Kettering Science Academy Maths

Year 10 Mathematics Higher HT 1

Factorising a quadratic expression

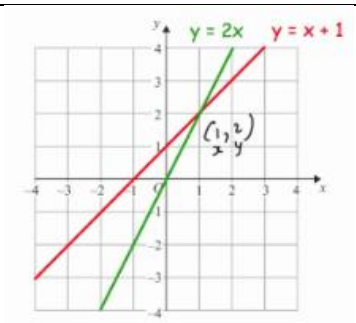
1.	Factorising a quadratic in the form of $ax^2 + bx + c$	Multiply to 5 Factorise $x^2 + 5x + 6$ ← Add to 6 2 and 3 add to 5 2 and 3 multiply to 6 $(x + 2)(x + 3)$ Check: $(x + 2)(x + 3) = x^2 + 5x + 6$	
2.	Difference of two squares	A special type of quadratic which only has two terms. One term is subtracted 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 $ax^2 + bx + c$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

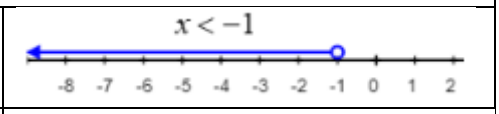
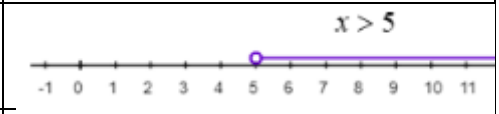
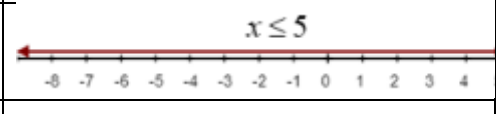
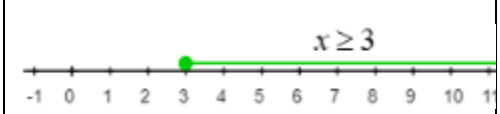
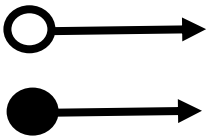
6.	Completing the square	x^2+bx+c can be written in the form $\left(x+\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$	If a is greater than 1 this will need to be factored out first!

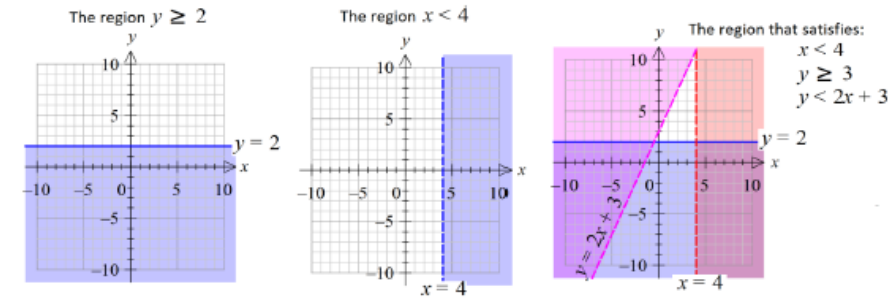
Simultaneous equations

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

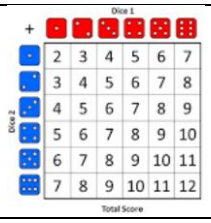
Solving simultaneous equations

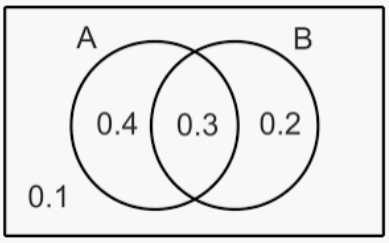
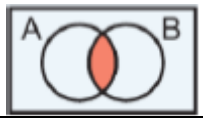
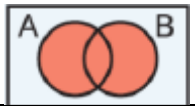
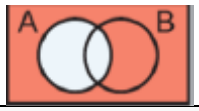
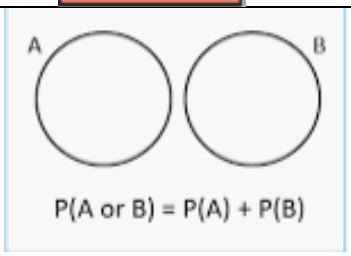
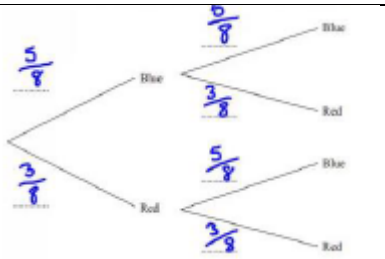
8.	Elimination	Add or subtract one equation from another to eliminate a variable	
		If the matching coeefieicents have the same sign then subtract the equations ✓ Same ✓ Subtract ✓ Substitute	If the matching coefficients have different signs then add the equations ✓ Different ✓ Add ✓ Substitute
9.	Substitution	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	

24.	Inequalities on graphs	 The unwanted sections are shaded
		Dashed lines are used to represent < or >
		Solid line is used to represent $\leq or \geq$

Probability - definitions

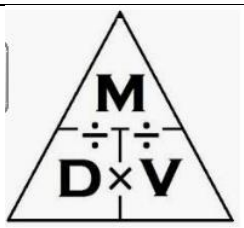
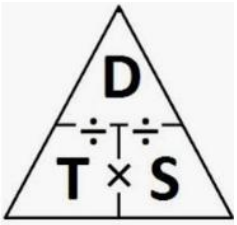
1.	Probability	The extent to which an event is likely to occur Written as a fraction, decimal or percentage	For equally likely outcomes the probability that an event will happen is $P = \frac{number\ of\ successful\ outcomes}{total\ number\ of\ possible\ outcomes}$
2.	Theoretical probability	Calculated 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		

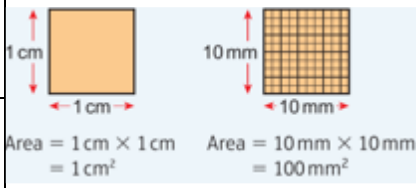
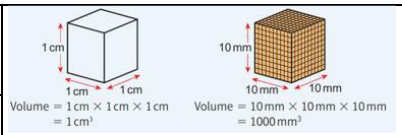
Kettering Science Academy Maths

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	

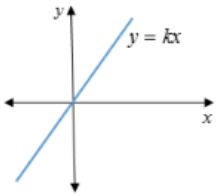
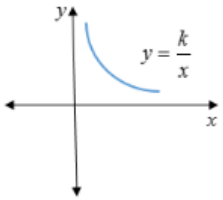
12.	Units of length	Metric units of length are millimetres, centimetres, metres and kilometres		
		10mm = 1cm	100cm = 1m	1000m = 1km
13.	Units of area	Metric units of length are millimetres^2, centimetres^2, metres^2 and kilometres^2		
		$1cm^2 = 100mm^2$		
		$1m^2 = 1000cm^2$		
14.	Units of volume	Metric 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.	
		Original Value x Multiplier = New Value Original Value = $\frac{\text{New Value}}{\text{Multiplier}}$	
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 $Original \times Multiplier^{time}$	
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	