RAYNES
PARK SIXTH FORM

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 hegartymaths 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

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The Bridge to A level Mathematics

Diagnosis Questions

1 Solving quadratic equations (hegarty 230-242)

Question 1 (hegarty 230-234)

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

Question 2 (hegarty 230-234)

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

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

(4)

Question 3 (hegarty 235-237, 255-256)

(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 (hegarty 280-286)

Question 1 (hegarty 284)

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

(3)

Question 2 (hegarty 284)

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

(3)

Question 3 (hegarty 283)

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

(4)

Total / 10

3 Simultaneous equations (hegarty 190-195, 218-219 and 246)

Question 1 (hegarty 218-219)

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

(3)

Question 2 (hegarty 218-219)

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

(3)

Question 3 (hegarty 246)

Solve the simultaneous equations

$x^2 + y^2 = 5$

$y = 3x + 1$

(4)

Total / 10

4 Surds (hegarty 113-120)

Question 1

(i) Simplify $(3 + \sqrt{2})(3 - \sqrt{2})$ **(hegarty 116-117)**

(2)

(ii) Express $\frac{1+\sqrt{2}}{3-\sqrt{2}}$ in the form $a + b\sqrt{2}$ where a and b are rational **(hegarty 118-119)**

(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. **(hegarty 115)**

(2)

(ii) Express $\frac{\sqrt{3}}{6-\sqrt{3}}$ in the form $p + q\sqrt{3}$ where p and q are rational **(hegarty 118-119)**

(3)

Total / 10

5 Indices (hegarty 102-110)

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 (hegarty 206-220)

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 (hegarty 206-220)

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 (hegarty 252-257, 800-801, 299-301)

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 (hegarty 252-257)

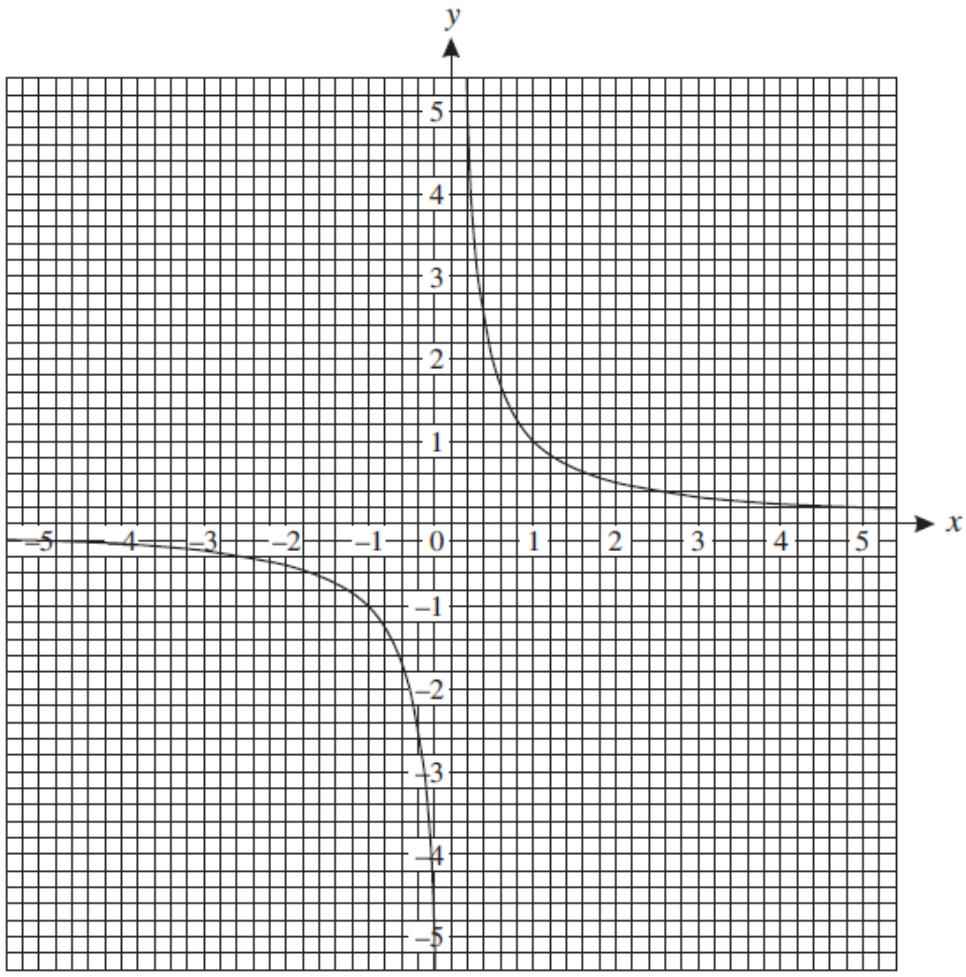
Sketch the graph of $y = 9 - x^2$

(3)

Question 3 (hegarty 300-301)

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 (hegarty 307-313)

Question 1

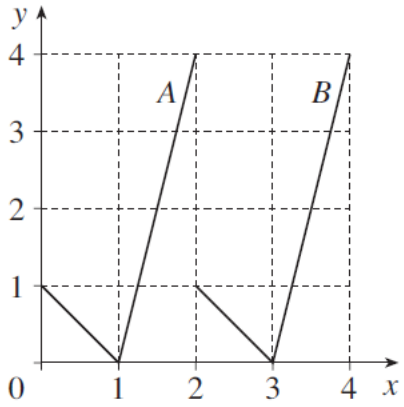
The curve $y = x^2 - 4$ is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

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)

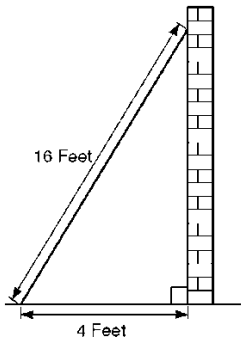
Total / 10

9 Trigonometric ratios (hegarty 509-515, 845-853, 303-306)

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)

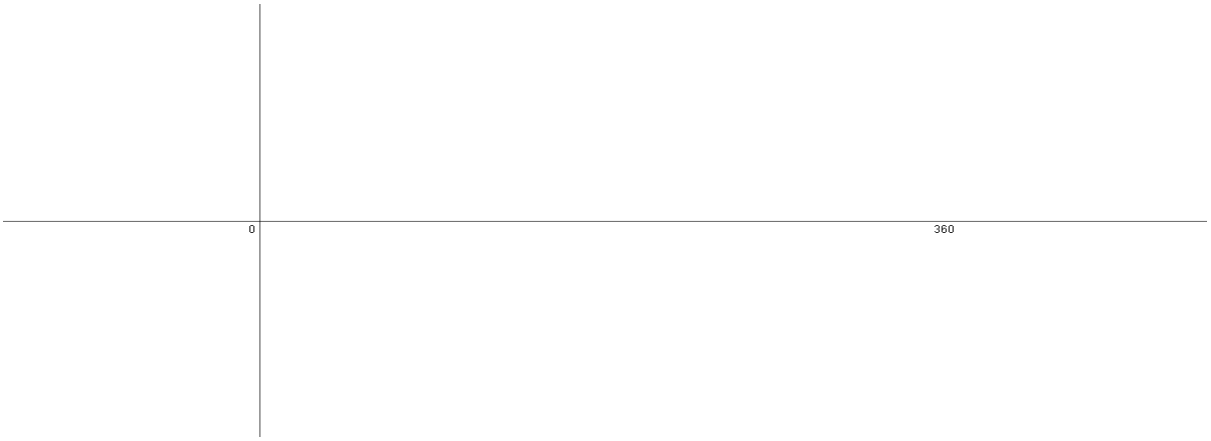
Question 2 (hegarty 306, 845-853)

Given that $\cos \Theta = \frac{1}{3}$ and Θ is acute, find the exact value of $\tan \Theta$

(3)

Question 3 (hegarty 303-305)

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

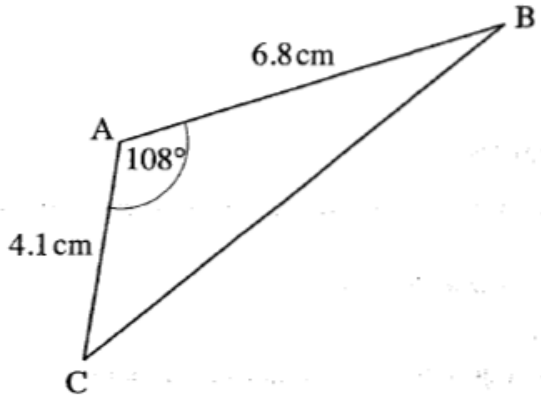


(3)

Total / 10

10 Sine / Cosine Rule (hegarty 520-530, 531-533)

Question 1 (hegarty 520-530, 532-533)



Not to scale

For triangle ABC, calculate

(i) the length of BC

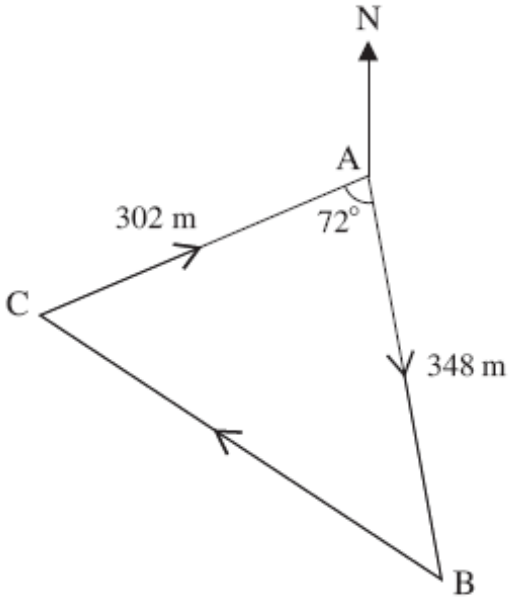
(3)

(ii) the area of triangle ABC

(3)

Question 2 (hegarty 531)

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

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Diagnosis Worked Solutions

1 Solving quadratic equations (hegarty 230-242)

Question 1 (hegarty clips 230-234)

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

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

$x = -2$ or -4

(2)

Question 2 (hegarty clips 230-234)

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 (hegarty 235-237, 255-256)

(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 (hegarty 280-286)

Question 1 (hegarty 284)

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 (hegarty 284)

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 (hegarty 283)

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 (hegarty 190-195, 218-219 and 246)

Question 1 (hegarty 218-219)
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 (hegarty 218-219)
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 (hegarty 246)
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 (hegarty 113-120)

Question 1

(i) Simplify $(3 + \sqrt{2})(3 - \sqrt{2})$ **(hegarty 116-117)**

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

(2)

(ii) Express $\frac{1+\sqrt{2}}{3-\sqrt{2}}$ in the form $a + b\sqrt{2}$ where a and b are rational **(hegarty 118-119)**

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

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. **(hegarty 115)**

(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 **(hegarty 118-119)**

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

(3)

Total / 10

5 Indices (hegarty 102-110)

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 (hegarty 206-220)

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

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 (hegarty 206-220)

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.

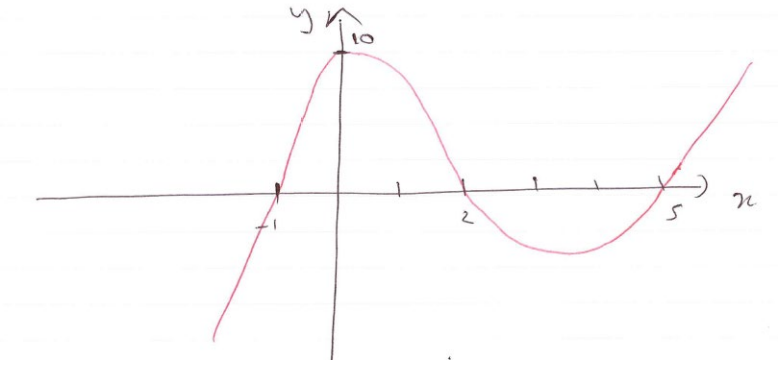
(5)

Total / 10

7 Sketching curves (hegarty 252-257, 800-801, 299-301)

Question 1 (hegarty 299)

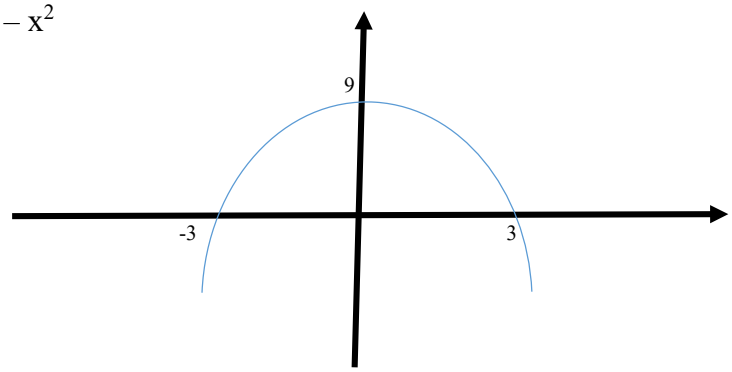
In the cubic polynomial f(x), the coefficient of x^3 is 1. The roots of f(x) = 0 are -1, 2 and 5.
Sketch the graph of y = f(x)



(3)

Question 2 (hegarty 252-257)

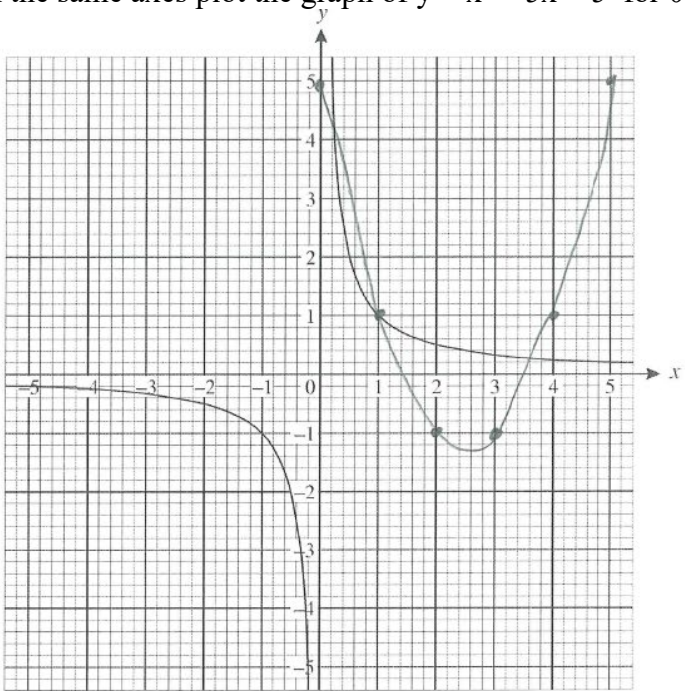
Sketch the graph of $y = 9 - x^2$



(3)

Question 3 (hegarty 301)

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 (hegarty 307-313)

Question 1

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

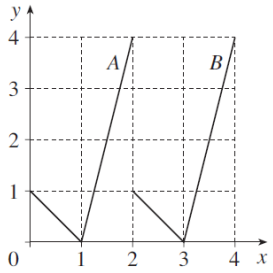
Write down an equation for the translated curve. You need not simplify your answer.

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

(2)

Question 2

This diagram shows graphs A and B.



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

A moved 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)

f(x-2)

f(x)+2 up 2

f(x+2) ← 2 — f(x) — 2 → f(x-2)

↓ down 2

f(x)-2

Answer f(x-2) (2)

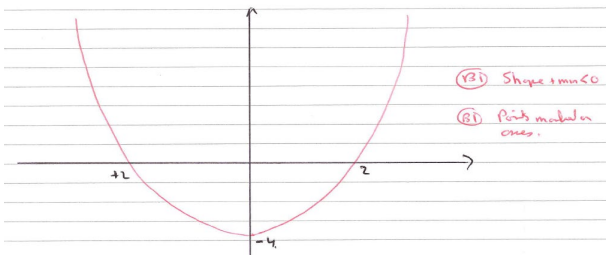
Question 3

(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 $y = x^2 - 4$

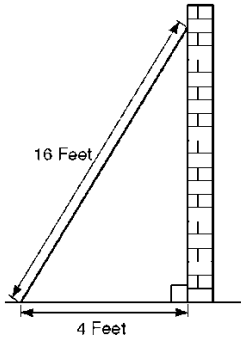


(2)

Total / 10

9 Trigonometric ratios (hegarty 509-515, 845-853, 303-306)

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.

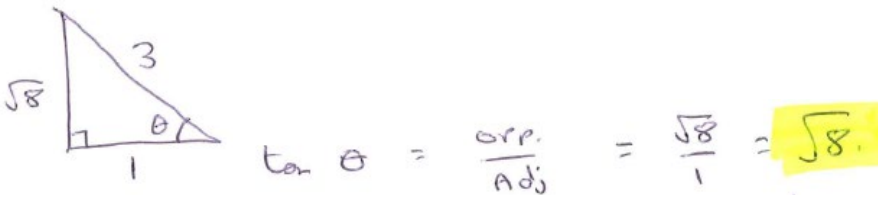
(i) Work out how high up the wall the ladder reaches. Give your answer to 3 significant figures.

$\sqrt{16^2 - 4^2}$
$\sqrt{256 - 16}$ 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

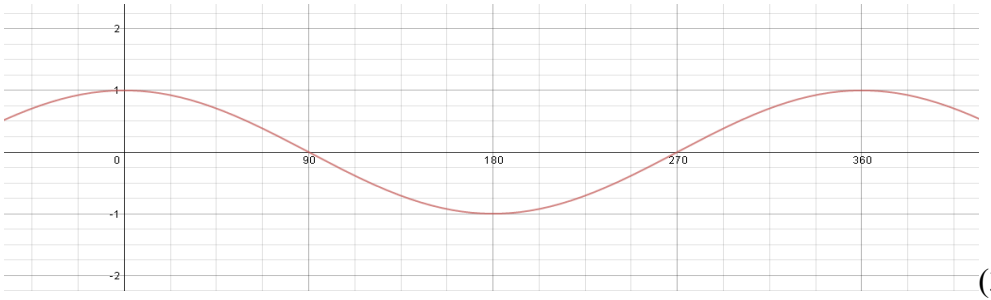
$\cos x = \frac{4}{16}$ correct ratio and substitution (M1)
$\cos x = 0.25$
$x = 75.522$
$x = 75.5°$ (A1) (2)

Question 2 (hegarty 306, 845-853)
Given that $\cos \Theta = \frac{1}{3}$ and Θ is acute, find the exact value of $\tan \Theta$



(3)

Question 3 (hegarty 303-305)
Sketch the graph of $y = \cos x$ for $0 \leq x \leq 360°$

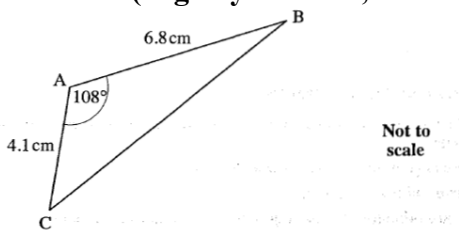


(3)

Total / 10

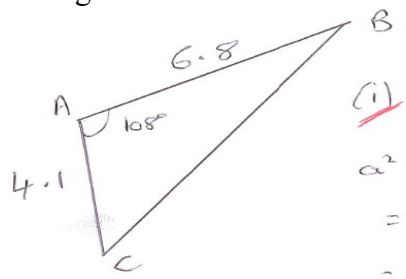
10 Sine / Cosine Rule (hegarty 520-530, 531-533)

Question 1 (hegarty 520-530, 532-533)



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 $= \frac{1}{2}ab\sin C$

2 sides + included angle

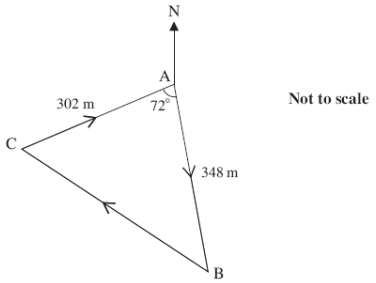
$= \frac{1}{2} \times 4.1 \times 6.8 \times \sin 108$

$= 13.26$

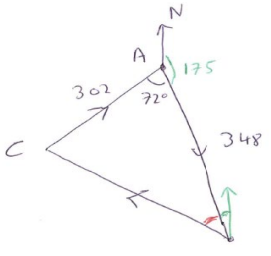
(3)

Question 2 (hegarty 531)

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

hegartymaths

Year 12 transition course

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 **180 skills** that you should be confident with as you start Year 12. Get 100% on each and use the videos if you are stuck.

Number

Topics	Clip Number	R	A	G
Indices, powers & roots				
Index form 1 (intro)	102			
Index form 2 (power of 0 & 1)	103			
Index form 3 (power of negative integers)	104			
Index form 4 (multiplying indices)	105			
Index form 5 (dividing indices)	106			
Index form 6 (power of power rule)	107			
Index form 7 (powers of unit fractions)	108			
Index form 8 (powers of non-unit fractions)	109			
Index form 9 (combination of rules)	110			
Multiplication & division with surds 1	113			
Multiplication & division with surds 2	114			
Simplifying surds	115			
Brackets involving surds 1	116			
Brackets involving surds 2	117			
Rationalising surds 1	118			
Rationalising surds 2	119			
Order of operations 3 (indices & roots)	120			

Algebra

Topics	Clip Number	R	A	G
Substitution				
Substitution 1	780			
Substitution 2	781			
Substitution 3	782			
Substitution 4	783			
Substitution 5	784			
Substitution 6	785			
Substitution 7	786			
Substitution 8	787			
Substitution (Equations of motion 1)	788			
Substitution (Equations of motion 2)	789			

Algebra (continued)

Topics	Clip Number	R	A	G
Manipulating expressions				
Collecting like terms 2	157			
Simplifying expressions involving multiplication	158			
Simplifying expressions involving division	159			
Expand two single brackets & simplify	161			
Expand double brackets 1	162			
Expand double brackets 2	163			
Expand double brackets 3	164			
Expand brackets (difference of two squares)	165			
Expand triple brackets	166			
HCF of algebraic expressions	167			
Factorise simple expressions 1	168			
Factorise simple expressions 2	169			
Simplifying expressions by factorising 1	170			
Simplifying expressions by factorising 2	171			
Expressions with algebraic fractions	172			
Indices with algebraic expressions 1	173			
Indices with algebraic expressions 2	174			
Indices with algebraic expressions 3	175			
Linear equations				
Solve 1 step equations (balance method)	178			
Solve 2 step equations (involving multiplication)	179			
Solve 2 step equations (involving division)	180			
Solve 2 step equations (x on denominator)	181			
Solve 2 step equations (x negative)	182			
Solve 3 step equations	183			
Solve equations with x on both sides 1	184			
Solve equations with x on both sides 2	185			
Solve equations with x on both sides 3	186			
Solve equations with algebraic fractions	187			
Setup & solve equations (in context)	188			
Simultaneous equations by elimination 4	193			
Simultaneous equations by substitution	194			
Simultaneous equations (in context)	195			
Linear sequences and graphs				
Midpoint of a line segment	200			
Gradient of a line segment 1	201			
Gradient of a line segment 2 (negative)	202			
Gradient of a line segment 3 (fractions)	203			
Gradient of a line segment 4 (summary)	204			

Straight line graphs 1	206			
Straight line graphs 2	207			
Straight line graphs 3	208			
Straight line graphs 4	209			

Algebra (continued)

Topics	Clip Number	R	A	G
Linear sequences and graphs (continued)				
Straight line graphs 5	210			
Straight line graphs 6	211			
Straight line graphs 7	212			
Straight line graphs 8	213			
Straight line graphs (parallel)	214			
Straight line graphs (perpendicular) 1	215			
Straight line graphs (perpendicular) 2	216			
Straight line graphs (alternative way to define)	220			
Solving equations & straight lines	217			
Solving simultaneous equations using straight lines 1	218			
Solving simultaneous equations using straight lines 2	219			
Quadratics				
Factorise quadratic expressions 1	223			
Factorise quadratic expressions 2	224			
Factorise quadratic expressions 3	225			
Factorise quadratic expressions 4	226			
Factorise quadratic expressions 5	227			
Factorise quadratic expressions 6	228			
Simplify algebraic fractions (involving quadratics)	229			
Completing the square 1	235			
Completing the square 2	236			
Completing the square 3	237			
Using the discriminant	243			
Solving quadratic equations 1 (by factorising)	230			
Solving quadratic equations 2 (by factorising)	231			
Solving quadratic equations 3 (by factorising)	232			
Solving quadratic equations 4 (by factorising)	233			
Solving quadratic equations 5 (inverse operations)	234			
Solving by completing the square 1	238			
Solving by completing the square 2	239			
Solving using the quadratic formula 1	241			
Solving using the quadratic formula 2	242			
Quadratic equations from algebraic fractions	244			
Quadratic equations in context	245			
Simultaneous equations involving quadratics	246			
Find the y-intercept of a quadratic graph	252			
Find the x-intercept (roots) of a quadratic graph	253			
Find the line of symmetry of a quadratic graph	254			
Find the turning point of quadratic graphs 1	255			
Find the turning point of quadratic graphs 2	256			
Sketch a fully labelled quadratic graph	257			
The discriminant & quadratic graphs	258			

Simultaneous equations using graphs (quadratic & linear)	259			
Using a quadratic graph to solve a related quadratic equation	260			

Algebra (continued)

Topics	Clip Number	R	A	G
Exponentials				
Manipulating powers 1	790			
Manipulating powers 2	791			
Manipulating powers 3	792			
Manipulating powers 4	793			
Manipulating powers 5	794			
Manipulating powers 6	795			
Exponential equations 1	796			
Exponential equations 2	797			
Exponential equations 3	798			
Harder exponential problems	799			
Exponential graphs (drawing)	302			
Exponential growth graphs	800			
Exponential decay graphs	801			
Points on exponential graphs 1	802			
Points on exponential graphs 2	803			
Real life exponential growth 1	804			
Real life exponential growth 2	805			
Real life exponential growth 3	806			
Real life exponential growth 4	807			
Real life exponential decay 1	808			
Real life exponential decay 2	809			
Real life exponential decay 3	810			
Real life exponential decay 4	811			
Circles				
Equation of a circle – centre origin 1	778			
Equation of a circle – centre origin 1	779			
Equation of a circle 1 (find centre and radius)	314			
Equation of a circle 2 (write equation)	315			
Equation of a circle 3 (location of points)	316			
Equation of a circle 4 (not standard form)	317			
Inequalities				
Integer solutions to inequalities	267			
Multiple inequalities on a number line	268			
Solve single linear inequalities 1 (positive x)	269			
Solve single linear inequalities 2 (negative x)	270			
Solve single linear inequalities 3 (difficult)	271			
Linear inequalities as graph regions 1	273			
Linear inequalities as graph regions 2	274			
Linear inequalities as graph regions 3	275			

Linear inequalities as graph regions 4	276			
Solving quadratic inequalities	277			

Algebra (continued)

Topics	Clip Number	R	A	G
Formulae				
Change the subject of the formula 1 (1 step)	280			
Change the subject of the formula 2 (2 step)	281			
Change the subject of the formula 3 (negative x)	282			
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Change the subject of the formula 5 (x with powers)	284			
Change the subject of the formula 6 (x on both sides)	285			
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Cubic graphs (recognising)	299			
Reciprocal graphs 1	300			
Reciprocal graphs 2	301			
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Cosine graph	304			
Tangent graph	305			
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Graph transformations				
Graph transformations 1 f(x)±a	307			
Graph transformations 2 f(x±a)	308			
Graph transformations 3 af(x)	309			
Graph transformations 4 f(ax)	310			
Graph transformations 5 f(x)	311			
Graph transformations 6 f(x)	312			
Graph transformations 7 (combined)	313			

Geometry and measures

Topics	Clip Number	R	A	G
Non-calculator trigonometry 1	845			
Non-calculator trigonometry 2	846			
Non-calculator trigonometry 3	847			
Non-calculator trigonometry 4	848			
Non-calculator trigonometry 5	849			
Non-calculator trigonometry 6	850			
Non-calculator trigonometry 7	851			
Non-calculator trigonometry (Problem solving 1)	852			
Non-calculator trigonometry (Problem solving 2)	853			

RAYNES
PARK SIXTH FORM

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)

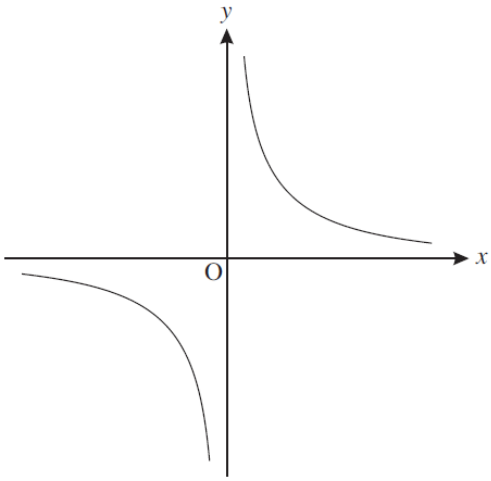
Question 2

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

(3)

Question 3

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

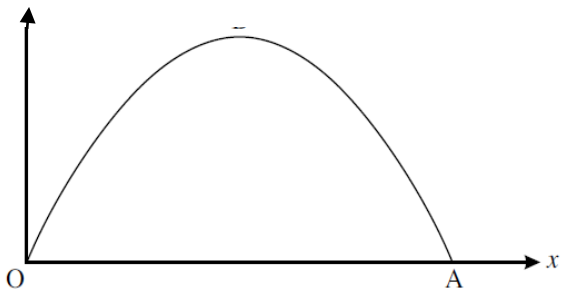


Sketch the graph of $y = \frac{1}{x-2}$, showing clearly any points where it crosses the axes.

(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.

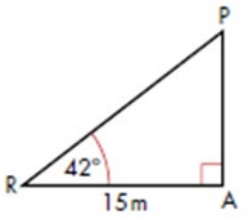
(2)

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)

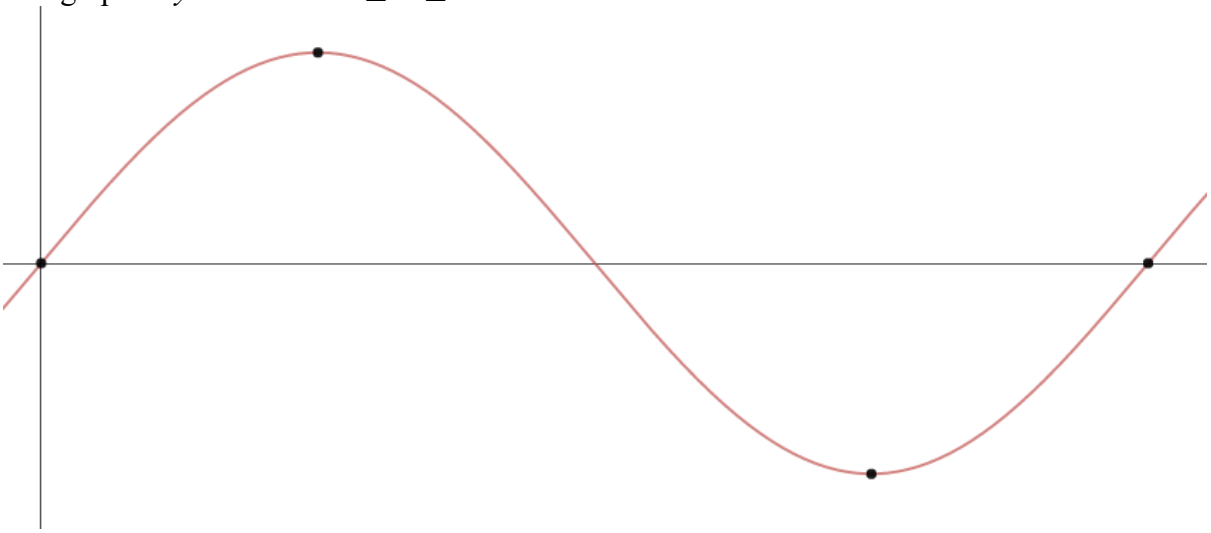
Question 2

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?

(……, ……)
(……, ……)
(……, ……)
(……, ……)

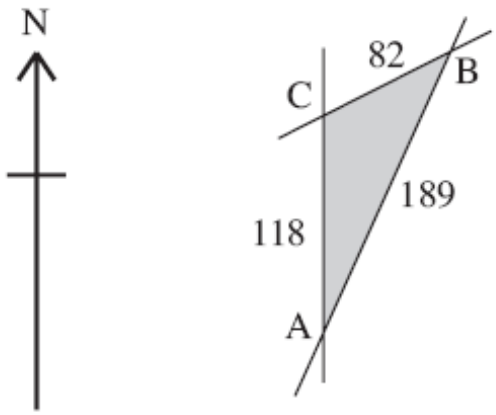
(4)

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)

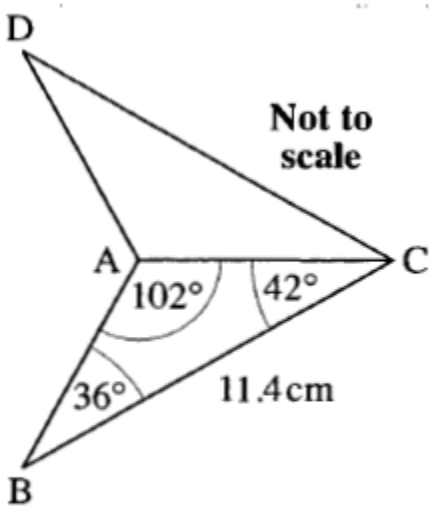
(ii) Calculate the area of the village green.

(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