

Transitioning into year 12 – A-level Mathematics

A-level mathematics is hard. However, it is possible to do very well if you do the right preparation and work ethic while studying.

Students who struggle usually do not have a firm grasp of the harder GCSE content before they start the course. In particular, the algebra. It is therefore vital that you work through this content before you join us. It might be that you are already proficient with it and just need to practise it during the summer. It might be that some of it you never really mastered first time around. It is imperative that you do so before you start in September.

We will assess all students on this harder GCSE content at the beginning of September. So please ensure that you are prepared.

Please first work your way through the 'Diagnosis Questions', then mark these using 'Diagnosis Mark Scheme'. For any areas for which you need support take a look at the 'Support' document: it contains links to helpful resources.

Mr Sims

Head of Mathematics

The Bridge to A level

Diagnosis



1 Solving quadratic equations

Question 1

Solve $x^2 + 6x + 8 = 0$ (2)

Question 2

Solve the equation $y^2 - 7y + 12 = 0$

Hence solve the equation $x^4 - 7x^2 + 12 = 0$ (4)

Question 3

(i) Express $x^2 - 6x + 2$ in the form $(x-a)^2 - b$ (3)

(ii) State the coordinates of the minimum value on the graph of $y = x^2 - 6x + 2$ (1)

Total / 10

2 Changing the subject

Question 1

Make v the subject of the formula $E = \frac{1}{2}mv^2$ (3)

Question 2

Make r the subject of the formula $V = \frac{4}{3}\pi r^2$ (3)

Question 3

Make c the subject of the formula $P = \frac{c}{c+4}$ (4)

Total / 10

3 Simultaneous equations

Question 1

Find the coordinates of the point of intersection of the lines $y = 3x + 1$ and $x + 3y = 6$ (3)

Question 2

Find the coordinates of the point of intersection of the lines $5x + 2y = 20$ and $y = 5 - x$ (3)

Question 3

Solve the simultaneous equations

$$x^2 + y^2 = 5$$

$$y = 3x + 1$$

(4)

Total / 10

4 Surds

Question 1

(i) Simplify $(3 + \sqrt{2})(3 - \sqrt{2})$ (2)

(ii) Express $\frac{1+\sqrt{2}}{3-\sqrt{2}}$ in the form $a + b\sqrt{2}$ where a and b are rational (3)

Question 2

(i) Simplify $5\sqrt{8} + 4\sqrt{50}$. Express your answer in the form $a\sqrt{b}$ where a and b are integers and b is as small as possible. (2)

(ii) Express $\frac{\sqrt{3}}{6-\sqrt{3}}$ in the form $p + q\sqrt{3}$ where p and q are rational (3)

Total / 10

5 Indices

Question 1

Simplify the following

- (i) a^0 (1)
- (ii) $a^6 \div a^{-2}$ (1)
- (iii) $(9a^6b^2)^{-0.5}$ (3)

Question 2

- (i) Find the value of $\left(\frac{1}{25}\right)^{-0.5}$ (2)
- (ii) Simplify $\frac{(2x^2y^3z)^5}{4y^2z}$ (3)

Total / 10

6 Properties of Lines

Question 1

A (0,2), B (7,9) and C (6,10) are three points.

- (i) Show that AB and BC are perpendicular (3)
- (ii) Find the length of AC (2)

Question 2

Find, in the form $y = mx + c$, the equation of the line passing through A (3,7) and B (5,-1).

Show that the midpoint of AB lies on the line $x + 2y = 10$ (5)

Total / 10

7 **Sketching curves**

Question 1

In the cubic polynomial $f(x)$, the coefficient of x^3 is 1. The roots of $f(x) = 0$ are -1, 2 and 5.

Sketch the graph of $y = f(x)$

(3)

Question 2

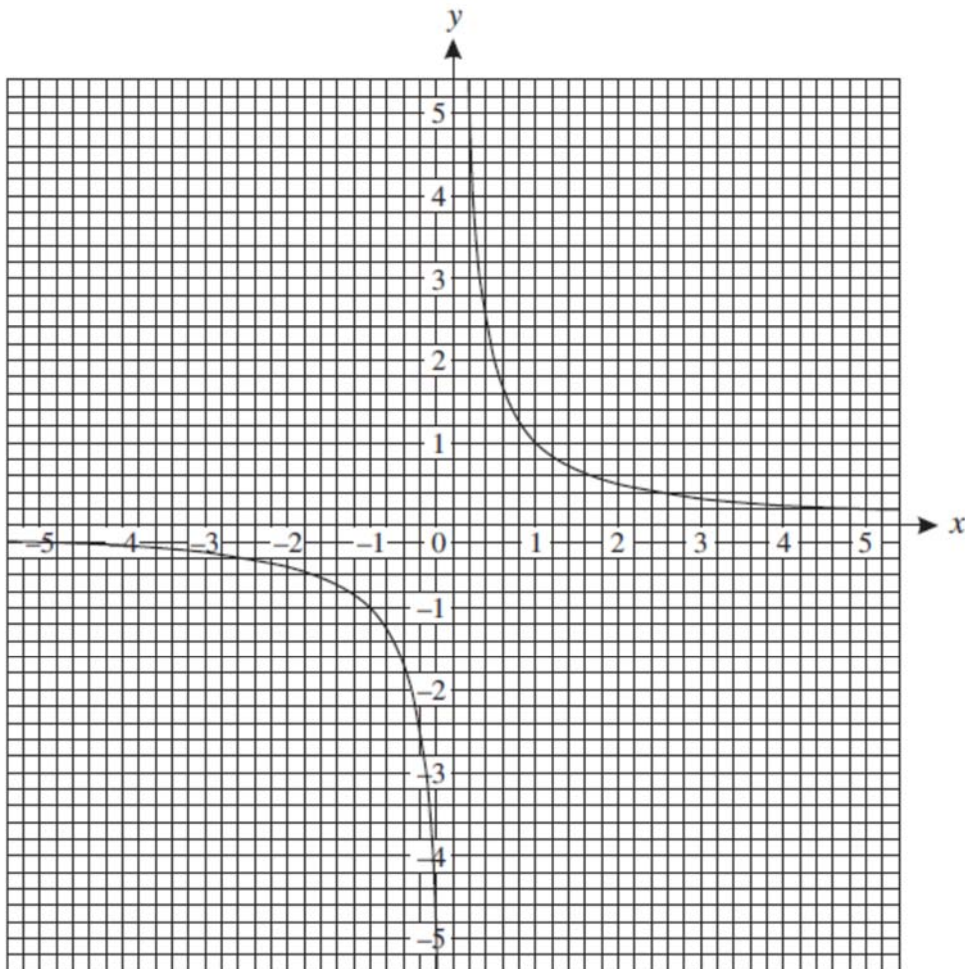
Sketch the graph of $y = 9 - x^2$

(3)

Question 3

The graph below shows the graph of $y = \frac{1}{x}$

On the same axes plot the graph of $y = x^2 - 5x + 5$ for $0 \leq x \leq 5$



(4)

Total / 10

8 Transformation of functions

Question 1

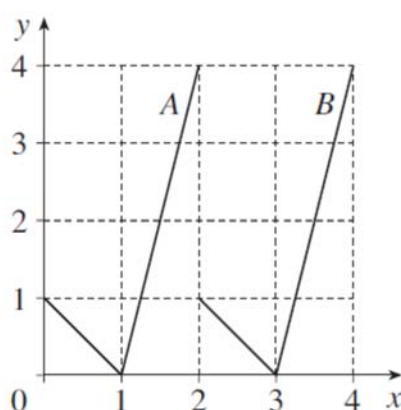
The curve $y = x^2 - 4$ is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

Write down an equation for the translated curve. You need not simplify your answer.

(2)

Question 2

This diagram shows graphs A and B.



(i) State the transformation which maps graph A onto graph B

(2)

(ii) The equation of graph A is $y = f(x)$.

Which one of the following is the equation of graph B ?

$y = f(x) + 2$

$y = f(x) - 2$

$y = f(x+2)$

$y = f(x-2)$

$y = 2f(x)$

$y = f(x+3)$

$y = f(x-3)$

$y = 3f(x)$

(2)

Question 3

(i) Describe the transformation which maps the curve $y = x^2$ onto the curve $y = (x+4)^2$

(2)

(ii) Sketch the graph of $y = x^2 - 4$

(2)

Total / 10

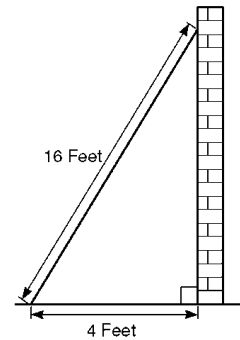


9 **Trigonometric ratios**

Question 1

Sidney places the foot of his ladder on horizontal ground and the top against a vertical wall.

The ladder is 16 feet long.



The foot of the ladder is 4 feet from the base of the wall.

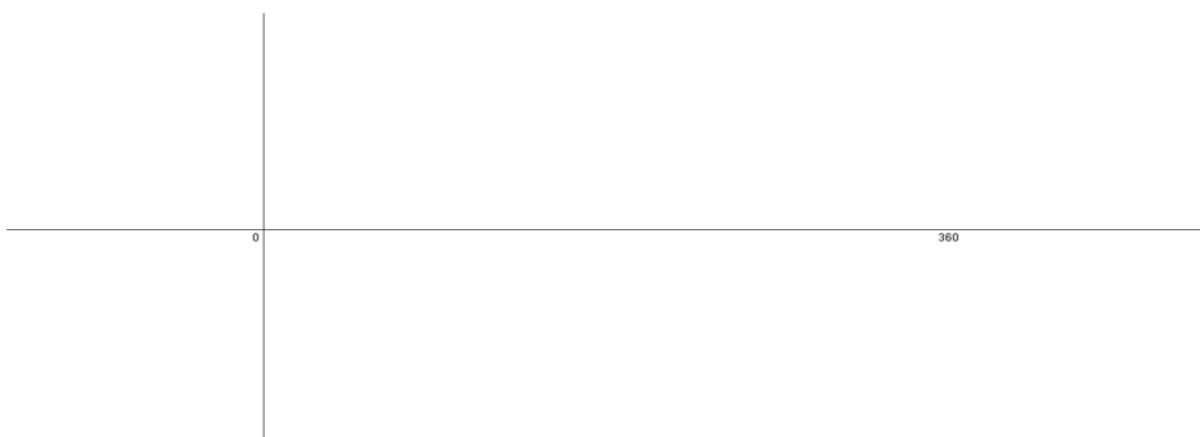
- (i) Work out how high up the wall the ladder reaches. Give your answer to 3 significant figures. (2)
- (ii) Work out the angle the base of the ladder makes with the ground. Give your answer to 3 significant figures (2)

Question 2

Given that $\cos \theta = \frac{1}{3}$ and θ is acute, find the exact value of $\tan \theta$ (3)

Question 3

Sketch the graph of $y = \cos x$ for $0 \leq x \leq 360^\circ$

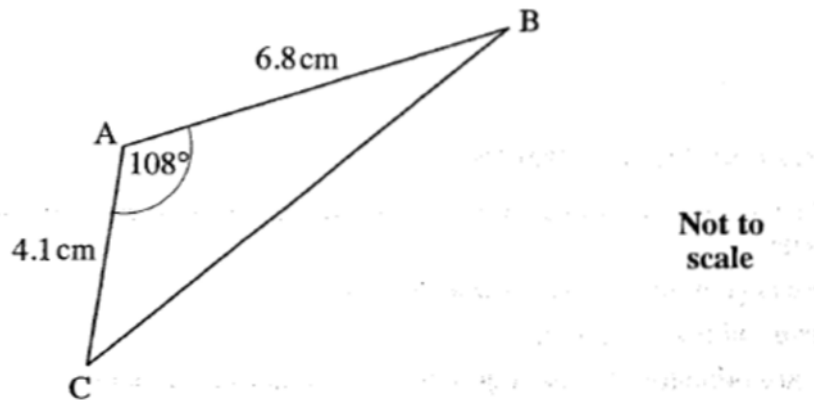


(3)

Total / 10

10 **Sine / Cosine Rule**

Question 1

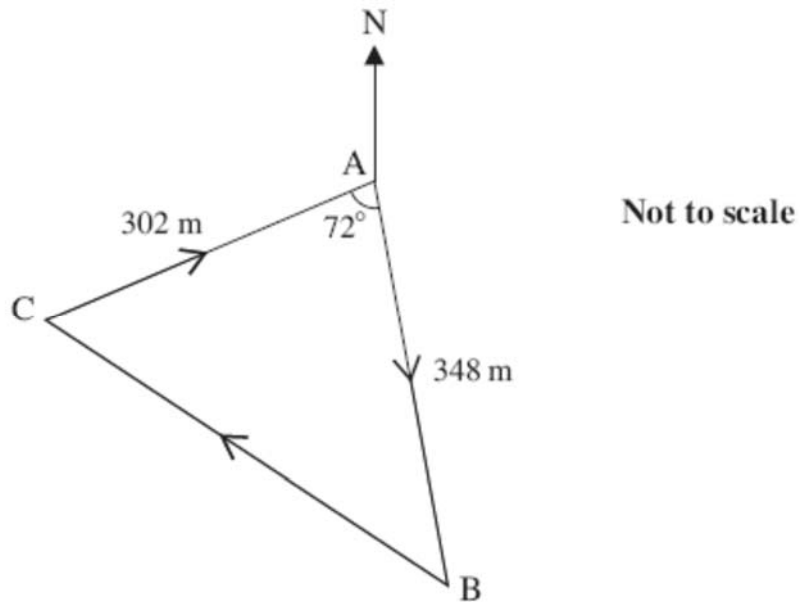


For triangle ABC, calculate

- (i) the length of BC (3)
- (ii) the area of triangle ABC (3)

Question 2

The course for a yacht race is a triangle as shown in the diagram below. The yachts start at A, then travel to B, then to C and finally back to A.



Calculate the total length of the course for this race. (4)

Total / 10

The Bridge to A level

Diagnosis

Mark Scheme



Section	Question	Answer	Marks	Notes
1	1	-2, -4	M1 A1	$(x \pm 2)(x \pm 4)$
	2	$y = 3$ or $y = 4$ cao $x = \pm\sqrt{3}$ or $x = \pm 2$ cao	M1 A1 B2	For $(y-3)(y+4)$ oe eg use of quad form $y = 3$ or $y = 4$ cao B1 for two roots correct or ft 'their' y B2 for cao
	3(i)	$(x - 3)^2 - 7$	B1 M1A1	$(x - 3)^2$ -7
	3(ii)	(3,-7)	B1	ft from part (i)
2	1	$v = \sqrt{\frac{2E}{m}}$ cao www	B3	Award M1 for a correct first constructive step, M2 for $v^2 = \frac{2E}{m}$ oe
	2	$r = \sqrt[3]{\frac{3V}{4\pi}}$	B3	Award M2 for $r^3 = \frac{3V}{4\pi}$, M1 for cube root of 'their' r^3
	3	$C = \frac{4P}{1-P}$ oe	M1 M1 M1 A1	PC + 4P = C 4P = C - PC 4P = C(1 - P)
3	1	(0.3,1.9)	M1 A1A1	for substitution or for rearrangement one mark each coordinate
	2	$(\frac{10}{3}, \frac{5}{3})$	M1 A1A1	for substitution or for rearrangement one mark each coordinate Note: award B2 if rounded to 1dp or worse
	3	$(\frac{2}{5}, \frac{11}{5})$ or (-1,-2) or answer given as x=, y=	M1 M1 A1A1	substituting linear into non-linear forming quadratic in x one mark for each set of solutions
4	1(i)	7	M1 A1	9-2
	1(ii)	$\frac{5}{7} + \frac{4}{7}\sqrt{2}$	M1 M1 A1	multiplying top and bottom by $3 + \sqrt{2}$ $\frac{3+2+3\sqrt{2}+\sqrt{2}}{7}$ if one (or none) error only
	2(i)	$30\sqrt{2}$	M1 A1	for $\sqrt{8} = 2\sqrt{2}$ or $\sqrt{50} = 5\sqrt{2}$
	2(ii)	$\frac{1}{11} + \frac{2}{11}\sqrt{3}$	M1 M1 A1	multiplying top and bottom by $6 + \sqrt{3}$ denominator = 11 (or 33)

5	1(i)	1	B1	
	1(ii)	a^8	B1	
	1(iii)	$\frac{1}{3a^3b}$	B1 B1 B1	3b a^3 inverse
	2(i)	± 5	M1 A1	for $\sqrt{25}$ or $\frac{1}{5}$ seen
	2(ii)	$8x^{10}y^{13}z^4$ (or $2^3x^{10}y^{13}z^4$)	B3	B2 for 3 elements correct B1 for 2 elements correct
6	1(i)	Grad AB = 1 Grad BC = -1 product of gradients = -1 hence perp	M1 M1 C1	
	1(ii)	10	M1 A1	Use of pythagoras
	2	$y = -4x + 19$ cao Midpoint (4,3) verifying on line $x + 2y = 10$	M1 M1 A1 B1 C1	calculating m using $(y - 7) = m(x - 3)$
7	1	Cubic the correct way up -1, 2 and 5 indicated on x-axis 10 indicated on y-axis	G1 G1 G1	
	2	Negative quadratic curve Intercept (0,9) Through (3,0) and (-3,0)	G1 G1 G1	
	3	Any correct y value calculated (0,5), (1,1), (2,-1), (3,-1), (4,1) and (5,5) calculated Above points plotted Smooth parabola through the points	B1 B1 G1 G1	
8	1	$y = (x - 2)^2 - 4$	B2	M1 if y omitted, or for $y = (x + 2)^2 - 4$
	2(i)	Translation of $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$	B1 B1	
	2(ii)	$y = f(x - 2)$	B2	B1 for $y = f(x + 2)$
	3(i)	Translation of $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$	B1 B1	
	3(ii)	sketch of parabola right way up min at (0,-4) and graph through (-2,0) and (2,0)	B1 B1	

9	1(i)	15.5	M1 A1	Use of Pythagoras
	1(ii)	$x = 75.5^\circ$	M1 A1	$(\cos x = \frac{4}{16})$ correct ratio and substitution
	2	$\sqrt{8}$ or $2\sqrt{2}$ (but not $\pm \sqrt{8}$)	M1 M1 A1	Use iof pythagoras use of $\tan \theta = \text{opp} / \text{adj}$
	3	Smooth curve between $y = 1$ and $y = -1$ (90,0) and (270,0) (0,1), (180,-1), (360,1)	G1 G1 G1	
10	1(i)	9.0 or 8.96 or 8.960	M1 M1 A1	for use of cosine rule for square-rooting 'their' 80.2(8)
	1(ii)	13.3 or better (13.2577..)	M1 A1 A1	use of 'their' $0.5 \times 4.1 \times 6.6 \times \sin 108$ correct values ans
	2	BC = 384 (or better) Total length = 1034m (or better)	M1 M1 A1 A1	recognisable attempt at cosine rule $BC^2 = 348^2 + 302^2 - 2 \times 348 \times 302 \times \cos 72$ BC = 383.86..... Total length = BC + 650 ft

The Bridge to A level Therapy



Therapy for Topics

All therapy references are referenced to the *PiXL Maths App* and/or *MyMaths*

For the *PiXL Maths App* you need to navigate to the *Therapy* videos.

After logging in, select the *Design a Test* tab.

This will give you 7 tabs to choose from (Number, Algebra, Ratio & Proportion, Geometry, Probability, Statistics and Problem Solving). Select one of these; this is the *Topic*.

You will now see a menu of *Test Titles*. Select the one you need, and you will need to select the *Begin Test* button.

You need not do this test, but it will bring up the *Therapy Video* button which you now select.

This will give you the menu of Therapy video titles applicable to this test, Select the one you need.

In Summary, all therapy references are for therapy videos from the PiXL Maths App.

The relevant video is found by accessing

Design a Test / Topic / Test Title / Therapy video title

The PiXL Maths App can be downloaded free from the PiXL website

<http://mathsapp.pixl.org.uk/>

For *MyMaths* your school needs to supply you with your login details

The hyperlinks in this document will take you directly to the pages you will need.

Therapy for Topic 1	Quadratic equations
<p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Functions / Graph transformations part a / Recognise the shape of quadratic graph transformations 2. Functions / Graph transformations part a / Calculate the minimum point of a quadratic function 3. Algebra / Equations / Solve simple quadratic equations <p>MyMaths Reference</p> <p>https://app.mymaths.co.uk/574-resource/solving-quadratics</p> <p>https://app.mymaths.co.uk/575-resource/quadratic-formula</p> <p>https://app.mymaths.co.uk/576-resource/completing-the-square</p>	
Therapy for Topic 2	Algebra
<p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Algebra / Harder equations and re-arranging formulae / Re-arrange a formula where the subject appears more than once <p>MyMaths Reference</p> <p>https://app.mymaths.co.uk/563-resource/algebraic-manipulation</p>	
Therapy for Topic 3	Simultaneous equations
<p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Algebra / Simultaneous equations / Solve linear and non-linear simultaneous equations <p>MyMaths Reference</p> <p>https://app.mymaths.co.uk/195-resource/quadratic-simultaneous-equs</p>	
Therapy for Topic 4	Surds
<p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Number / Surds / Simplify a surd 2. Number / Surds / Rationalise a surd 3. Number / Surds / Operate with surds <p>MyMaths Reference</p> <p>https://app.mymaths.co.uk/599-resource/surds-part-1</p> <p>https://app.mymaths.co.uk/600-resource/surds-part-2</p>	
Therapy for Topic 5	Indices
<p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Number / Indices / Evaluate positive, negative and fractional indices <p>MyMaths Reference</p> <p>https://app.mymaths.co.uk/597-resource/indices-part-2</p> <p>https://app.mymaths.co.uk/598-resource/indices-part-3</p>	

<p>Therapy for Topic 6</p> <p>MyMaths Reference https://app.mymaths.co.uk/559-resource/equation-of-a-line</p>	<p>Properties of lines</p>
<p>Therapy for Topic 7</p> <p>MyMaths Reference https://app.mymaths.co.uk/588-resource/sketching-polynomials</p>	<p>Sketching curves</p>
<p>Therapy for Topic 8</p> <p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Functions / Graph transformations part a / Recognise the shape of quadratic graph transformations 2. Functions / Graph transformations part a / Calculate the minimum point of a quadratic function 3. Functions / Graph transformations part b / Recognise trigonometric graph transformations 4. Functions / Graph transformations part b / Interpret values from a transformed trigonometric graph <p>MyMaths Reference https://app.mymaths.co.uk/585-resource/transforming-graphs</p>	<p>Transformation of functions</p>
<p>Therapy for Topic 9</p> <p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Geometry / Trigonometry / Calculate an unknown angle or side using SOH CAH TOA 2. Geometry / Trigonometry / Apply Pythagoras' Theorem and SOH CAH TOA in 3D contexts <p>MyMaths Reference https://app.mymaths.co.uk/663-resource/special-triangles</p>	<p>Trigonometric ratios</p>
<p>Therapy for Topic 10</p> <p>Maths App Reference</p> <ol style="list-style-type: none"> 1. Geometry / Sine and Cosine Rules / Apply the sine and cosine rules to calculate a length or an angle 2. Geometry / Sine and Cosine Rules / Calculate the area of non-right angled triangles and of a segment. <p>MyMaths Reference https://app.mymaths.co.uk/656-resource/the-cosine-rule</p>	<p>Sine / Cosine Rule</p>