RAYNES
PARK HIGH SCHOOL

The Bridge to A level Mathematics

This pack contains a programme of activities and resources to prepare you to start A level Maths in September.

It is aimed to be used after you complete your GCSE and over the summer holidays to ensure you are ready to start your course in September.

The resources include:

1. Links with activities on five websites where you can research the topics you will be exploring in your sixth form courses and get a flavour of mathematics beyond GCSE.
2. 10 key pre-knowledge topics that will help you to be successful in your course. The topics covered are a mixture of GCSE topics, and topics which extend GCSE but which will be very useful on your A level course.
3. A diagnostic assessment that will test your key knowledge of these 10 topics, with worked solutions.
4. Suggested Sparx clips to help you with those topics with which you are having difficulty.
5. A second assessment which you will need to bring to the first lesson in September.
6. After two weeks you will be required to sit an **Induction Test**, based on this material. This will determine whether A level Mathematics is the right course for you.

Websites

NRich

http://nrich.maths.org/secondary-upper

Mathwire

http://mathwire.com/archives/enrichment.html

The History of Maths – Wikipedia

https://en.wikipedia.org/wiki/History_of_mathematics

The History of Maths – Youtube video

https://www.youtube.com/watch?v=cy-8lPVKLIo

Exam Solutions – Edexcel (this is really useful once you've started the course)

https://www.examsolutions.net

10 key Topics

1	Solving quadratic equations
2	Changing the subject
3	Simultaneous equations
4	Surds
5	Indices
6	Properties of Lines
7	Sketching curves
8	Transformation of functions
9	Trigonometric ratios
10	Sine / Cosine Rule

Refer to page 23 for Sparx Maths codes to support with the topics stated above

RAYNES
PARK HIGH SCHOOL

The Bridge to A level Mathematics

Diagnosis Questions

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 (hegarty 215-216)

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

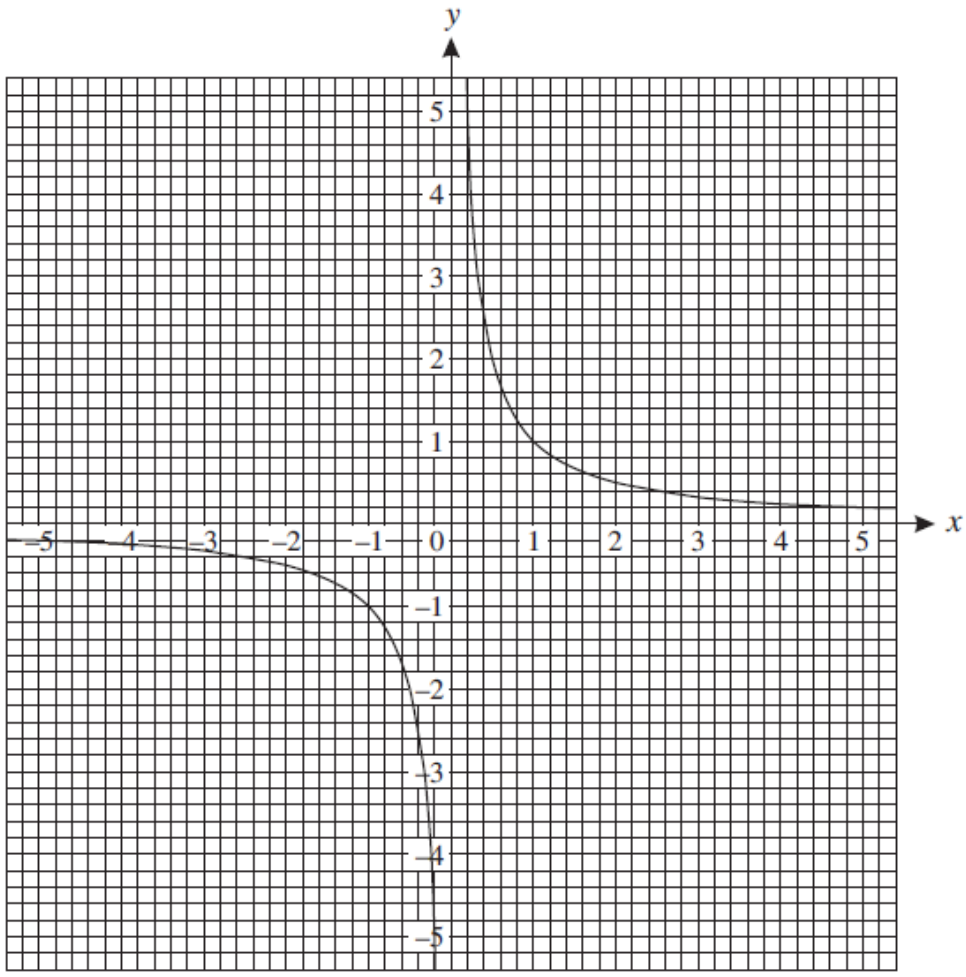
Sketch the graph of $y = 9 - x^2$

(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

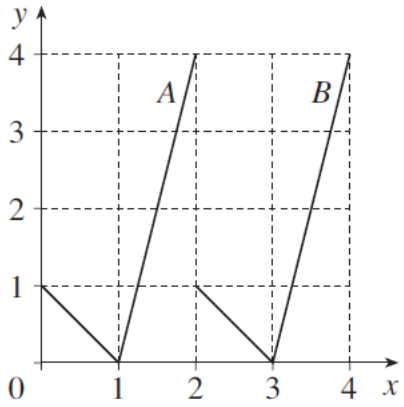
The curve $y = x^2 - 4$ is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

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)

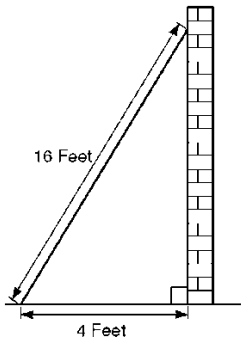
Total / 10

9 Trigonometric ratios

Question 1 (hegarty 509-515)

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)

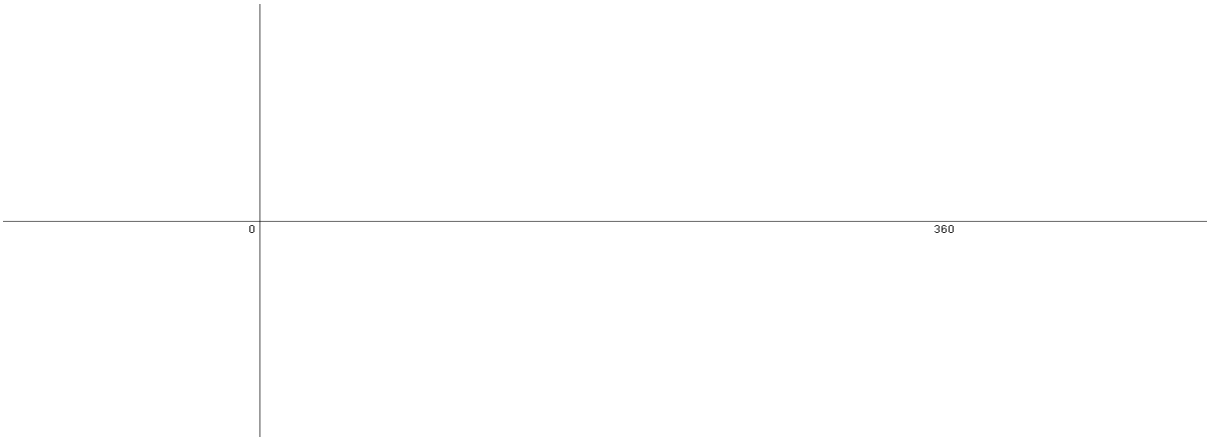
Question 2

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 $0 \leq x \leq 360°$

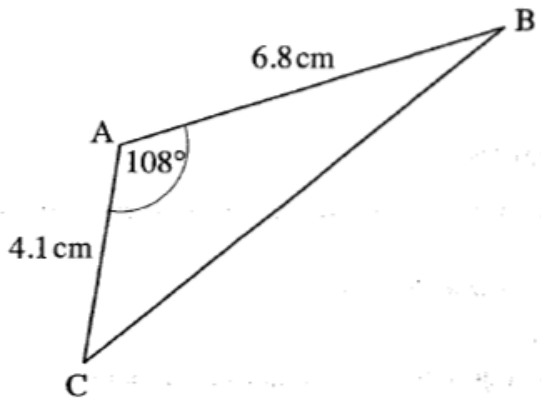


(3)

Total / 10

10 Sine / Cosine Rule

Question 1



Not to scale

For triangle ABC, calculate

(i) the length of BC

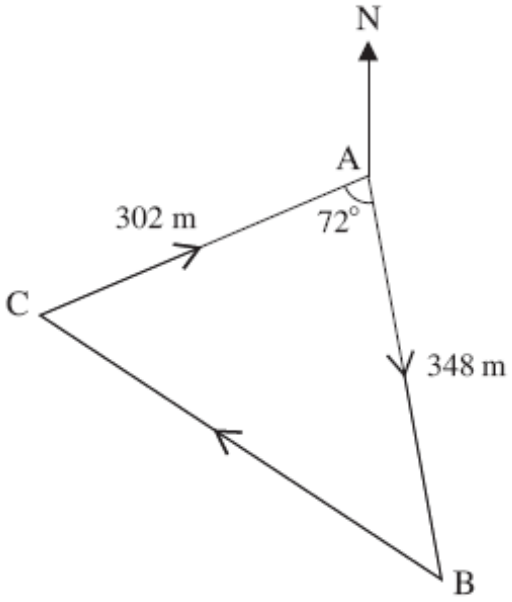
(3)

(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.



Not to scale

Calculate the total length of the course for this race.

(4)

Total / 10

RAYNES
PARK HIGH SCHOOL

The Bridge to A level Mathematics

Diagnosis Worked Solutions

1 Solving quadratic equations

Question 1

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

$(x + 2)(x + 4) = 0$

x = –2 or –4

(2)

Question 2

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

Hence solve the equation $x^4 – 7x^2 + 12 = 0$

$y^2 - 7y + 12 = 0$

$(y - 3)(y - 4) = 0 \rightarrow y = 3$ or $y = 4$

$x^4 - 7x^2 + 12 = 0 \rightarrow$ Let $x^2 = y$

$(x^2)^2 - 7x^2 + 12 = 0 \rightarrow y^2 - 7y + 12 = 0 \rightarrow y = 3$ or $y = 4$

$\rightarrow x^2 = 3$ or $x^2 = 4$

$\rightarrow x = \pm\sqrt{3}$ or $x = \pm 2$

(4)

Question 3

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

$x^2 - 6x + 2 = (x - 3)^2 - 9 + 2$

$= (x - 3)^2 - 7$

(3)

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

Minimum point of $x^2 - 6x + 2$ is therefore $(3, -7)$

(1)

Total / 10

2 Changing the subject

Question 1

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

$$E = \frac{1}{2}mv^2$$
$$\Rightarrow 2E = mv^2$$
$$\Rightarrow \frac{2E}{m} = v^2$$
$$\pm\sqrt{\frac{2E}{m}} = v$$

(3)

Question 2

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

$$V = \frac{4}{3}\pi r^3$$
$$3V = 4\pi r^3$$
$$\frac{3V}{4\pi} = r^3$$
$$\sqrt[3]{\frac{3V}{4\pi}} = r$$

get rid of fractions

make r^3 the subject.

cube both sides

(3)

Question 3

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

$$P = \frac{C}{C+4}$$ Get rid of fractions
$$\Rightarrow P(C+4) = C$$ Expand brackets
$$\Rightarrow PC + 4P = C$$ Get terms with C on L.H.S., other terms on R.H.S.
$$PC + 4P - C = 0$$
$$PC - C = -4P$$ Factorise.
$$C(P-1) = -4P$$ Divide
$$C = \frac{-4P}{P-1} \quad \left(= \frac{4P}{1-P}\right)$$

(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

$y = 3x+1$ and $x+3y=6$

$x + 3(3x+1) = 6$

$x + 9x + 3 = 6$

$10x = 3$

$x = \frac{3}{10}$

$y = 3(\frac{3}{10}) + 1$

$= \frac{9}{10} + 1$

$= 1\frac{9}{10}$

$(3/10, 1\,9/10)$ or $(0.3, 1.9)$

(3)

(3)

Question 2

Find the coordinates of the point of intersection of the lines 5x + 2y = 20 and y = 5 – x

(ii) $5x + 2y = 20$ & $y = 5 - x$.

Solving simultaneously

$5x + 2(5-x) = 20$ M1

$\Rightarrow 5x + 10 - 2x = 20$

$\Rightarrow 3x = 10$

$\Rightarrow x = 10/3$, $y = 5 - 10/3 = 5/3$

Pt. of intersection is $(10/3, 5/3)$ A2

Note - if you round these fractions to decimals (10.3, 1.7) you lose a mark.

(3)

Question 3

Solve the simultaneous equations

$x^2 + y^2 = 5$ $\qquad$ $y = 3x + 1$

Sub in $y = 3x+1$ into equation 2.

$x^2 + (3x+1)^2 = 5$

$x^2 + (3x+1)(3x+1) = 5$

$x^2 + 9x^2 + 3x + 3x + 1 = 5$

$10x^2 + 6x + 1 = 5$

$10x^2 + 6x - 4 = 0$

$(\div 2)$

$5x^2 + 3x - 2 = 0$

$(5x - 2)(x+1) = 0$

$x = \frac{2}{5}$ or $x = -1$

When $x = \frac{2}{5}$

$y = (3 \times \frac{2}{5}) + 1$

$= \frac{6}{5} + \frac{5}{5} = \frac{11}{5}$

When $x = -1$

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

$= -3 + 1$

$= -2$

(4)

Total / 10

4 Surds

Question 1

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

$$(3+\sqrt{2})(3-\sqrt{2})$$
$$= 3^2 + 3\sqrt{2} - 3\sqrt{2} - (\sqrt{2})^2$$
$$= 9 - 2$$
$$= 7$$

(2)

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

$$\frac{(1+\sqrt{2})}{(3-\sqrt{2})} = \frac{(1+\sqrt{2})(3+\sqrt{2})}{(3-\sqrt{2})(3+\sqrt{2})}$$
$$= \frac{3 + \sqrt{2} + 3\sqrt{2} + (\sqrt{2})^2}{7}$$
$$= \frac{3 + 4\sqrt{2} + 2}{7}$$
$$= \frac{5}{7} + \frac{4}{7}\sqrt{2}$$

To rationalise a denominator of form $(x + \sqrt{y})$ multiply top + bottom by $(x - \sqrt{y})$

(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.

(i) $5\sqrt{8} + 4\sqrt{50}$
$= 5\sqrt{4}\sqrt{2} + 4\sqrt{25}\sqrt{2}$
$= 5 \times 2\sqrt{2} + 4 \times 5\sqrt{2}$
$= 10\sqrt{2} + 20\sqrt{2}$
$= 30\sqrt{2}$

Always look for square number factors

(2)

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

$$\frac{\sqrt{3}}{6-\sqrt{3}} = \frac{\sqrt{3}}{6-\sqrt{3}} \times \frac{(6+\sqrt{3})}{(6+\sqrt{3})}$$
$$= \frac{\sqrt{3} \times 6 + \sqrt{3}\sqrt{3}}{6^2 - (\sqrt{3})^2}$$
$$= \frac{6\sqrt{3} + 3}{36 - 3}$$
$$= \frac{3 + 6\sqrt{3}}{33}$$
$$= \frac{3}{33} + \frac{6}{33}\sqrt{3}$$
$$= \frac{1}{11} + \frac{2}{11}\sqrt{3}.$$

(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)

(i) $a^0 = 1$

(ii) $a^6 \div a^{-2} = a^{6--2}$

$= a^8$

(iii) $(9a^6b^2)^{-\frac{1}{2}} = (3^2a^6b^2)^{-\frac{1}{2}}$

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

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)

(i) $\left(\frac{1}{25}\right)^{-\frac{1}{2}} = (25)^{\frac{1}{2}} = \sqrt{25} = \pm 5$

(ii) $\frac{(2x^2y^3z)^5}{4y^2z} = \frac{2^5x^{10}y^{15}z^5}{2^2y^2z^1}$

$= 2^{5-2}x^{10}y^{15-2}z^{5-1}$

$= 2^3x^{10}y^{13}z^4 = 8x^{10}y^{13}z^4$

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

Grad of AB $= \frac{9-2}{7-0} = 1$

Grad of BC $= \frac{10-9}{6-7} = -1$

Product of gradients = 1 x -1 = -1 → AB and BC perpendicular

(3)

(ii) Find the length of AC

$(6-0)^2 + (10-2)^2 = AC^2$
$AC = 10$

(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

$m = \frac{-1-7}{5-3} = \frac{-8}{2} = -4$

$y = -4x + c$

Substitute in (3,7) [5,-1] would do equally as well

$7 = -4 \times 3 + c$

$\Rightarrow 19 = c$

$\Rightarrow y = -4x + 19$

Midpoint of AB = (4, 3)

Sub. in to $x + 2y = 10$ & show that equation is true.

$4 + 2 \times 3 = 4 + 6 = 10$ TRUE.

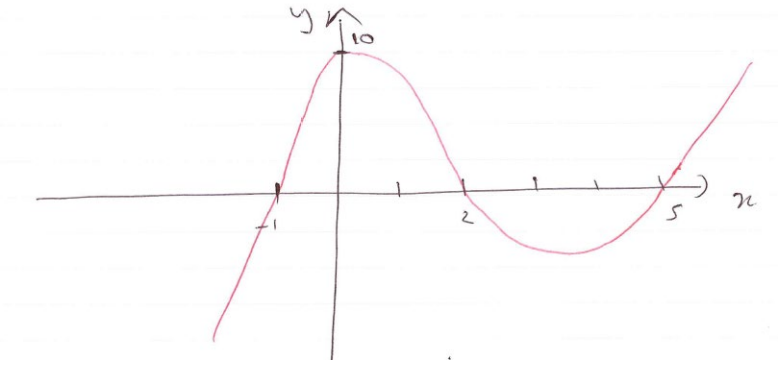
(5)

Total / 10

7 Sketching curves

Question 1 (hegarty 299)

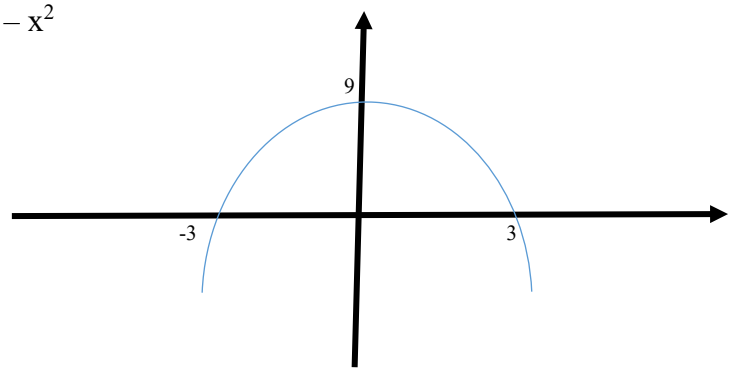
In the cubic polynomial f(x), the coefficient of x^3 is 1. The roots of f(x) = 0 are -1, 2 and 5.
Sketch the graph of y = f(x)



(3)

Question 2

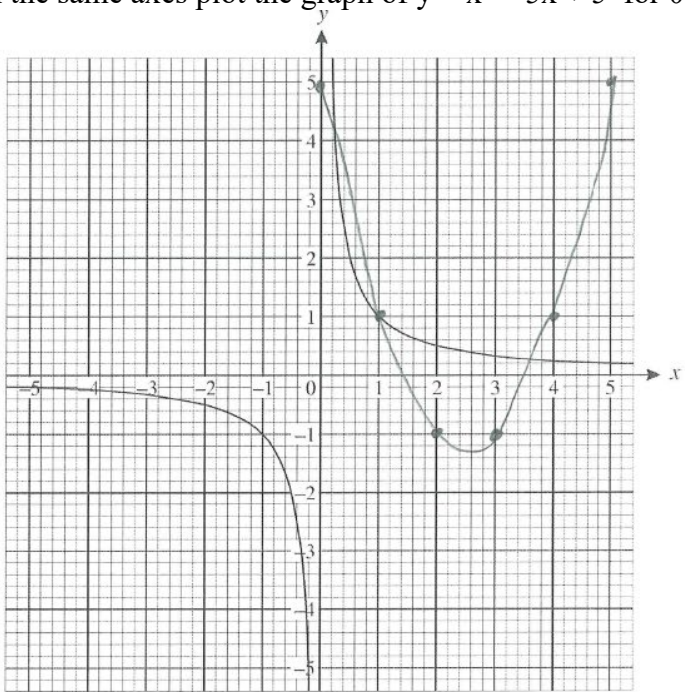
Sketch the graph of $y = 9 - x^2$



(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 $0 \leq x \leq 5$



x	0	1	2	3	4	5
x^2	0	1	4	9	16	25
$-5x$	0	-5	-10	-15	-20	-25
+5	+5	+5	+5	+5	+5	+5
y	5	1	-1	-1	1	5

(4)

Total / 10

8 Transformation of functions

Question 1

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

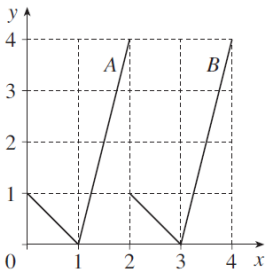
Write down an equation for the translated curve. You need not simplify your answer.

$y = (x-2)^2 - 4$

(2)

Question 2

This diagram shows graphs A and B.



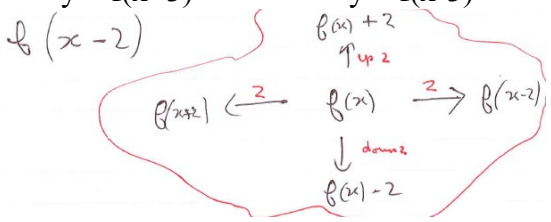
(i) State the transformation which maps graph A onto graph B

A movement of 2 to the right is a translation of $\begin{pmatrix} +2 \\ 0 \end{pmatrix}$

(2)

(ii) The equation of graph A is $y = f(x)$.
Which one of the following is the equation of graph B ?

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



Answer f(x-2)

(2)

Question 3

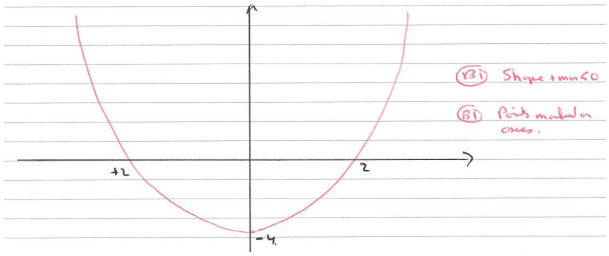
(i) Describe the transformation which maps the curve $y = x^2$ onto the curve $y = (x+4)^2$

• Translation (B1)

• $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$ (B1) (or 4 units to the left)

(2)

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

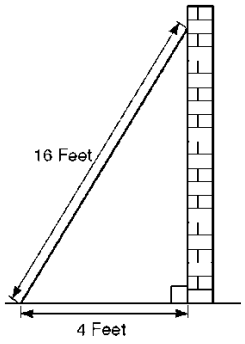


(2)

Total / 10

9 Trigonometric ratios

Question 1 (hegarty 509-515)
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.

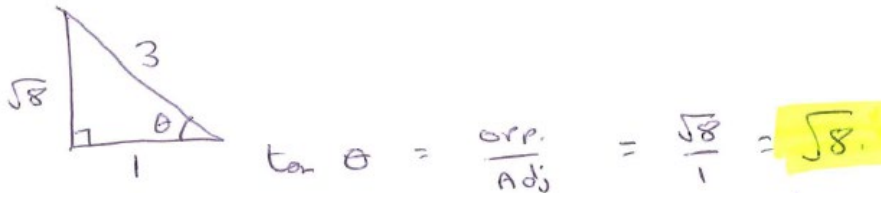
(i) Work out how high up the wall the ladder reaches. Give your answer to 3 significant figures.

$\sqrt{16^2 - 4^2}$
$\sqrt{256 - 16}$ correct substitution (M1)
$\sqrt{240}$
15.49
15.5 (3sf) (A1) (2)

(ii) Work out the angle the base of the ladder makes with the ground. Give your answer to 3 sig fig

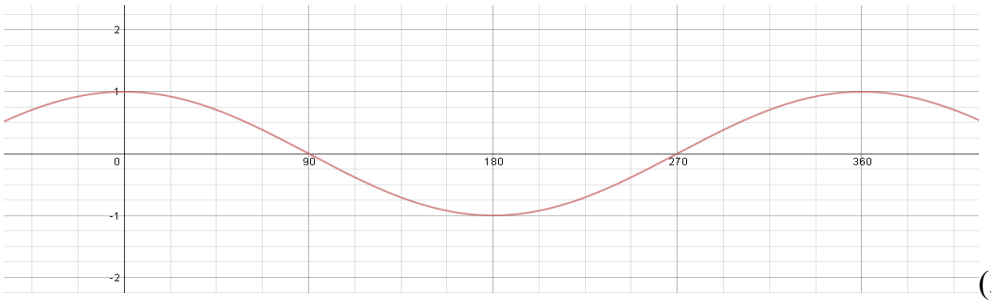
$\cos x = \frac{4}{16}$ correct ratio and substitution (M1)
$\cos x = 0.25$
$x = 75.522$
$x = 75.5°$ (A1) (2)

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 $0 \leq x \leq 360°$

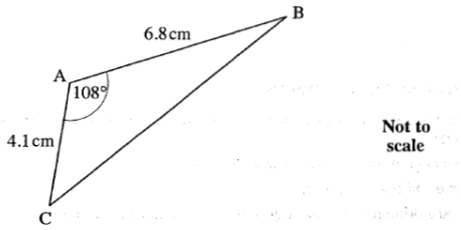


(3)

Total / 10

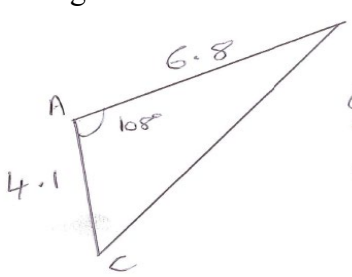
10 Sine / Cosine Rule

Question 1



For triangle ABC, calculate

(i) the length of BC



(i) By the Cosine Rule.

$a^2 = b^2 + c^2 - 2bc\cos A$

$= 6.8^2 + 4.1^2 - 2 \times 6.8 \times 4.1 \times \cos 108$

$= 63.05 - -17.23$

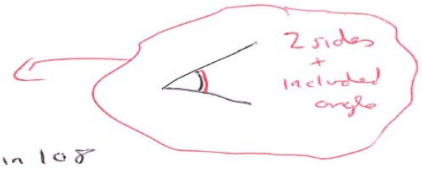
$= 80.28$

$\Rightarrow a = \sqrt{80.28} = 8.960$

(3)

(ii) the area of triangle ABC

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



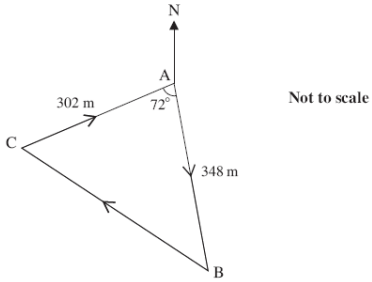
$= \frac{1}{2} \times 4.1 \times 6.8 \times \sin 108$

$= 13.26$

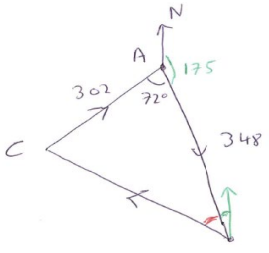
(3)

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.



Use the Cosine Rule to find CB

$CB^2 = 302^2 + 348^2 - 2 \times 302 \times 348 \times \cos 72$

$CB = 384$

Total length = 384 + 650 = 1034m

(4)

Total / 10

Year 12 transition course Sparx maths codes

As you transition from Year 11 to Year 12, it is very important to refresh your memory on certain core mathematical skills. Moreover, it is vital that you have a sound understanding of some more difficult skills. In the tables below, you will find **skills** that you should be confident with as you start Year 12. Get 100% on each and use the videos if you are stuck.

Solving quadratic equations	
Factorising to solve quadratics: x^2+bx+c=0	**U228**
Factorising to solve quadratics: ax^2+bx+c=0	**U960**
Solving quadratics: completing the square	**U589**
Solving quadratics: quadratic formula	**U665**
Constructing and solving quadratic equations	**U150**
Solving quadratic equations graphically	**U601**
Plotting graphs of quadratic functions	**U989**
Interpreting graphs of quadratic functions	**U667**
Turning points by completing the square	**U769**
Change of Subject	
Changing the subjects of formulae with one step	**U675**
Changing the subjects of formulae with two or more steps	**U181**
Changing the subject when the subject appears more than once	**U191**
Simultaneous equations	
Solving simultaneous equations: elimination	**U760**
Solving simultaneous equations: substitution	**U757**
Solving simultaneous equations with quadratics	**U547**
Solving simultaneous equations graphically	**U836**
Solve quadratics Sim equations graphically	**U875**
Constructing & solving simultaneous equations	**U137**
Surds	
Multiplying and dividing surds	**U633**
Simplifying surds	**U338**
Adding and subtracting surds	**U872**
Expanding brackets with surds	**U499**
Rationalising denominators: single term	**U707**
Rationalising denominators: two terms	**U281**
Indices	
Index rules with positive indices	**U235**
Index rules with negative indices	**U694**
Indices	**U985**
Indices	**U772**
Properties of lines	

Calculating midpoints	**U933**
Solving shape problems involving coordinates	**U889**
Plotting straight line graphs	**U741**
Finding equations of straight line graphs	**U315**
Interpreting equations of straight line graphs	**U669**
y = mx+ c from gradient and a point	**U477**
y=mx+c from two points on the line	**U848**
Equations of parallel lines	**U377**
Sketching curves	
Graphs of cubic functions	**U980**
Graphs of reciprocal functions	**U593**
Graphs of exponential functions	**U229**
Translating graphs	**U598**
Reflecting graphs	**U487**
Transforming functions	
Transforming graphs	**U455**
Sine/Cosine Rule	
The sine rule	**U952**
The cosine rule	**U591**
The area rule	**U592**

RAYNES
PARK HIGH SCHOOL

The Bridge to A level Mathematics

Test Yourself

(This is to be printed, completed and brought to your first Mathematics lesson in September)

1 Solving quadratic equations

Question 1

Find the real roots of the equation $x^4 - 5x^2 - 36 = 0$ by considering it as a quadratic equation in x^2

(4)

Question 2

(i) Write $4x^2 - 24x + 27$ in the form of $a(x - b)^2 + c$

(4)

(ii) State the coordinates of the minimum point on the curve $y = 4x^2 - 24x + 27$.

(2)

Total / 10

2 Changing the Subject

Question 1

Make t the subject of the formula $s = \frac{1}{2}at^2$

(3)

Question 2

Make x the subject of $3x - 5y = y - mx$

(3)

Question 3

Make x the subject of the equation $y = \frac{x+3}{x-2}$

(4)

Total / 10

3 Simultaneous equations

Question 1

Find the coordinates of the point of intersection of the lines $x + 2y = 5$ and $y = 5x - 1$

(3)

Question 2

The lines $y = 5x - a$ and $y = 2x + 18$ meet at the point $(7, b)$.

Find the values of a and b.

(3)

Question 3

A line and a curve has the following equations :

$$3x + 2y = 7 \qquad y = x^2 - 2x + 3$$

Find the coordinates of the points of intersection of the line and the curve by solving these simultaneous equations algebraically

(4)

Total / 10

4 Surds

Question 1

(i) Simplify $\sqrt{24} + \sqrt{6}$

(2)

(ii) Express $\frac{36}{5-\sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers.

(3)

Question 2

(i) Simplify $6\sqrt{2} \times 5\sqrt{3} - \sqrt{24}$

(2)

(ii) Express $(2 - 3\sqrt{5})^2$ in the form $a + b\sqrt{5}$, where a and b are integers.

(3)

Total / 10

5 Indices

Question 1

Find the value of the following.

(i) $\left(\frac{1}{3}\right)^{-2}$

(2)

(ii) $16^{\frac{3}{4}}$

(2)

Question 2

(i) Find a, given that $a^3 = 64x^{12}y^3$

(2)

(ii) $\left(\frac{1}{2}\right)^{-5}$

(2)

Question 3

Simplify $\frac{16^{\frac{1}{2}}}{81^{\frac{3}{4}}}$

(2)

Total / 10

6 Properties of Lines

Question 1

The points A (-1,6), B (1,0) and C (13,4) are joined by straight lines. Prove that AB and BC are perpendicular.

(2)

Question 2

A and B are points with coordinates (-1,4) and (7,8) respectively. Find the coordinates of the midpoint, M, of AB.

(1)

Question 3

A line has gradient -4 and passes through the point (2,-6). Find the coordinates of its points of intersection with the axes.

(4)

Question 4

Find the equation of the line which is parallel to $y = 3x + 1$ and which passes through the point with coordinates (4,5).

(3)

Total / 10

7 Sketching curves

Question 1

You are given that f(x) = (x + 1)(x – 2)(x – 4)

Sketch the graph of y = f(x)

(3)

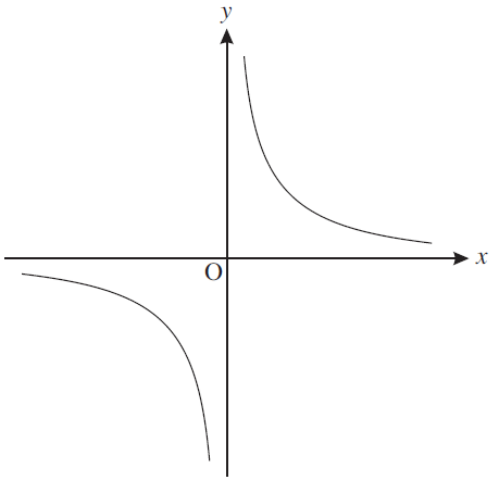
Question 2

Sketch the graph of $y = x(x - 3)^2$

(3)

Question 3

This diagram shows a sketch of the graph of $y = \frac{1}{x}$

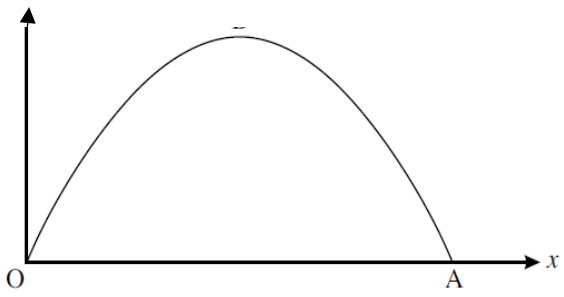


Sketch the graph of $y = \frac{1}{x-2}$, showing clearly any points where it crosses the axes.

(3)

Question 4

This curve has equation $y = \frac{1}{5}x\ (10 - x)$. State the value of x at the point A.



(1)

Total / 10

8 Transformation of functions

Question 1

The graph of $y = x^2 - 8x + 25$ is translated by $\begin{pmatrix} 0 \\ -20 \end{pmatrix}$. State an equation for the resultant graph.

(1)

Question 2

$f(x) = x^3 - 5x + 2$

Show that $f(x - 3) = x^3 - 9x^2 + 22x - 10$

(4)

Question 3

You are given that $f(x) = 2x^3 + 7x^2 - 7x - 12$

Show that $f(x - 4) = 2x^3 - 17x^2 + 33x$

(3)

Question 4

You are given that $f(x) = (x + 1)(x - 2)(x - 4)$.

The graph of $y = f(x)$ is translated by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$.

State an equation for the resulting graph. You need not simplify your answer.

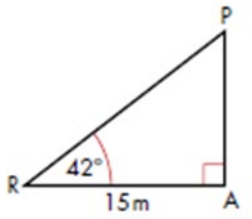
(2)

Total / 10

9 Trigonometric ratios

Question 1

AP is a telephone pole. The angle of elevation of the top of the pole from the point R on the ground is 42°as seen in the diagram.



Calculate the height of the pole. Give your answer to 3 significant figures.

(3)

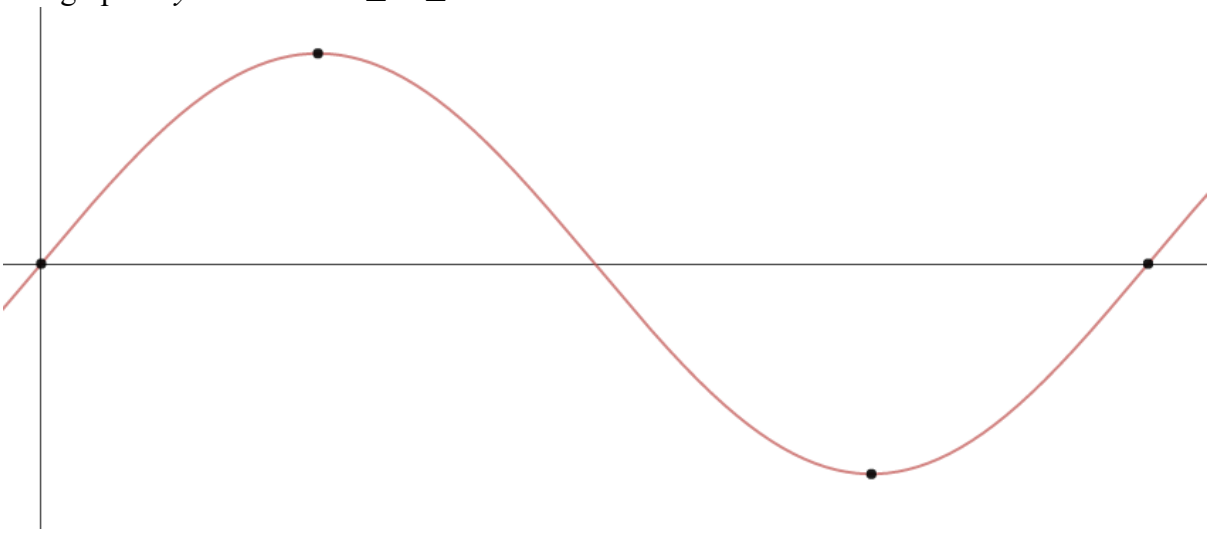
Question 2

Given that $\sin \Theta = \frac{\sqrt{3}}{4}$, find in surd form the possible values of $\cos \Theta$.

(3)

Question 3

The graph of $y = \sin x$ for $0 \leq x \leq 360°$ is shown below.



What are the coordinates of the 4 points labelled on the graph?

(……, ……)
(……, ……)
(……, ……)
(……, ……)

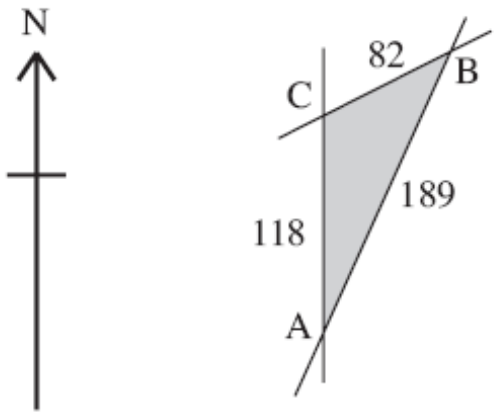
(4)

Total / 10

10 Sine / Cosine Rule

Question 1

This diagram shows a village green which is bordered by 3 straight roads AB, BC and AC. The road AC runs due North and the measurements are shown in metres.



Not to scale

(i) Calculate the bearing of B from C, giving your answer to the nearest 0.1°

(4)

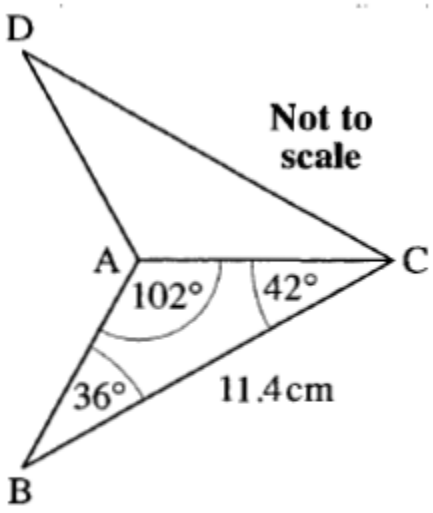
(ii) Calculate the area of the village green.

(2)

Question 2

This diagram shows a logo ABCD. It is symmetrical about AC.

Find the length of AB and hence find the area of the logo



(4)

Total / 10