Intermediate 2 Maths

Key Facts and Methods

Use this (as well as trying questions) to revise by:
1. Testing yourself
2. Asking a friend or family member to test you by reading the questions (on the left-hand side) to you
3. Using the booklet to jog your memory when you are stuck on an exam question

The questions are on the left-hand side of each page and the answers are on the right.

If the person who is testing you has not done Intermediate 2 maths before, some maths symbols have been written out in full to help them read them out loud.

Questions with a grey background are also repeated on the formula sheet, but it is still a good idea to memorise them ahead of the exam

Unit 1 Outcome 1: Percentages

What is the difference between **appreciation** and **depreciation**?	Appreciation means something is increasing, depreciation means it is decreasing
How do you find out what percentage something has increased (or decreased) by?	$\dfrac{\text{Increase (or decrease)}}{\text{Original}} \times 100$

Unit 1 Outcome 2: Volumes of Solids

What is the formula for the volume of a **cylinder**?	$V = \pi r^2 h$
What is the formula for the volume of a **cone**?	$V = \frac{1}{3}\pi r^2 h$
What is the formula for the volume of a **sphere**?	$V = \frac{4}{3}\pi r^3$
What is a **hemisphere**?	Half a sphere
What is a **prism**?	A shape with a uniform cross-section (the same shape all the way through)
How do you find the volume of a **prism**?	1. Find the area of the *end* 2. Multiply by the length

Unit 1 Outcome 3: Straight Line

What letter is used to mean **gradient**?	m
What letter is used in a formula to mean **y-intercept**?	c
What is the **general equation** of a straight line?	$y = mx + c$
In the equation of any straight line, where do you look to find the gradient?	Before the letter x
In the equation of any straight line, where do you look to find the *y*-intercept?	It is the number on its own (the one that is not in front of a letter)

What is the formula for the **gradient** between two coordinate points?	$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ **[m equals y two minus y one over x two minus x one]**
What does it mean if the gradient of a straight line is **negative**?	The line slopes downwards
What is the gradient of a **horizontal** line?	zero
What is the gradient of a **vertical** line?	undefined
What is the equation of a **horizontal** line?	$y =$ something
What is the equation of a **vertical** line?	$x =$ something
What are the three steps to find the equation of a straight line?	1. Write down y-intercept 2. Calculate gradient 3. Put into $y = mx + c$

Unit 1 Outcome 4: Algebra

What is $x \times x$? (*x* times *x*)	x^2 (*x* squared)
What is $x^2 \times x$? (*x* squared times *x*)	x^3 (*x* cubed)
What is $x + x$? (*x* add *x*)	$2x$ (two *x*)
What is $x^2 + x^2$? (*x* squared add *x* squared)	$2x^2$ (two *x* squared)
When you **factorise** a trinomial, what can you say about the numbers in the brackets?	They will multiply to equal the number at the end
How do you factorise using the **difference of two squares** method?	You have two brackets that are almost the same – except that one has a plus sign in and the other has a minus sign in
What three things do you have to have to use the **difference of two squares** method?	1. Only two terms 2. Take away sign 3. Contains square sign and/or square numbers

Unit 1 Outcome 5: Circles

What is an **arc**?	A curve of a circle
What is a **sector**?	A slice of the area of a circle
How do you find the **area of a sector** of a circle?	1. Use πr^2 **[pi r squared]** 2. Divide by 360 3. Multiply by the angle
How do you find the **length of an arc** in a circle?	1. Use πd **[pi d]** 2. Divide by 360 3. Multiply by the angle
What is a **tangent** to a circle?	A line that just touches the edge of the circle at one point
When you have a circle diagram including a **tangent**, what can you say about angles?	The angle between the tangent and the radius is a right angle
What do you know about the **angle in a semicircle**?	It is a right angle
In a question about angles in circles, what is the first thing you have to do?	Identify the right angles
What do the angles in a triangle add up to make?	180 degrees
What do the angles in a quadrilateral add up to make?	360 degrees
Where will you find equal angles in a diagram?	1. In an isosceles triangle 2. In an X shape 3. In a Z shape (parallel lines)
Where can you find right angles in circle diagrams?	1. Between a tangent and radius 2. Angle in a semicircle
How do you find a straight length *inside* a circle?	1. Find a right-angled triangle where the radius is a hypotenuse 2. Use Pythagoras

Unit 2 Outcome 1: Sine and Cosine Rule

Don't forget to use the formula sheet in the exam:

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

What is the Intermediate 2 formula for the area of a triangle?	$A = \frac{1}{2}ab\sin C$ **[A = half a b sine C]**
In the formula for the **area of a triangle**, which angle do you use?	The angle that is in between the two sides you have used
When do you use the **cosine rule** in a triangle?	When you know two lengths and the angle in between
When do you use the **sine rule** in a triangle?	With two pairs of opposite sides
When do you use the **cosine rule for angles** in a triangle?	When you know all three lengths but no angles
In the cosine rule for lengths, does it matter which side is b and which side is c?	No
In the sine rule, does it matter which side is a and which side is b?	No
In the cosine rule for angles, does it matter which side is a, b or c?	Yes. a has to be the side <u>opposite</u> the angle you are finding.
When is sine positive?	Between 0° and 180°
When is tan positive?	Between 0° and 90°, and 180° and 270°
When is cos positive?	Between 0° and 90°, and 270° and 360°

Unit 2 Outcome 2: Simultaneous Equations

How do you solve simultaneous equations **graphically**?	Draw the two graphs and write down the coordinate the graphs intersect
How do you solve simultaneous equations **algebraically**?	Scale both equations, then add or take away

Unit 2 Outcome 3: Graphs, Charts and Tables

What is does **cumulative frequency** mean?	A running total
What is the difference between a **dotplot** and a **boxplot**?	A dotplot is like a bar graph with dots. A boxplot is a diagram showing the median, quartiles, lowest and highest.
What five values are shown by a **boxplot**?	Lowest, Lower Quartile, Median, Upper Quartile, Highest
How do you find an angle in a **pie chart**?	1. Write as fraction of the total 2. Find this fraction of 360°
How do you find the equation of a **line of best fit** in a scattergraph?	$y = mx + c$
How do you use a line of best fit to estimate a value from a scattergraph	Substitute a number into the equation of the line of best fit
How do you find the **quartiles**?	Put the list in order and split it into four equal groups

Unit 2 Outcome 4: Statistics

Don't forget to use the formula sheet in the exam:

$$\text{Standard Deviation: } s = \sqrt{\frac{\sum (x - \overline{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - \left(\sum x\right)^2 / n}{n-1}}$$

How do you find the **Semi-Interquartile Range** (SIQR)?	$\dfrac{\text{Upper Quartile} \; - \; \text{Lower Quartile}}{2}$
What does the symbol Σ **(sigma)** mean?	Add together all the numbers
What does the symbol $\overline{x}$ **(x bar)** mean?	The mean
In the standard deviation formula, what does n mean?	How many numbers there are
What does it mean if the **standard deviation** is higher?	The numbers are more spread out
What does it mean if the **mean** is higher?	The numbers are higher on average
What does it mean if the **Semi-Interquartile Range** is higher?	The numbers are more spread out
What does it mean if the **median** is higher?	The numbers are higher on average
What is the probability of something **impossible**?	Zero
What is the probability of something **certain**?	One
How is a **probability** always written down?	As a fraction

Unit 3 Outcome 1: Further Algebra	
What are the three steps to **add** or **subtract** two fractions?	1. Multiply the bottoms together 2. Multiply diagonally to get the new tops 3. Add or take away the top line (the bottom line stays the same)
How do you **multiply** two fractions?	Multiply the tops, multiply the bottoms. Remember to simplify if possible
How do you **divide** two fractions?	Flip the second fraction upside down and multiply them
When you **multiply two powers**, what happens to the numbers in the powers?	You add them
When you **divide two powers**, what happens to the numbers in the powers?	You take them away
When you take a **power of a power**, what happens to the numbers in the powers?	You multiply them
What does it mean if the number in a power is **negative**?	The answer is a fraction.
How do you work out a **negative** power?	Move the letter to the bottom and make the power positive
What does it mean if the number in a power is a **fraction**?	It is a root (square root, cube root etc)
How do you work out a **fraction** power?	The number on the *bottom* of the fraction tells you what type of root it is
What is a **surd**?	A root that does not have an exact answer
How do you **rationalise the denominator**?	Multiply top and bottom by the surd
What are the first ten **square numbers** up to 100?	1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Unit 3 Outcome 2: Quadratic Equations

Don't forget to use the formula sheet in the exam:

$$\text{The roots of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

How do you find an **x-coordinate** if you know the *y*-coordinate?	Substitute *y* into the original equation
How do you find a **y-coordinate** if you know the *x*-coordinate?	Substitute *x* into the original equation
What is the **turning point** of $y = (x + b)^2 + c$? **(x plus b squared plus c)**	$(-b, c)$
What does the **equation of a line of symmetry** look like?	$x = a$ where *a* is the number the graph is symmetrical about
What are the **roots** of a quadratic equation?	The numbers that make the equation equal to zero
How do you find the **roots** of a quadratic equation from looking at its graph?	The numbers where the graph crosses the *x*-axis
Before you can solve a quadratic equation, what do you have to have on the right-hand side?	Zero
What phrase in a question mean it is likely that you need to use the **quadratic formula**?	"giving your answer to 2 decimal places" (or to 1 decimal place)
How do you solve a quadratic equation using the quadratic formula?	1. Identify *a*, *b* and *c* 2. Calculate $b^2 - 4ac$ (and check its positive) 3. Put everything into the formula 4. Split the answer up into two: one with a + sign, one with a − sign
To successfully use the quadratic formula, what do you have to check about the number beneath the square root sign ($b^2 - 4ac$)?	It must not be negative
What happens if the number under the square root sign in the quadratic formula is negative?	***Either*** you made a mistake ***Or*** the equation has no solutions

Unit 3 Outcome 3: Further Trigonometry

How can you tell whether a graph is sin, tan or cos?	Sine is a wave starting at (0,0); cos is a 'bucket', tan is a "squint straw"
In a sin or cos graph, what is the **amplitude**?	The height of the graph
In a sin, cos or tan graph, what is the **frequency**?	How often the graph repeats itself in 360° (or 180° for tan)
In a sin, cos or tan graph, what is the **period**?	How many degrees it takes for the graph before it begins to repeat
In a sin, cos or tan graph, what is the **phase angle**?	How far the graph has been shifted to the left or right
For a graph of the form $y = a\sin bx$ or $y = a\cos bx$, what number is a?	The amplitude
For a graph of the form $y = a\sin bx$, $y = a\cos bx$ or $y = a\tan bx$, what number is b?	The frequency
For a graph of the form $y = a\sin(x-b)$, $y = a\cos(x-b)$ or $y = a\tan(x-b)$, what number is b?	The phase angle
What are the three steps to solve an equation for $0 \le x < 360°$?	1. Rearrange 2. Use 2ndF 3. Find the second answer
What fact do you need to know about $\sin^2 x$ and $\cos^2 x$? **(sine squared x) (cos squared x)**	$\sin^2 x + \cos^2 x = 1$ **(sine squared x plus cos squared x equals 1)**
What fact do you need to know about how tan is linked to sin and cos?	$\tan x = \dfrac{\sin x}{\cos x}$ **(tan x equals sine x over cos x)**
What does $\sin^2 x + \cos^2 x$ always equal? **(sine squared x plus cos squared x)**	1
What does $\dfrac{\sin x}{\cos x}$ always equal? **(sine x over cos x)**	$\tan x$

Whole Course: Choosing the correct Method

otherwise known as "how to stop yourself failing because you end up leaving questions worth lots of marks blank because you don't know (or can't be bothered choosing) the method"

How do you choose between the sine rule and the cosine rule?	Use cosine rule when you have two sides and the angle in between. Use sine rule in any other question.
How do you find a length in a triangle when you do <u>not</u> have two sides and the angle in between	Sine rule
How do you find a length in a triangle when you know two sides and the angle between?	Cosine rule
How do you find an angle in a triangle when you know the length of all three sides?	Cosine rule for angles
How do you find an area of a curved shape?	Use πr^2 , divide by 360, multiply by the angle
How do you find angles in a circle diagram	Find right angles first then use rules of angles
How do you find the area of a triangle?	Use $A = \frac{1}{2}ab\sin C$
How do you find the length of a curved line?	Use πd , divide by 360, multiply by the angle
How do you find the length of a straight line?	Use either sine rule or cosine rule (in triangles), or Pythagoras (inside a circle)
What do you do with a shape with sides that have lengths containing x?	It wants you to write each length in a bracket and then multiply out the brackets
What do you do if question has a straight line graph in?	Find the equation using $y=mx+c$
What is it telling you if a question says to factorise **FULLY**?	Take a common factor out first, then use two brackets
What do you do if a question wants you to write down two equations, then work out some values?	You have to use simultaneous equations
(unit 3 only) How do you solve an equation "for $0 \le x < 360°$ "? (x between zero and 360)	Rearrange, use 2nd function and find the second answer
(unit 3 only) How do you solve an equation "giving your answer to 2 decimal places"?	Use the quadratic formula