampling techniques</th></tr>
<tr><td rowspan="2">9.</td><td rowspan="2">Simple random sampling</td><td colspan="2">Where every member of the sampling frame has an equal chance of being selected.</td></tr>
<tr><td>Advantages
Free of bias
Easy and cheap to implement for small populations and samples</td><td>Disadvantages
Not suitable when population size or sample size is large
A sampling frame is needed</td></tr>
</table>

<table>
<tr><td rowspan="2">10.</td><td rowspan="2">Systematic sampling</td><td colspan="2">Where required elements are chosen at regular intervals from an ordered list</td></tr>
<tr><td>Advantages
Simple and quick to use
Suitable for large samples and populations</td><td>Disadvantages
A sampling frame is needed
It can introduce bias if the sampling frame is not random</td></tr>
<tr><td rowspan="3">11.</td><td rowspan="3">Stratified sampling</td><td colspan="2">The population is divided into mutually exclusive strata (e.g. males and females) and a random sample is taken from each</td></tr>
<tr><td colspan="2">$$Number\ sample\ in\ a\ stratum = \frac{number\ in\ stratum}{number\ in\ population} \times overall\ sample\ size$$</td></tr>
<tr><td>Advantages
Sample accurately reflects the population structure
Guarantees proportional representation of groups within a population</td><td>Disadvantages
Population must be clearly classified into distinct strata
Selection within each stratum suffers from the same disadvantages as simple random sampling</td></tr>
<tr><td colspan="4"><h2>Non- random sampling techniques</h2></td></tr>
<tr><td rowspan="2">12.</td><td rowspan="2">Quota sampling</td><td colspan="2">A researcher selects a sample that reflects the characteristics of the whole population</td></tr>
<tr><td>Advantages
Allows a small sample to be representative of the whole population
No sampling frame required
Quick, easy and inexpensive
Allows for easy comparison between different groups in a population</td><td>Disadvantages
Non random sampling can introduce bias
Population must be divided into groups which can be costly or inaccurate
Increasing scope of study increases number of groups, which adds time and expense
Non-responses are not recorded as such</td></tr>
<tr><td rowspan="3">13.</td><td rowspan="3">Opportunity sampling</td><td colspan="2">Taking the sample from people who are available at the time the study is carried out and who fit the criteria you are looking for</td></tr>
<tr><td colspan="2">Also known as ‘convenience sampling’</td></tr>
<tr><td>Advantages
Easy to carry out
Inexpensive</td><td>Disadvantages
Unlikely to provide a representative sample
Highly dependent of the individual researcher</td></tr>
</table>

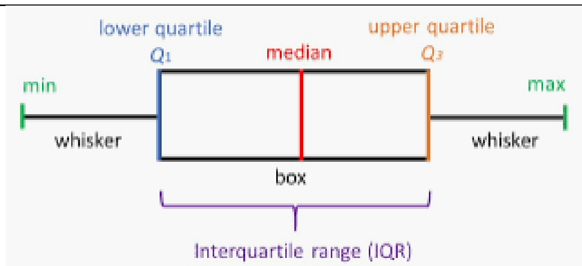
Types of data

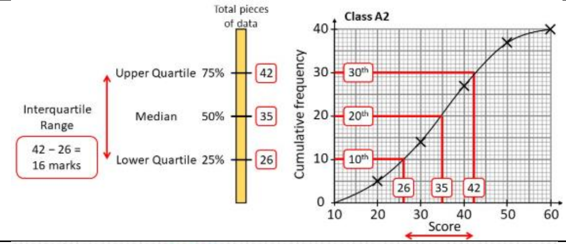
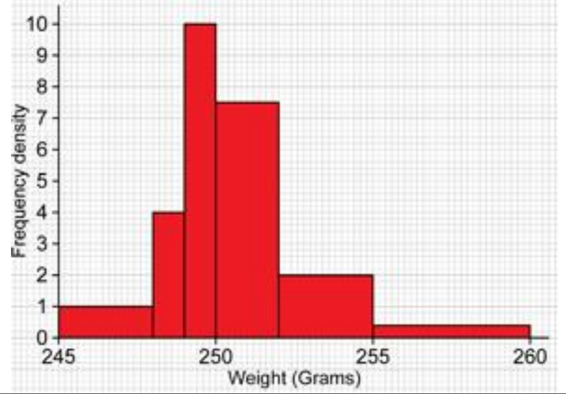
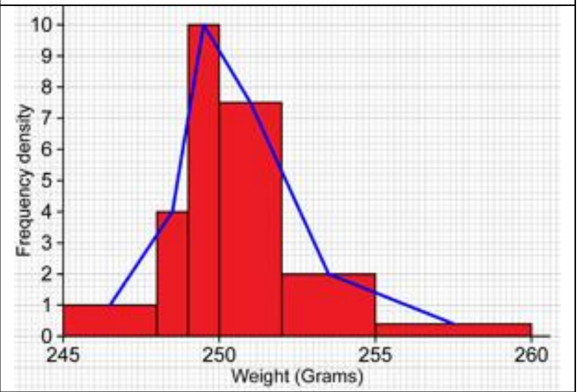
14.	Quantitative data (or variables)	Data (or variables) associated with numerical observations e.g. shoe size
15.	Qualitative date (or variables)	Data (or variables) associated with non-numerical observations e.g. hair colour
16.	Continuous variable (data)	A variable that can take any value in a given range e.g. time
17.	Discrete variable (data)	A variable that can take only specific values in a given range e.g. number of girls in a family

Representing and interpreting data

18.	Class	Another name for the groups in a grouped frequency table
19.	Class boundaries	The maximum and minimum values that belong in each class
20.	Class width	The difference between the upper and lower class boundaries
21.	Midpoint	The average of the class boundaries
22.	Outlier	An extreme value that lies outside the overall pattern of the data
23.	Anomalies	Any outliers that should be removed from the data because it is an error and it would be misleading to keep it in

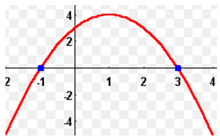
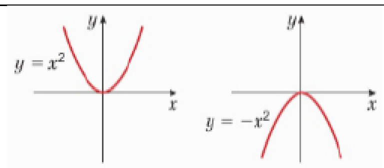
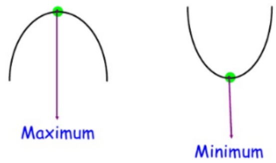
Types of graphs/charts

<table>
<tr><td>24.</td><td>Box plots</td><td>A diagram that displays median, quartiles, minimum and maximum values of a set of data</td><td>
</td></tr>
<tr><td>25.</td><td>Cumulative frequency</td><td colspan="2">A running total of frequencies</td></tr>
<tr><td>26.</td><td>Cumulative frequency table</td><td>A table that shows how many data items are less than or equal to the upper class boundary of each data class</td><td>
<table>
<tr><th>Time, t (minutes)</th><th>Frequency</th><th>Cumulative Frequency</th></tr>
<tr><td>$0 < t \leq 20$</td><td>16</td><td>16</td></tr>
<tr><td>$20 < t \leq 30$</td><td>24</td><td>40</td></tr>
<tr><td>$30 < t \leq 50$</td><td>19</td><td>59</td></tr>
<tr><td>$50 < t \leq 80$</td><td>8</td><td>67</td></tr>
</table>
</td></tr>
</table>

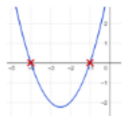
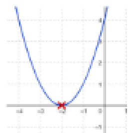
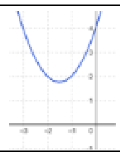
27.	Upper class boundary	The highest possible value in each class	
28.	Cumulative frequency graph	A graph with the data values on the x axis and the cumulative frequency on the y axis	
29.	Histogram	A chart where the area of each bar is proportional to the frequency of each class Area of each bar = k x frequency (k = 1 is the easiest value to use when drawing a histogram)	
31.	Frequency density	The height of each bar on a histogram	If k = 1 then: $$frequency\ density = \frac{frequency}{class\ width}$$
31.	Frequency polygon	Can be formed by joining the middle of each bar in a histogram	

Year 10 Mathematics
Higher
HT 5

Quadratics - definitions

2.	Roots	Solutions to a quadratic equation/function $ax^2 + bx + c = 0$ The x values where the graph crosses the x axis A quadratic can have 0, 1 or 2 roots	
3.	Quadratic graph	Curved shaped called a parabola A positive x^2 will give a '∪' shape A negative x^2 will give a '∩' shape	
4.	Turning points	The point where a curve turns in the opposite direction	

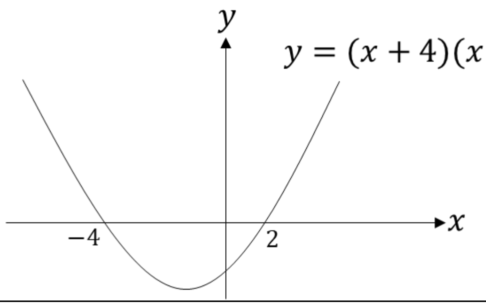
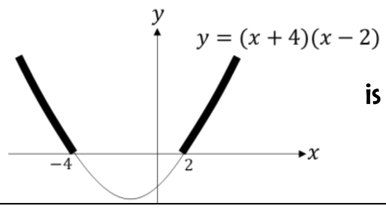
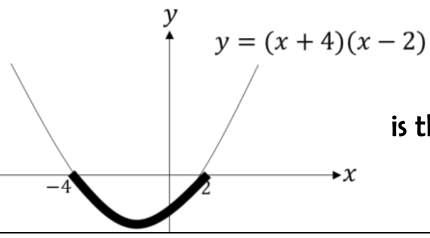
Using the discriminant

5.	Discriminant	The part of the quadratic formula under the square root	$b^2 - 4ac$
6.	$b^2 - 4ac > 0$	Two distinct real roots	
7.	$b^2 - 4ac = 0$	One repeated real root	
8.	$b^2 - 4ac < 0$	No real roots	

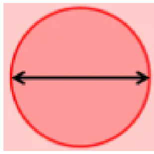
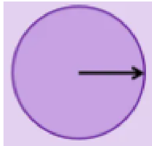
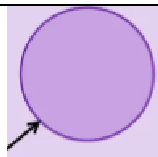
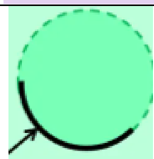
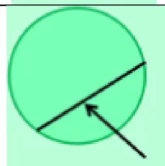
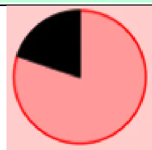
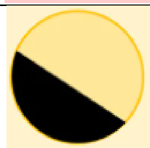
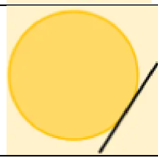
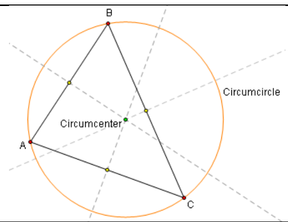
Skletching quadratic graphs

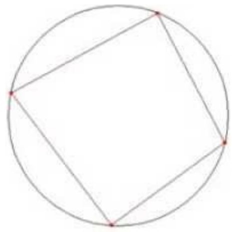
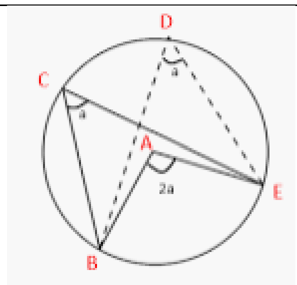
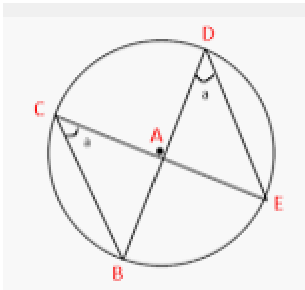
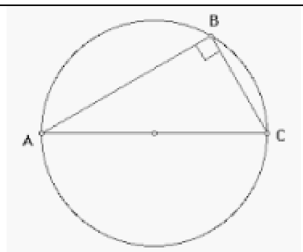
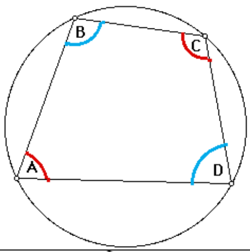
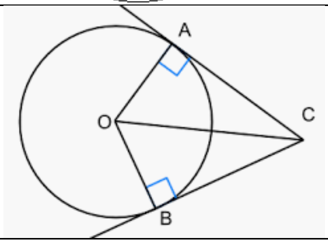
9.	General shape	A positive x^2 will give a '∪' shape A negative x^2 will give a '∩' shape	
	Find the roots	By factorising or using the formula	Equation must be equal to zero
	Find the y intercept	Substitute x =0 zero into the equation	
	Calculate the coordinates of the turning point	Complete the square to get in the form of $f(x) = a(x+p)^2 + q$	Coordinates of turning point are then $(-p, q)$

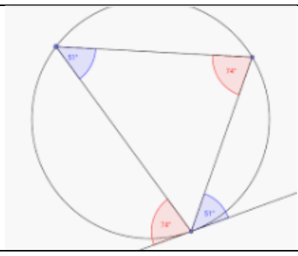
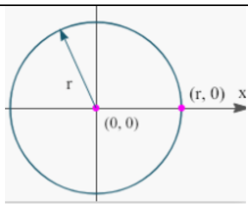
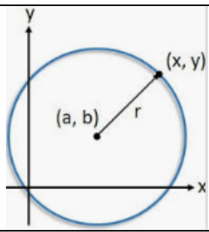
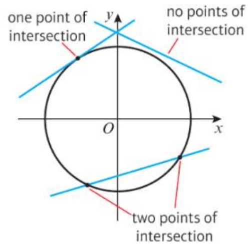
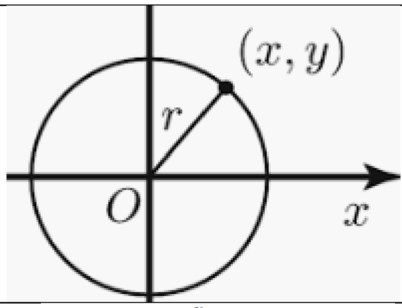
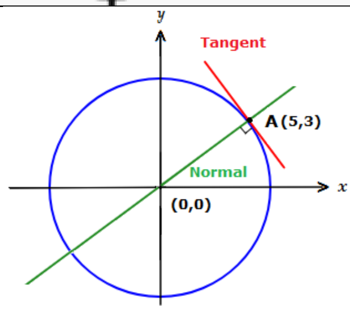
Solving quadratic inequalities

10.	Solve (by factorising or using quadratic formula) $ax^2 + bx + c = 0$	e.g $x^2 - 2x + 8 = 0$ $(x + 4)(x - 2) = 0$ $x = \ -4 \ or \ x = 2$
11.	Sketch the graph clearings showing the roots and parabola shape	
12.	Check whether your quadratic was greater than or less than zero then highlight parts of the graphs that satisfy this	If $x^2 - 2x + 8 > 0$  Therefore $x < -4$ or $x > 2$ is the solution
		If $x^2 - 2x + 8 < 0$  Therefore $-4 < x < 2$ is the solution

Circles - definitions and formulae

1.	Diameter	A straight line from edge to edge passing through the centre	
		Double the size of the radius	
2.	Radius	A straight line from the centre to the edge	
		Half the size of the diameter	
3.	Radii	The plural of radius	
4.	Circumference	Distance around the outside of the circle	
5.	Arc	Part of the circumference	
6.	Chord	A line within a circle where each end touches the edge	
7.	Sector	The region created by two radii and an arc	
8.	Segment	The region created by a chord and an arc	
9.	Tangent	A line outside the circle which only touches the circumference at one point	
10.	Semi -circle	Half a full circle	
11.	Line segment	A finite part of a straight line with two distinct endpoints	
12.	Perpendicular bisector	A straight line that is perpendicular to the line L and passes through the midpoint of L	
13.	Circumcircle	A unique circle that passes through all three vertices of a triangle	
14.	Circumcentre	The centre of a circumcircle, where the perpendicular bisectors of the sides of the triangle intersect	

15.	Cyclic quadrilateral	A quadrilateral with all four vertices on the circumference of a circle	
Circle Theorems			
16.	Angles at the centre	Angle at the centre is twice the angle at the circumference	
17.	Angles in the same segment	Angles at the circumference in the same segment are equal	
18.	Angles in a semi-circle	Angle in a semi-circle is 90◦	
19.	Cyclic quadrilateral	Opposite angles of a cyclic quadrilateral add to 180◦	
20.	Tangent to a circle	Angle between a tangent and radius is 90◦ Two tangents from the same point to a circle are equal in length	

21.	Alternate segment	Angles in the alternate segment are equal	
Circle geometry			
22.	Equation of a circle	With centre $(0,0)$ and radius, r $x^2 + y^2 = r^2$	With centre (a, b) and radius, r $(x - a)^2 + (y - b)^2 = r^2$
			
23.	Intersections between circles and lines	• No intersection • Once (where the line touches the circle • Twice (where the line crosses the circle)	
24.	Gradient of a radius to a circle	Gradient (m) of radius to a point$(x, y)$with an equation $x^2 + y^2 = r^2$ is $\frac{y}{x}$	
25.	Gradient of tangent to a circle	Gradient (m) of tangent to a point(x, y) is the negative reciprocal of the gradient of the radius at the same point	

Year 10 Mathematics
Higher
HT 6

Surds

1.	Surd	A number written exactly using square or cube roots	e.g. $\sqrt{5}$ is a surd but $\sqrt{25}$ is not because it has a value of 5
2.	Rationalise	Eliminate a surd	
3.	Multiply	$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ and $\sqrt{a} \times \sqrt{a} = a$	e.g. $\sqrt{2} \times \sqrt{3} = \sqrt{6}$ and $\sqrt{3} \times \sqrt{3} = 3$
4.	Divide	$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$	e.g. $\frac{\sqrt{6}}{\sqrt{2}} = \sqrt{\frac{6}{2}} = \sqrt{3}$
5.	Add and subtract	$\sqrt{a} + \sqrt{b}$ cannot simplify	e.g. $\sqrt{3} + \sqrt{2} = \sqrt{3} + \sqrt{2}$
		But $\sqrt{a} + \sqrt{a} = 2\sqrt{a}$	e.g. $5\sqrt{2} - 2\sqrt{2} = 3\sqrt{2}$
6.	Simplify	$\sqrt{50} = \sqrt{25 \times 2} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$	e.g. $\sqrt{50} + \sqrt{18} = 5\sqrt{2} + 3\sqrt{2} = 8\sqrt{2}$
7.	Rationalise the denominator	Multiply numerator and denominator (use equivalent fractions) by whatever will result in the denominator simplifying to an integer.	e.g. $\frac{1}{\sqrt{7}} = \frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{7}{\sqrt{7}}$
			e.g. $\frac{1}{5+\sqrt{2}} = \frac{1}{5+\sqrt{2}} \times \frac{5-\sqrt{2}}{5-\sqrt{2}} = \frac{5-\sqrt{2}}{3}$

Algebraic Fractions

8.	Simplifying	Cancel common factors (factorising if needed)	$\frac{(x-3)(x+2)}{(x+2)(x+5)} = \frac{x-3}{x+5}$
9.	Adding and subtracting	Find a common denominator	$\frac{a}{b} + \frac{c}{d} = \frac{ad}{bd} + \frac{bc}{bd} = \frac{ad+bc}{bd}$
10.	Multiplying	Multiply as with normal fraction	$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$
11.	Dividing	Divide as with normal fractions	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

Changing the subject of a formula

12.	Always use inverse operations to isolate the term you have been asked to make the subject		
	If the letter you want as the subject appears twice you will need to factorise		
	Make u the subject: $v = u + at$ $(\boldsymbol{-at})$ $v - at = u$ So $u = v - at$	Make u the subject: $v^2 = u^2 + 2as$ $(\boldsymbol{-2as})$ $v^2 - 2as = u^2$ $(\sqrt{\ \ })$ $\sqrt{v^2 - 2as} = u$ So $u = \sqrt{v^2 - 2as}$	Make m the subject: $I = mv - mu$ $(\boldsymbol{Factorise})$ $I = m(v - u)$ $(\div (\boldsymbol{v} - \boldsymbol{u}))$ $\frac{I}{v - u} = m$ So $m = \frac{I}{v - u}$

Algebraic proof

13.	Proof	A logical argument fro a mathematical statement
		Use algebra to prove something is true/untrue for all cases
14.	Counter example	Use an example that does not fit the statement to prove the statement is incorrect
Notation to use in proof		
15.	n	Any number
16.	n + 1	Consecutive number
17.	2n	Even number
18.	2n + 2	Consecutive even number to 2n
19.	2n + 1	Odd number
20.	2n + 3	Consecutive odd number to 2n + 1
21.	an	A multiple of a e.g. 3n represents a multiple of 3

Functions

22.	Function	A rule for working out values of y (output) given values of x (input)		
23.	$f(x)$	Function notation read as 'f of x', where x is the input into the function		
24.	Composite functions	$fg(x)$	Evaluate $g(x)$ first then substitute this into $f(x)$	
25.		$gf(x)$	Evaluate $f(x)$ first then substitute this into $g(x)$	
26.	Inverse fuction	$f^{-1}(x)$	Reverses the effect of the original function	$f(x)=3x+2$ $f^{-1}(x)=\frac{x-2}{3}$