Edexcel Predicted Paper 3 Higher - 2019

This is paper is just a **prediction** (with the usual provisos!) of questions on topics that have not yet come up on Papers 1 and 2. This worksheet was automatically generated by the DrFrostMaths platform: students can practice this set of questions interactively by going to www.drfrostmaths.com, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

[Edexcel IGCSE(9-1) SAM 2H Q13] Make b the subject of $P = \frac{1}{2}ab^2 + c$ where b is positive.

$b =$ .....

(3 marks)

Question 2

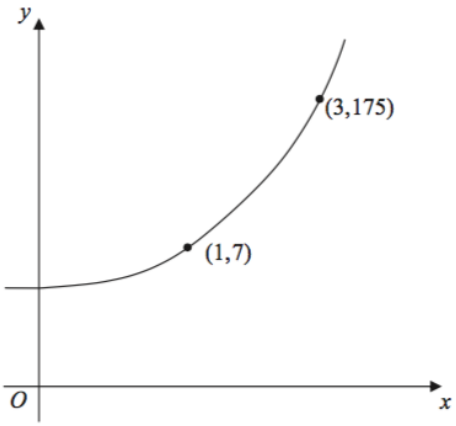


Diagram **NOT** accurately drawn

[Edexcel GCSE June2008-4H Q25]

The sketch shows a curve with equation $y = ka^x$

where k and a are constants, and $a > 0$ The curve passes through the points (1, 7) and (3, 175).
Calculate the value of k and the value of a .

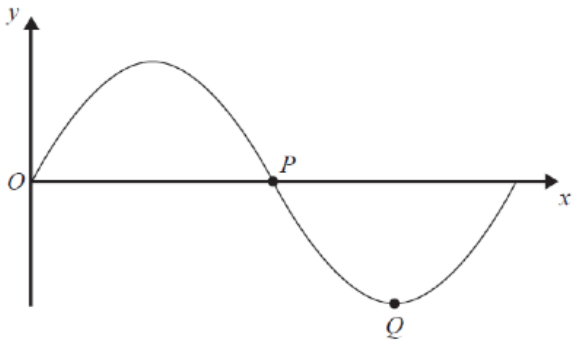
.....

(3 marks)

Question 3

[Edexcel GCSE June2014-1H Q26b]

The diagram shows part of a sketch of the curve $y = \sin x^\circ$.



Write down the coordinates of the point Q.

.....

(1 mark)

Question 4

[Edexcel IGCSE May2014(R)-3H Q8a]

Complete the table of values for $y = x^2 - 5x + 4$.

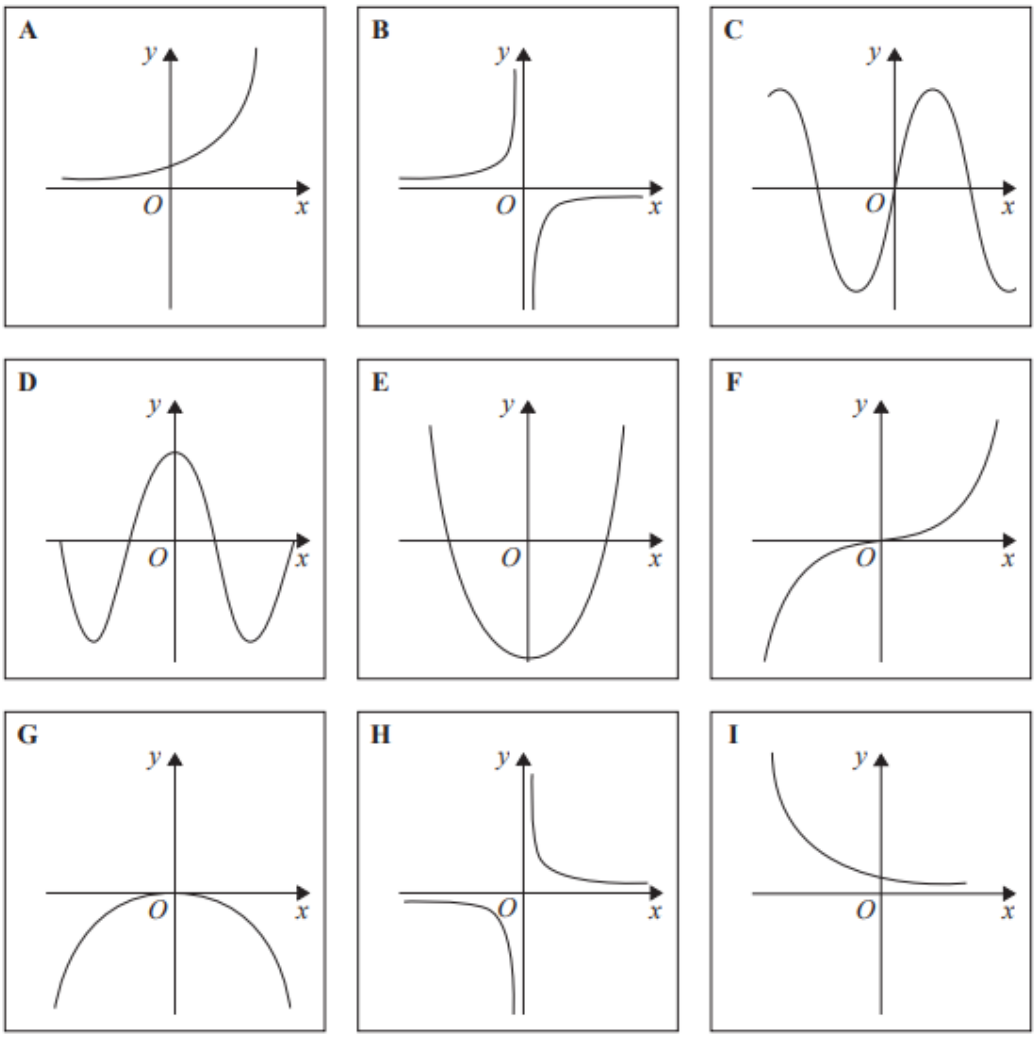
x	0	1	2	3	4	5
y	.....	.....	-2	.....	.....	4

(2 marks)

Question 5

[Edexcel GCSE(9-1) June 2017 2H Q14]

Here are some graphs.



In the table below, match each equation with the letter of its graph.

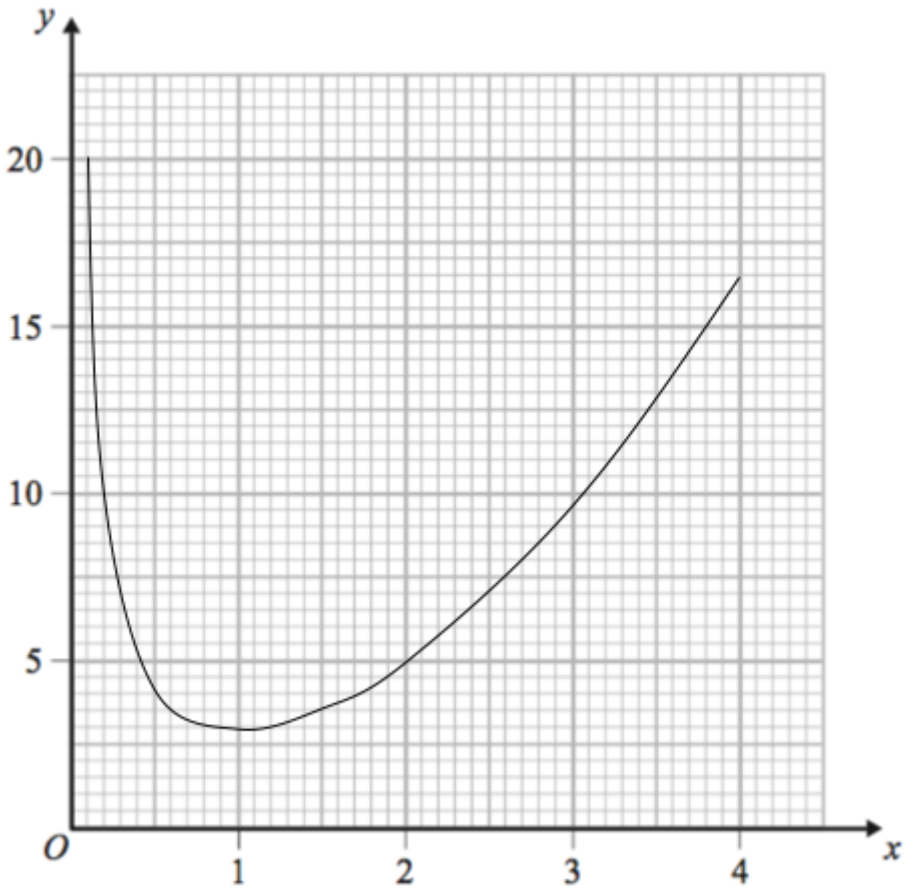
Equation	Graph
$y = \ sin\, x$	.....
$y = x^3 + 4x$	.....
$y = 2^x$	.....
$y = \frac{4}{x}$	.....

(3 marks)

Question 6

[Edexcel IGCSE May2013(R)-4H Q20c Edited]

The graph of $y = x^2 + \frac{2}{x}$ is drawn below.



Use the graph to find estimates for the solutions of $x^2 + \frac{2}{x} = 14$ in the interval $0.1 \leq x \leq 4$

Give your estimates correct to 1 decimal place.

$x =$ .....

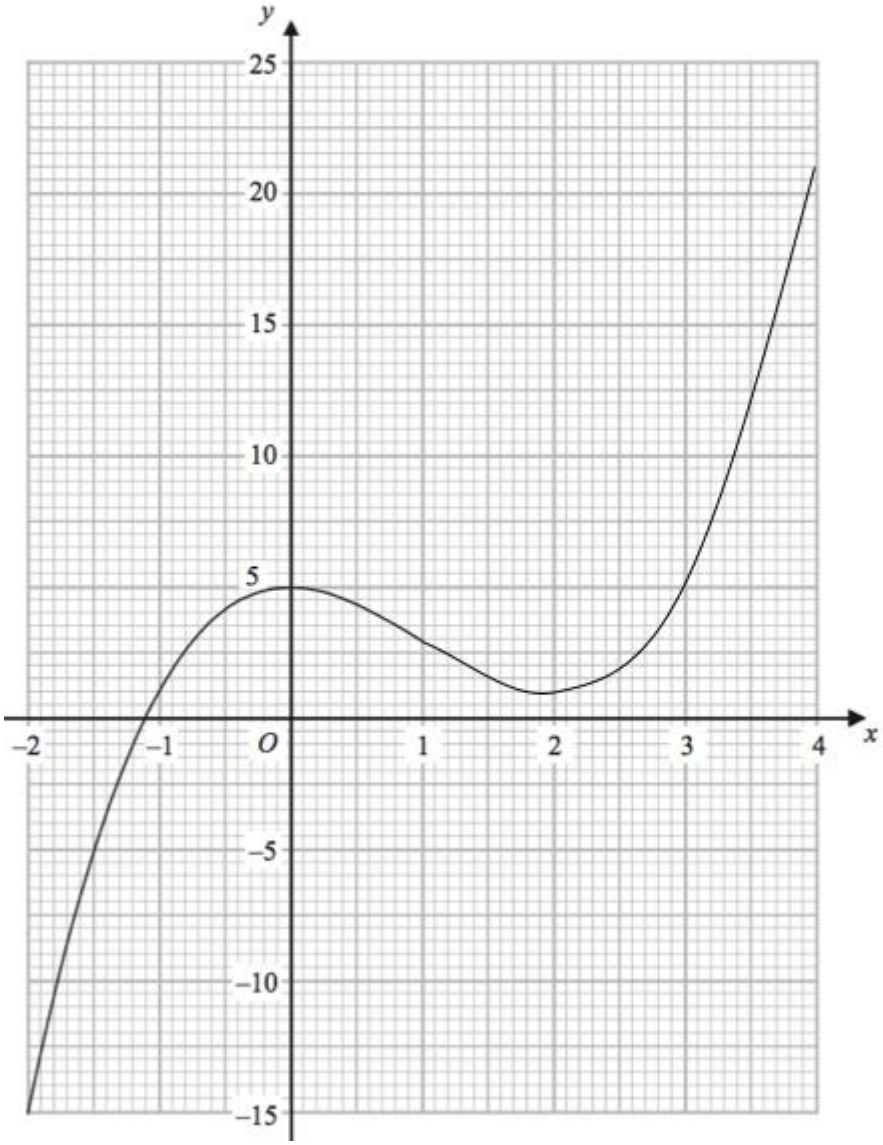
$x =$ .....

(2 marks)

Question 7

[Edexcel IGCSE May2015(R)-4H Q15d Edited]

The graph of $y = x^3 - 3x^2 + 5$ is drawn below.



By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $x^3 - 3x^2 + 2x + 4 = 0$

$x =$ **.....**

(3 marks)

Question 8

[Edexcel IGCSE(9-1) SAM 1H Q11]
Expand and simplify $(x + 5)(x - 3)(x + 3)$

.....

(3 marks)

Question 9

[Edexcel IGCSE May2016(R)-4H Q14c] Expand and simplify

$$4x(x + 3) - (2x - 3)^2$$

.....

(3 marks)

Question 10

[Edexcel IGCSE(9-1) SAM 1F Q21a, SAM 1H Q6a]

Factorise fully

$$18e^3f + 45e^2f^4$$

.....

(2 marks)

Question 11

[Edexcel IGCSE Jan2015(R)-4H Q20a]

Factorise $4x^2 - 1$

.....

(2 marks)

Question 12

[Edexcel IGCSE May2016(R)-4H Q14b]

Factorise $3x^2 - 8x - 3$

.....

(2 marks)

Question 13

[Edexcel Specimen Papers Set 2, Paper 1H Q21]

Solve the inequality $x^2 > 3(x + 6)$

.....

Question 14

[Edexcel GCSE June2009-4H Q3] The n th term of a number sequence is $n^2 + 1$

Write down the first three terms of the sequence.

.....

(2 marks)

Question 15

[Edexcel IGCSE May2015-3H Q3a]
The first four terms of an arithmetic sequence are

5 9 13 17

Write down an expression, in terms of n , for the n th term.

n th term = **.....**

(2 marks)

Question 16

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 2H Q12a] Here are the first four terms of a quadratic sequence.

3 8 15 24

Find an expression, in terms of n , for the n th term of this sequence.

.....

(3 marks)

Question 17

[Edexcel IGCSE(9-1) SAM 2F Q24, SAM 2H Q9 Edited]

Solve the simultaneous equations

$$3x + y = 13$$
$$x - 2y = 9$$

.....

(3 marks)

Question 18

[Edexcel IGCSE June2011-3H Q22] Solve the simultaneous equations

$$y = 2x - 3$$

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

.....

(6 marks)

Question 19

[Edexcel IGCSE May2013(R)-3H Q21b Edited]

Solve

$$x^2 - x - 210 = 0$$

.....

(3 marks)

Question 20

[Edexcel IGCSE May2014-4H Q18a Edited]

Solve $5x^2 - 6x - 2 = 0$

Give your solutions correct to 3 significant figures.

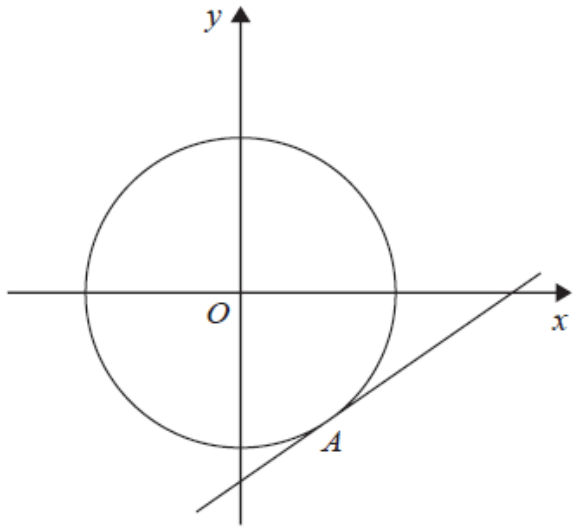
.....

(3 marks)

Question 21

[Edexcel GCSE(9-1) Mock Set 3 Autumn 2017 3H Q22]

The diagram shows the circle with equation $x^2 + y^2 = 261$



A tangent to the circle is drawn at point *A* with coordinates $(p, -15)$, where $p > 0$

Find an equation of the tangent at *A*.

.....

(5 marks)

Question 22

[Edexcel IGCSE May2012-4H Q2]

A group of students take a test. The group consists of 12 boys and 8 girls.
The mean mark for the boys is 18
The mean mark for the girls is 16.5

Calculate the mean mark for the whole group.

.....

(4 marks)

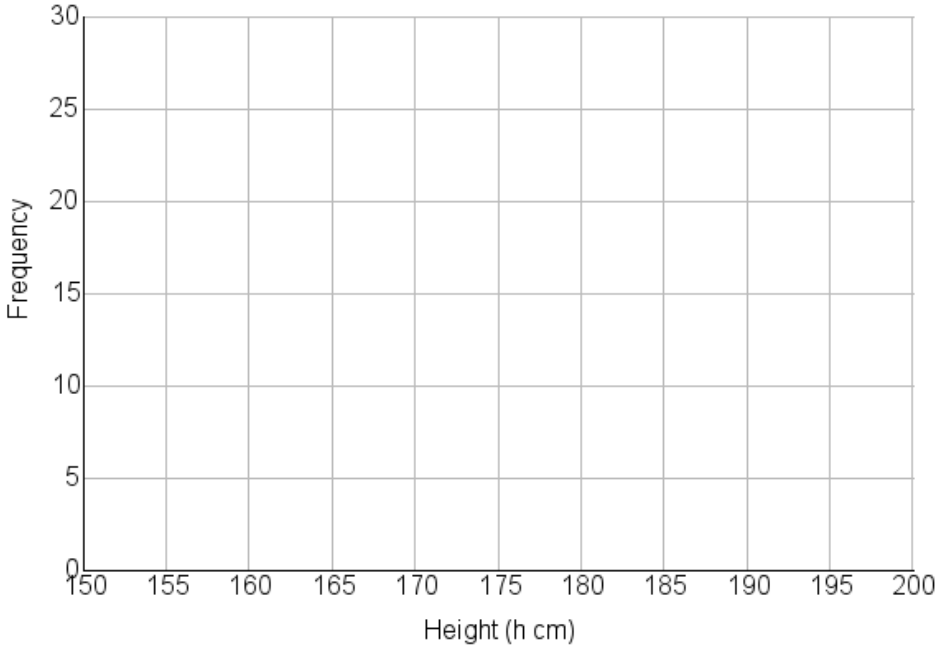
Question 23

[Edexcel GCSE Nov2014-2H Q8]

The frequency table gives information about the heights of some people.

Height (h cm)	Frequency
$160 < h \leq 165$	2
$165 < h \leq 170$	5
$170 < h \leq 175$	10
$175 < h \leq 180$	21
$180 < h \leq 185$	16
$185 < h \leq 190$	4

Draw a frequency polygon for this information.

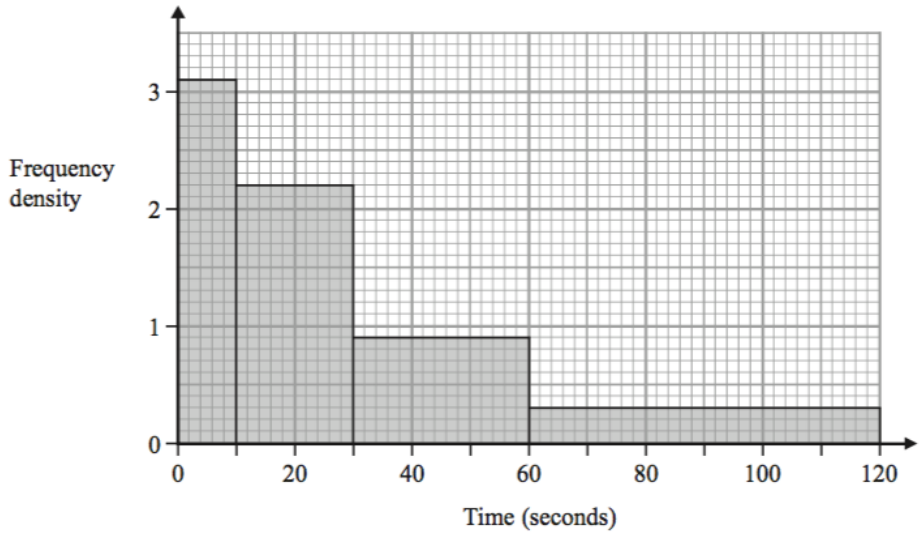


(2 marks)

Question 24

[Edexcel IGCSE May2014(R)-3H Q15]

The histogram shows information about the times taken by a telephone call centre to answer incoming calls.



Work out an estimate for the percentage of calls that are answered in less than 40 seconds.

..... %

(3 marks)

Question 25

[Edexcel GCSE Nov2013-2F Q26, Nov2013-2H Q6] There are 130 adults at a language school. Each adult studies one of French or Spanish or German.

96 of the adults are women.
12 of the women study French. 73 of the adults study Spanish.
55 of the women study Spanish. 9 of the men study German.

How many of the adults study French?

.....

(4 marks)

Question 26

[Edexcel GCSE Nov2011-1F Q21b, Nov2011-3H Q4]

Jim did a survey on the lengths of caterpillars he found on a field trip.
Information about the lengths is given in the stem and leaf diagram.

1	3	5	7	7				
2	0	6	8	8	8	9		
3	1	5	5	5	5	6	8	9
4	1	5						
5	2							

Key: 5|2 means 5.2 cm

Work out the median.

..... cm

(2 marks)

Question 27

[Edexcel IGCSE Jan2012-3H Q17 Edited]

Convert $0.1\dot{7}$ to a fraction, giving your answer in its simplest form.

.....

(2 marks)

Question 28

[Edexcel IGCSE Jan2016-3H Q14a]

Liam invests £8000 in a savings account for 4 years.
The savings account pays compound interest at a rate of

4.5 % for the first year
2.75 % for all subsequent years.

Work out the value of Liam's investment at the end of 4 years.

£ **.....**

(3 marks)

Question 29

[Edexcel GCSE(9-1) Nov 2017 2H Q13b]

At the beginning of 2009 the value of a company was £250 000.
In 6 years the value of this company increased to £325 000.

This is equivalent to an increase of $x\%$ each year.

Find the value of x .
Give your answer correct to 2 significant figures.

$x =$ **.....** %

(3 marks)

Question 30

[Edexcel IGCSE May2014-4H Q4b]

In a sale, all normal prices are reduced by 15%.
The normal price of a food processor is reduced by 13.50 dollars.
Work out the normal price of the food processor.

..... dollars

(3 marks)

Question 31

[Edexcel GCSE(9-1) June 2018 1H Q9a]

Write down the value of $36^{\frac{1}{2}}$

.....

(1 mark)

Question 32

[Edexcel IGCSE May2012-3H Q17b]

Simplify

$$(9c^8)^{\frac{1}{2}}$$

.....

(2 marks)

Question 33

[Edexcel GCSE Nov2014-1H Q22b] Simplify

$$\left(\frac{64x^6}{25y^2}\right)^{-\frac{1}{2}}$$

.....

(2 marks)

Question 34

[Edexcel IGCSE May2014-4H Q24] Given that

$$\left(2^{\frac{1}{2}}\right)^n = \frac{2^x}{8^y}$$

express n in terms of x and y.

$n =$ **.....**

(3 marks)

Question 35

[Edexcel IGCSE May2015-4H Q18b Edited]

A and B are two sets.

$n(\xi) = 36 \qquad n(B) = 21$
$n(A \cap B) = 8 \quad n(A') = 18$

By drawing a Venn diagram or otherwise, find $n(A \cup B)$

$n(A \cup B) =$ **.....**

(1 mark)

Question 36

[Edexcel GCSE March2013-1H Q13]

The diagram shows a square and 4 regular pentagons.

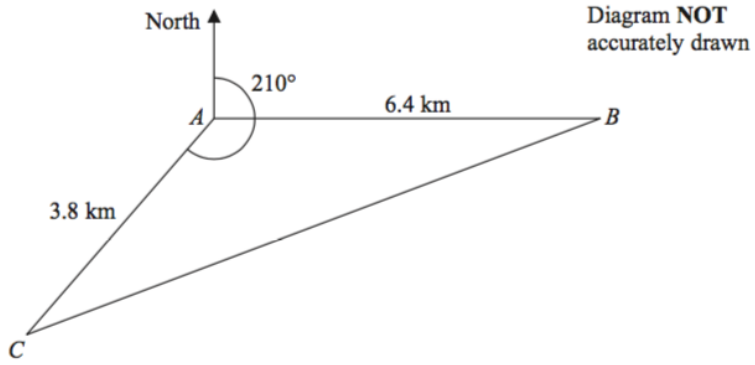
Work out the size of the angle marked x .

$x =$ ..... °

(5 marks)

Question 37

[Edexcel IGCSE May2014(R)-4H Q19 Edited]



A, *B* and *C* are 3 villages.
B is 6.4 km due east of *A*.
C is 3.8 km from *A* on a bearing of 210°.

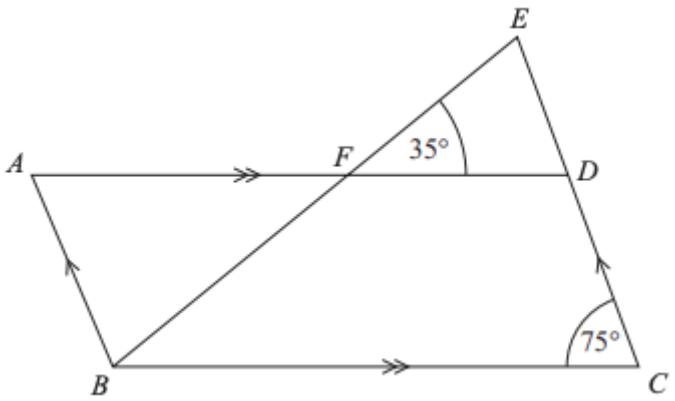
Calculate the bearing of *B* from *C*.
Give your answer correct to the nearest degree.

..... °

(6 marks)

Question 38

[Edexcel GCSE(9-1) Nov 2017 1F Q25, Nov 2017 1H Q3 Edited]



$ABCD$ is a parallelogram. EDC is a straight line. F is the point on AD so that BFE is a straight line.

Angle $EFD = 35^\circ$
Angle $DCB = 75^\circ$

Find angle ABF .

angle $ABF =$ ..... $^\circ$

(4 marks)

Question 39

[Edexcel IGCSE May2012-3H Q13 Edited]

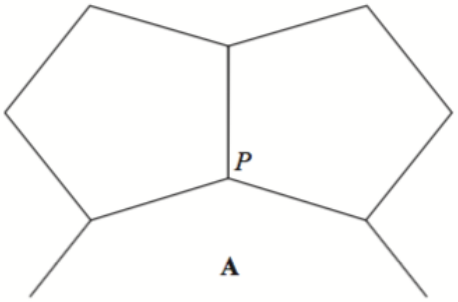


Diagram **NOT** accurately drawn

The diagram shows two congruent regular pentagons and part of a regular n -sided polygon **A**. Two sides of each of the regular pentagons and two sides of **A** meet at the point *P*.

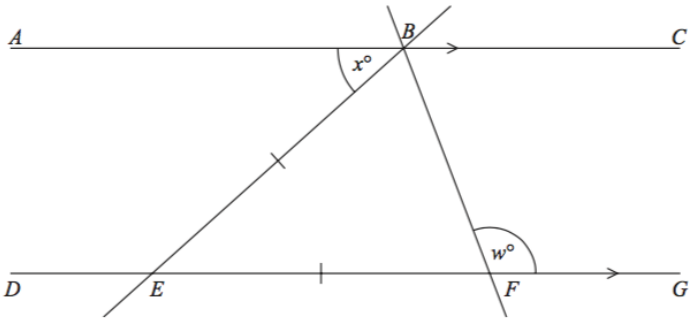
Calculate the value of n .

$n =$ ..... sides

(5 marks)

Question 40

[Edexcel GCSE(9-1) Mock Set 3 Autumn 2017 2H Q9 Edited]



In the diagram *ABC* and *DEFG* are parallel lines. Angle *ABE* = x

EB = *EF*

Find an expression for *w*

$w =$ ..... °

(4 marks)

Question 41

[Edexcel IGCSE June2011-4H Q6a] The diagram shows a trapezium PQRS.

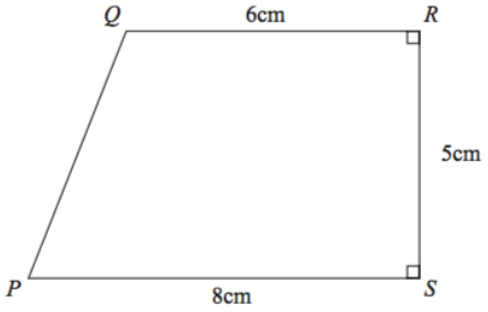


Diagram **NOT** accurately drawn

Calculate the area of the trapezium PQRS.

..... cm^2

(2 marks)

Question 42

[Edexcel GCSE June2014-2H Q19]

Here is a cuboid drawn on a 3-D grid.

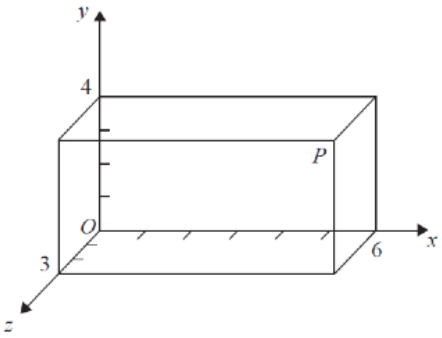


Diagram **NOT** accurately drawn

P is a vertex of the cuboid.

T divides the line *OP* in the ratio 1: 2.

Find the coordinates of *T*.

.....

(2 marks)

Question 43

[Edexcel IGCSE Jan2017(R)-3H Q1]

The area of the floor of a room is 12 m^2.

Change 12 m^2 into cm^2.

..... cm^2

(2 marks)

Question 44

[Edexcel GCSE Nov2014-2H Q13a]

The diagram shows a swimming pool in the shape of a prism.

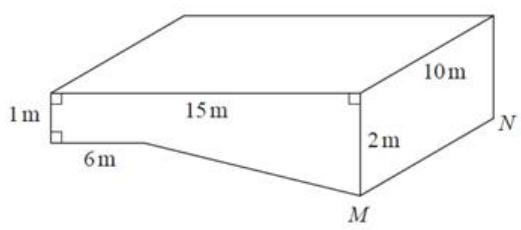


Diagram **NOT** accurately drawn

The swimming pool is empty.

The swimming pool is filled with water at a constant rate of 50 litres per minute.

Work out how long it will take for the swimming pool to be completely full of water.
Give your answer in hours.
(1 m^3 = 1000 litres)

..... hours

(5 marks)

Question 45

[Edexcel GCSE June 2017 2H Q18]

Ibrar mixes 74 g of lead and 126 g of tin to make 200 g of an alloy.

Lead has a density of 11.34 g/cm ^{3} .
Tin has a density of 7.31 g/cm ^{3} .

Work out the density of the alloy. Give your answer correct to 1 decimal place

..... g/cm ^{3}

(3 marks)

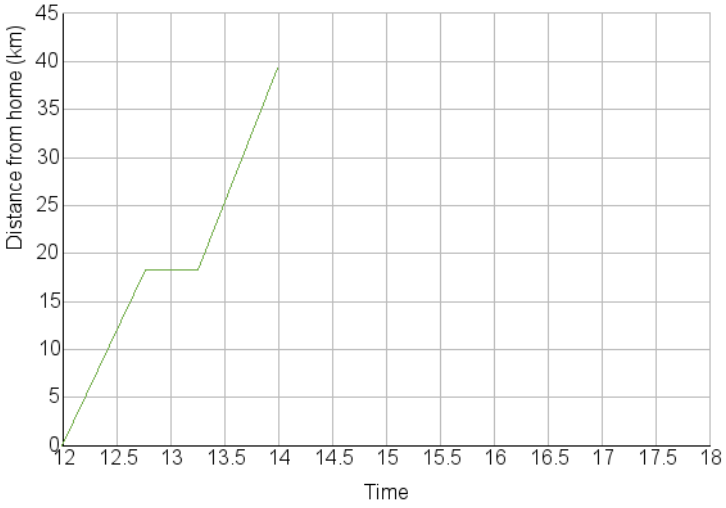
Question 46

[Edexcel IGCSE May2012-4H Q3b]

Bhavik left his home at 12 00 to cycle to Sam's house.
On the way Bhavik stopped for a rest, and then continued his journey.
The distance-time graph shows his journey.

Bhavik stayed at Sam's house for 2 hours.
He then cycled back to his home.
He arrived home at 17 15.

Show all this information on the graph.



(2 marks)

Question 47

[Edexcel IGCSE May2016-4H Q9]

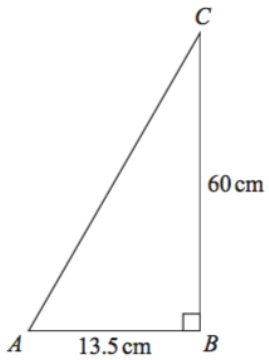


Diagram **NOT** accurately drawn

Work out the perimeter of the triangle.

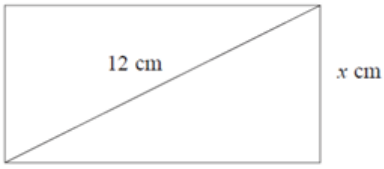
..... cm

(4 marks)

Question 48

[Edexcel IGCSE Jan2016-3H Q22]

The diagram shows a rectangle.



The width of the rectangle is x cm.
The length of a diagonal of the rectangle is 12 cm.

The perimeter of the rectangle is 28 cm.

Find the possible values of x .
Give your values correct to 3 significant figures.
Show your working clearly

.....

(7 marks)

Question 49

[Edexcel GCSE Nov2013-2H Q28 Edited]

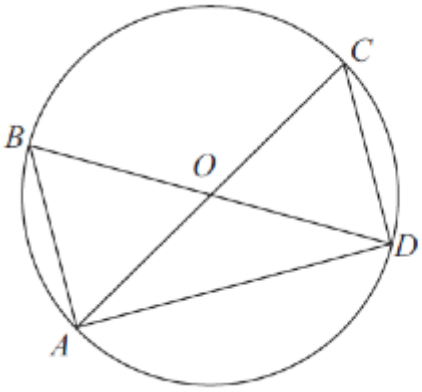


Diagram **NOT** accurately drawn

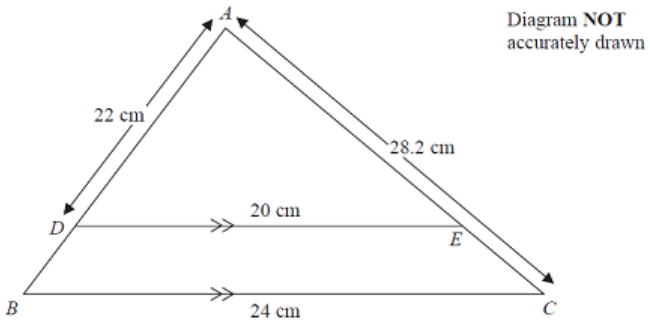
AOC and *BOD* are diameters of a circle, centre *O*.
Prove that triangle *ABD* and triangle *DCA* are congruent.

(3 marks)

Question 50

[Edexcel IGCSE Jan2016(R)-4H Q13b]

The diagram shows triangle ABC .



ADB and AEC are straight lines.DE is parallel to BC .$DE = 20$ cm, $BC = 24$ cm, $AD = 22$ cm, $AC = 28.2$ cm

Work out the length of EC .

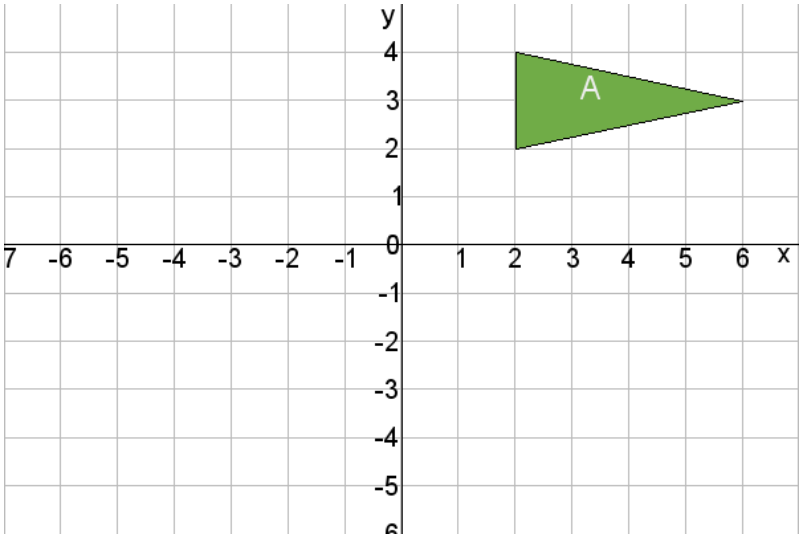
$EC =$ ..... cm

(2 marks)

Question 51

[Edexcel GCSE Nov2013-1H Q23]

On the grid, enlarge the triangle by scale factor $-\frac{1}{2}$, centre (0, –2).



(2 marks)

Question 52

[Edexcel IGCSE(9-1) SAM 2H Q21]

Here is triangle LMN, where angle LMN is an obtuse angle.

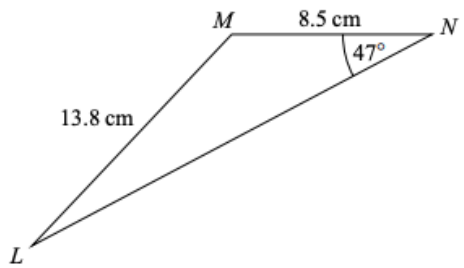


Diagram **NOT** accurately drawn

Work out the area of triangle LMN.
Give your answer correct to 3 significant figures.

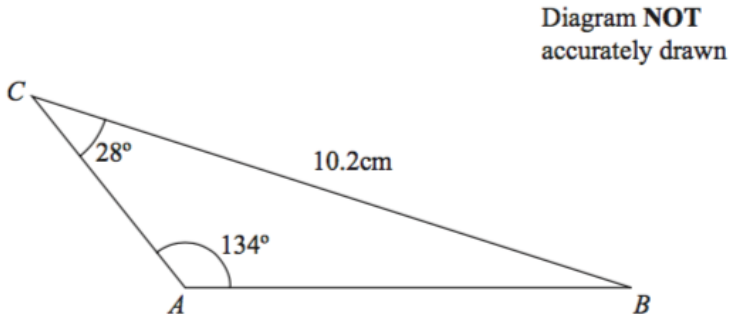
..... cm ^{2}

(6 marks)

Question 53

[Edexcel IGCSE June2011-4H Q19]

The diagram shows triangle ABC.



Angle BCA = 28°
Angle CAB = 134°
BC = 10.2 cm.

Calculate the length of AB.
Give your answer correct to 3 significant figures.

..... cm

(3 marks)

Question 54

[Edexcel GCSE(9-1) June 2018 3H Q18a Edited]

Show that the equation $x^3 + x = 7$ has a solution between 1 and 2

.....

(2 marks)

Question 55

[Edexcel GCSE(9-1) June 2018 3H Q18c Edited]

The equation $x^3 + x = 7$ has a solution between 1 and 2.
The equation $x^3 + x = 7$ can be rearranged to give $x = \sqrt[3]{7 - x}$

Starting with $x_0 = 2$, use the iteration formula $x_{n+1} = \sqrt[3]{7 - x_n}$ three times to find an estimate for a solution of $x^3 + x = 7$

.....

(3 marks)

Question 56

[Edexcel GCSE(9-1) Nov 2017 2H Q23a]

S is a **geometric** sequence.

Given that $(\sqrt{x} - 1)$, 1 and $(\sqrt{x} + 1)$ are the first three terms of S, find the value of x.

.....

(3 marks)

Question 57

[Edexcel GCSE(9-1) Nov 2017 2H Q18]

At time $t = 0$ hours a tank is full of water. Water leaks from the tank.
At the end of every hour there is 2% less water in the tank than at the start of the hour. The volume of water, in litres, in the tank at time t hours is V_t

Given that

$V_0 = 2000 \qquad V_{t+1} = kV_t$

write down the value of k .

.....

(1 mark)

Answers

Question 1

$b = \sqrt{\frac{2(P-c)}{a}}$

$P-c=\frac{1}{2}ab^2$ $\frac{2(P-c)}{a}=b^2$ $b=\sqrt{\frac{2(P-c)}{a}}$	3	AO1	M1 M1 A1	Isolate term in b Isolate b^2 oe with b as the subject

Question 2

$k = 1.4$, $a = 5$

$7 = ka^1$; $175 = ka^3$ $k = \frac{7}{a}$, $175 = \frac{7}{a}a^3$, $175 = 7a^2$ $a^2 = 25$, so $a = 5$, $k = 1.4$ Or $7^3 = k^3a^3$, $175 = ka^3$ $k^2 = \frac{7^3}{175}$, $k = 1.4$, $a = 5$	$k = 1.4$ $a = 5$	3	M1 either $a^2 = 25$ or $7 = ka$ (or $7 = ka^1$) and $175 = ka^3$ A1 $k = 1.4$ oe A1 $a = 5$ SC Either $a = 5$ or $k = 1.4$ oe gets B2

Question 3

$(270, -1)$

270, –1	1	B1 for 270, –1 accept $\frac{3\pi}{2}$, –1

Question 4

4, 0, (–2), –2, 0, (4)	2	B2 Award B1 for any 2 correct.

Question 5

C, F, A, H	B3 [B2 [B1	for a fully correct table for 2 or 3 correct] for 1 correct]

Question 6

any value in the range $x = 0.1$ to $x = 0.2$ and any value in the range $x = 3.6$ to $x = 3.7$

0.1 to 0.2 and 3.7	2	B2	B1 for each correct value ± ½ sq ft from their graph if at least 1 mark scored in (b) tol

Question 7

any value in the range $x = -0.9$ to $x = -0.7$

$y = 1 - 2x$ drawn				M2	Line must be long enough to cross curve and verify accuracy. M1 for $x^3 - 3x^2 + 5 = -2x + 1$ or $y = -2x + 1$ oe
	−0.8		3	A1	dep on M2 Accept $-0.9 \leq x \leq -0.7$

Question 8

$x^3 + 5x^2 - 9x - 45$

e.g. $(x^2 + 5x - 3x - 15)(x + 3)$ **or** $(x^2 + 2x - 15)(x + 3)$ **or** $(x - 5)(x^2 + 3x - 3x - 9)$ **or** $(x - 5)(x^2 - 9)$			AO1	M1	expansion of any two of the three brackets – at least 3 correct terms
E.g. $x^3 + 3x^2 + 2x^2 + 6x - 15x - 45$ **or** $x^3 + 5x^2 - 9x - 45$				M1	(dep) ft for at least 3 correct terms in second expansion
	$x^3 + 5x^2 - 9x - 45$	3		A1	

Question 9

$24x - 9$

$4x^2 + 12x$ or $4x^2 - 12x + 9$ or $-4x^2 + 12x - 9$ oe		3	M1	For expansion of $4x(x + 3)$ or $(2x - 3)^2$ or $-(2x \quad 3)^2$
$4x^2 + 12x - 4x^2 + 12x - 9$			M1	Fully correct expansions with correct removal of bracket (ie all signs correct)
	$24x - 9$ or $3(8x - 3)$		A1	

Question 10

$9e^2f(2e + 5f^3)$

$9e^2f(2e + 5f^3)$	2	AO1	M1 A1	Any correct partially factorised expression

Question 11

$(2x - 1)(2x + 1)$

	2	M1 $(2x \pm 1)(2x \pm 1)$
$(2x-1)(2x+1)$		A1 cao

Question 12

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

$(3x+1)(x-3)$	2	M1 A1	for $(3x \pm 1)(x \pm 3)$

Question 13

$x < -3$ or $x > 6$

Question 14

2 and 5 and 10

1^2+1 2^2+1 3^2+1	2, 5, 10	2	M1 for 1^2+1 or 2^2+1 or 3^2+1 (but not 1^2+1, 2^2+2, 3^2+3) A1 for 2, 5, 10 SC: B1 for 1, 2, 5 with or without working

Question 15

n th term = $4n + 1$

$4n+1$	2	M1 $4n + k$ (k may be zero) A1 oe eg. $5 + (n-1)\times 4$ **NB: $n = 4n + 1$ oe scores M1 A0**

Question 16

$n^2 + 2n$

(a)		$n^2 + 2n$	3	M1 correct deduction from differences, e.g. 2nd difference of 2 implies $1n^2$ or 1^2, 2^2, 3^2 M1 1^2, 2^2, 3^2 linked with 2, 4, 6· A1 $n^2 + 2n$ oe

Question 17

$x = 5$, $y = -2$

$3x + y = 13$ **or** $6x + 2y = 26$ $-\ 3x - 6y = 27$ $+\ x - 2y = 9$ eg. $3x - 2 = 13$ **or** $15 + y = 13$	5, −2	3	AO1	M1 M1 A1	multiplication of one equation with correct operation selected **or** rearrangement of one equation with substitution into second (dep) correct method to find second variable for both solutions dependent on correct working

Question 18

$x = 1\,,\ y = -1$ or $x = \frac{7}{5}\,,\ y = -\frac{1}{5}$

$x^2 + (2x-3)^2 = 2$		6	M1	for correct substitution
$x^2 + 4x^2 - 6x - 6x + 9 = 2$ or $x^2 + 4x^2 - 12x + 9 = 2$			B1	(indep) for correct expansion of $(2x-3)^2$ even if unsimplified
$5x^2 - 12x + 7 (= 0)$			B1	for correct simplification Condone omission of '= 0'
$(5x-7)(x-1) (= 0)$ or $\frac{12 \pm \sqrt{4}}{10}$ or $\frac{12}{10} \pm \frac{\sqrt{4}}{10}$ or $\frac{6}{5} \pm \frac{1}{5}$			B1	for correct factorisation or for correct substitution into quadratic formula and correct evaluation of '$b^2 - 4ac$' or for using square completion correctly as far as indicated
$x = 1$ or $x = 1\frac{2}{5}$			A1	for both values of x dep on all preceding marks
	$x = 1,\ y = -1$ $x = 1\frac{2}{5},\ y = -\frac{1}{5}$		A1	for complete, correct solutions (need not be paired) dep on all preceding marks No marks for $x = 1,\ y = -1$ with no working

Question 19

$x = -14$ or $x = 15$

$(x - 15)(x + 14)$ $(= 0)$		3	M2 M1 for $(x \pm 15)(x \pm 14)$	M1 $\frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 1 \times (-210)}}{2}$ (may be partially evaluated, condone no brackets around negative numbers, accept 1^2)
	$-14\,,\ 15$		A1 (dep on M2) for $-14,\ 15$ **or** 15	M1 (indep) for $\sqrt{841}$ or 29 A1 (dep on M1) for $-14,\ 15$ **or** 15

Question 20

$x = 1.47$ or $x = -0.272$

$\frac{--6 \pm \sqrt{(-6)^2 - 4 \times 5 \times -2}}{2 \times 5}$			M1	for correct substitution; condone one sign error ; condone missing brackets around $(-6)^2$; accept 6 and 6^2 in place of $--6$ and $(-6)^2$ **There may be partial evaluation – if so, this must be correct**
$\sqrt{76}$ or $\sqrt{36+40}$ or $2\sqrt{19}$ or 8.71.....			M1	(independent) for correct simplification of discriminant (if evaluated, at least 3sf rounded or truncated)
	1.47, −0.272	3	A1	for −0.27 to −0.272 **and** 1.47 to 1.472 **Award 3 marks if first M1 scored and answer correct**

Question 21

$y = 0.4x - 17.4$

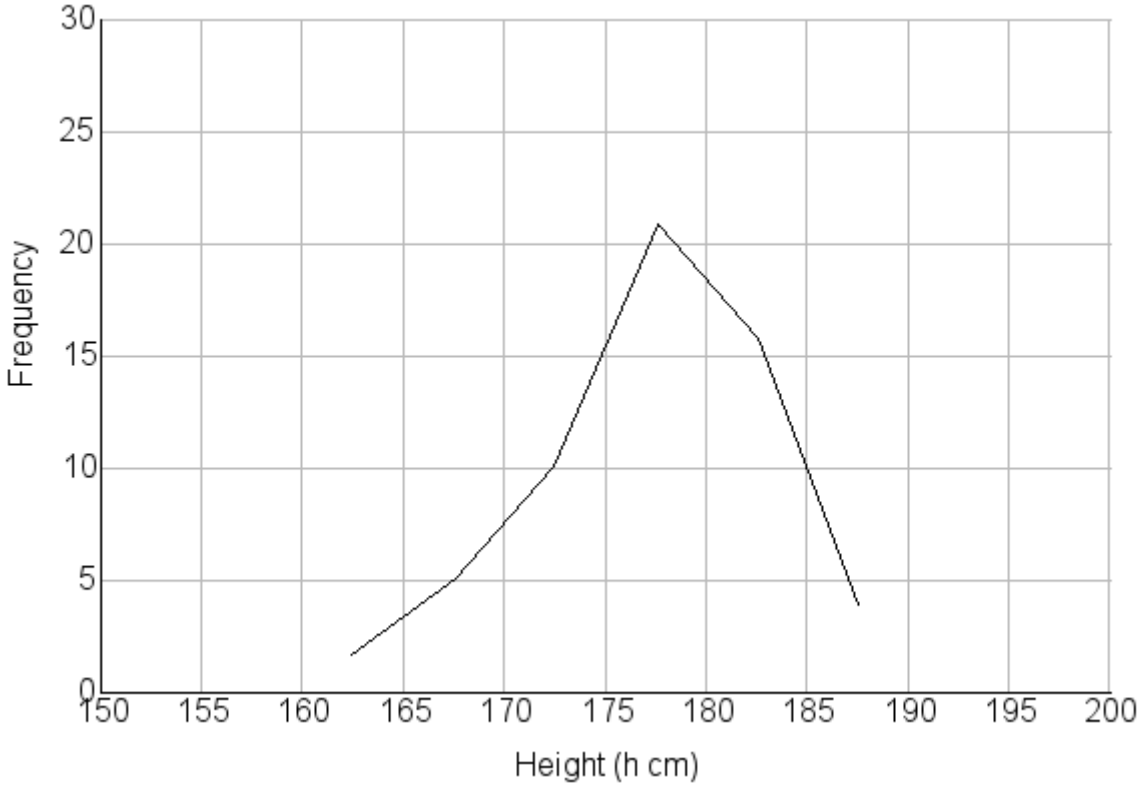
$y = 0.4x - 17.4$	P1	for process to find p, e.g. $\sqrt{261-15^2}$
	P1	for process to find gradient of OA, e.g. $-15 \div 6$ $(=\frac{-5}{2})$
	P1	(dep on previous P1) for process to find the perpendicular gradient using $-\frac{1}{m}$ or states gradient as $\frac{2}{5}$
	P1	for process to find the y-intercept of the gradient, e.g. $-15 = \frac{2}{5} \times 6 + c$
	A1	oe

Question 22

17.4

(12 x 18) + (8 x 16.5) (=348) "348" ÷ 20		17.4	4	M2 M1 A1	M1 for 12 x 18 (=216) or 8 x 16.5 (=132) dep on at least 1 previous M1 17.4
				Alt M1: M1: M1: A1:	Ratio method 12:8 = 3:2 or 6:4 18 x3 and 16.5 x 2 or 18 x 6 and 16.5 x 4 (18 x 3 + 16.5 x 2) ÷ 5 or (18 x 6 + 16.5 x 4) ÷ 10 17.4
				Alt M1 M2 A1	Proportion method 60 % boys and 40% girls stated or implied (0.6 x 18) + (0.4 x 16.5) (= 10.8 + 6.6) M1 for 0.6 x 18 or 0.4 x 16.5 17.4
				SC B1 for 17.1 (from {(8 x 18) + (12 x 16.5)}÷20)	

Question 23



Polygon drawn	2	B2 for fully correct frequency polygon - points plotted at the midpoint (B1 for all points plotted accurately but not joined with straight line segments) **or** all points plotted accurately and joined with last joined to first to make a polygon **or** all points at the correct heights and consistently within or at the ends of the intervals and joined (can include joining last to first to make a polygon) NB: ignore parts of graph drawn to the left of the 1st point or the right of the last point; ignore any histograms drawn.

Question 24

70 %

(3.1 x 10) + (2.2 x 20) + (0.9 x 30) + (0.3 x 60) or 31 + 44 + 27 + 18 (=120) or 120 or 12 or 1200 or 600 or 24 oe Or (3.1 x 10) + (2.2 x 20) + (0.9 x 10) or 31 + 44 + 9(=84) or 84 or 8.4 or 840 or 420 or 16.8 oe			M1	For a correct method to work out the total area (by using freq density, counting squares, oe) or for a correct method to work out the total area less than 40 calls (by using freq density, counting squares, oe). Allow one error
$\frac{84}{120}$ or $\frac{8.4}{12}$ or $\frac{840}{1200}$ or $\frac{8}{24}$ or $\frac{420}{600}$ or $\frac{16.8}{24}$ oe			M1ft	For a correct fraction $\frac{a}{120}$ oe, or $\frac{84}{b}$ oe where $a < 120$ *oe and* $b > 84$ oe
	70		A1	cao

Question 25

19

19	4	M1 for 130 − 96 (=34) M1 for 73 − 55 (=18) M1 for "34" − 9 − "18" + 12 A1cao **OR** M1 for. 96 − 55 − 12 (=29) M1 for 9 + "29" (=38) M1 for 130 − 73 − "38" A1 cao

Question 26

3.1 cm

3.1	2	M1 for sight of the 11th value or 31 A1 cao

Question 27

$\frac{8}{45}$

$x = 0.1777....$ and $10x = 1.777..$ $9x = 1.6$	16/90 oe		See at least 3 sevens or recurring symbol. Condone omission of x. M1 Accept $10x = 1.777..$ and $100x = 17.77..$ A1 Must be integers in numerator and denominator but not 8 & 45 N.B for 0.1777 = 1/10 + 0.0777.. (0.777 needs to be shown to be 7/90 to gain first M1)

Question 28

any value in the range £ 9068.8 to £ 9069

8000×1.045 oe (=8360)			M1	or 8000×1.0275^3 (=8678.316375)	M2 for $8000 \times 1.045 \times 1.0275^3$
"8360" $\times 1.0275^3$ oe			M1	"8678.316375" × 1.045	
	9068.84	3	A1	accept 9069 and answers in the range 9068.8(0) - 9068.9(0) SC: B1 for an answer of 9020 (8000 + 360 + 3×220)	

Question 29

any value in the range $x =$ 4.4 % to $x =$ 4.5 %

(b)	4.5	P1	for a process to find multiplier for 6 year period, eg 325 ÷ 250 oe (= 1.3) or 130(%) or for $250000 \times y^6 = 325000$
		P1	for a process to find multiplier for one year, eg ("1.3")$^{\frac{1}{6}}$ or 1.044…or 1.045
		A1	4.4 – 4.5

Question 30

90 dollars

13.50 ÷ 15 (=0.9) **or** 100 † 15 (=6.6….)			M1	M1 for 13.5 ÷ 3 (=4.5) (=5%)	M2 for 13.5 ÷ 0.15
"0.9" × 100 (=90) **or** "6.6…" × 13.5(0)			M1 dep	M1 for 4.5 × 20	
	90	3	A1		

Question 31

6

6	B1	cao	

Question 32

$3c^4$

$3c^4$	2	B2	B1 for 3 B1 for c^4

Question 33

$\frac{5y}{8x^3}$

$\frac{5y}{8x^3}$	2	M1 for correct square root or correct use of reciprocal eg $\frac{8x^3}{5y}$ **or** $\frac{25y^2}{64x^6}$ A1 for $\frac{5y}{8x^3}$ **or** $\frac{5}{8}yx^{-3}$ oe

Question 34

$n = 2x - 6y$

$2^{\frac{1}{2}n} = \frac{2^x}{(2^3)^y}$			M1	for writing 8 as 2^3 or $2^{\frac{1}{2}n}$ on lhs
$2^{\frac{1}{2}n} = 2^{x-3y}$			M1	for 2^{x-3y} **or** $\frac{1}{2}n = x - 3y$
	$n = 2x - 6y$	3	A1	or for $n = 2(x - 3y)$ **or** $n = (x - 3y) \div 0.5$

Question 35

$n(A \cup B) =$ 31

31	1	B1	or ft from diagram

Question 36

$x =$ 54 °

730	5	M1 for $\frac{5}{100}\times 200$ (= 10) oe M1 for $\frac{10}{100}\times 350$ (= 35) oe M1 for 6 × '10' **or** 4 × '35' M1 (dep on M1 earned for a correct method for a percentage calculation) for "60" + "140"+ 530 A1 cao **Or** M1 for 6 × 200 (= 1200) or 4 × 350 (= 1400) M1 for $\frac{5}{100}\times$"1200"(= 60) oe M1 for $\frac{10}{100}\times$"1400"(= 140) oe M1(dep on M1 earned for a correct method for a percentage calculation) for "60" + "140"+ 530 A1 cao

Question 37

068 °

$(BC^2 =)3.8^2 + 6.4^2 - 2\times3.8\times6.4\cos120^\circ$ (= 79.72)			M1 correct use of Cosine rule to find BC	Award M2 A1 for $BC = 8.9 - 8.93$ **or** $\sqrt{79.72}$ **or** $\sqrt{\frac{1993}{25}}$ oe
$(BC^2 =)$ 14.44 + 40.96 + 24.32 (=79.72)			M1 correct order of operations	
			A1 for $BC = 8.9 - 8.93$ **or** $\sqrt{79.72}$ **or** $\sqrt{\frac{1993}{25}}$ oe	
$\frac{\sin C}{6.4} = \frac{\sin 120}{"8.92.."}$ **or** $6.4^2 = 3.8^2 + "8.92"^2 - 2\times3.8\times"8.92"\times\cos C$			M1 correct use of Sine rule or Cosine rule to find angle C	Award M2 for $C = 38 - 38.5$ Award M2 for $B = 21.5 - 22$ **and** $C = 180 - 120 - B$
$\sin C = \frac{6.4\times0.866...}{"8.92.."} (= 0.62\ldots)$ **or** $\cos C = \frac{3.8^2 + "8.92"^2 - 6.4^2}{2\times3.8\times"8.92"}$ (=0.78…) $C = 38 - 38.5$			M1 correct rearrangement	
	068	6	A1 (0)68 − (0)68.4	
Alternative CD is the perpendicular from C to BA produced. $\angle CAD = 60^\circ$ **or** $ACD = 30^\circ$			M1 uses triangle CAD and $\angle CAD = 60^\circ$ **or** $ACD = 30^\circ$ ***CD* may not be drawn in but can be implied**	
$AD = 3.8\cos60^\circ$ **or** 3.8sin30 (= 1.9)			M1 for correct method to find horizontal length	
$BD = 6.4+1.9$ (= 8.3)			A1 for $BD = 8.3$	
$CD = 3.8\sin60$ **or** 3.8cos30 (=3.29)			M1	
$\tan BCD = \frac{8.3}{3.8\sin 60}$ oe			M1	
	068		A1 (0)68 − (0)68.4	

Question 38

angle $ABF = 70^\circ$

CB extended to form *CG*	Reasoning	B1	for 35 **or** 75 **or** 145 **or** 105 **or** *DEF* = 70, marked on the diagram or 3 letter description
		M1	for 180−70−35 **or** 180−75−35 **or** a correct pair of angles that would lead to 75 or 70, eg *AFB* = 35 and *FAB* = 75 **or** *AFB* = 35 and *ABG* = 75 **or** *FBC* = 35 and *ABG* = 75 **or** *EDF* = 75 and *DEF* = 70 **or** *FDC* = 105 and *FBC* = 35 **or** *ABC* = 105 and *FBC* = 35
		C2	(dep on B1M1) All figures correct with all appropriate reasons stated. Angles must be clearly labelled or on the diagram. Full solution must be seen
		(C1	(dep on B1 or M1) for one reason clearly used and stated.) Corresponding angles are equal, alternate angles are equal, opposite angles in a parallelogram are equal, angles in a triangle sum to 180, angles on a straight line sum to 180, vertically opposite angles are equal, vertically opposite angles are equal, angles in a quadrilateral sum to 360, co-interior angles sum to 180, allied angles sum to 180, angles around a point sum to 360

Question 39

$n =$ 10 sides

finds int angle of pentagon $\frac{(5-2)\times180}{5}$	finds ext angle of pentagon $\frac{360}{5}$		5	M1	for $\frac{(5-2)\times180}{5}$ or $\frac{360}{5}$	Award M1A1 for int angle of pentagon shown as 108° or ext angle shown as 72° on printed diagram or on candidate's own diagram
108	72			A1	for 108 or 72	
If there is *clear* evidence the candidate thinks the *interior* angle is 72° or the *exterior* angle is 108°, do not award the above two marks.						
int angle of polygon = 144 or ext angle of polygon = 36				B1	for int angle of polygon = 144 or ext angle of polygon = 36	Award B1 for int angle of polygon shown as 144° or ext angle shown as 36° on printed diagram or candidate's own diagram
$\frac{360}{36}$ or $\frac{180(n-2)}{n}=144$ oe				M1	for $\frac{360}{36}$ or $\frac{180(n-2)}{n}=144$ oe	
			10	A1	for 10 cao Award no marks for an answer of 10 with no working Award 5 marks for an answer of 10 if at least the first M1A1 are awarded	

Question 40

$w = 90 + \frac{1}{2}x$

shown	M1	for use of parallel lines to find an angle, e.g. angle $BEF = x$
	M1	(dep M1) for second step, e.g. for angle $EBF = \frac{180 - x}{2}$ oe or angle $EFB = \frac{180 - x}{2}$ oe
	M1	for complete method leading to $w = 90 + \frac{1}{2}x$
	C1	for complete set of reasons linked to method: Alternate angles are equal Base angles of an isosceles triangle are equal, Angles in a triangle add up to 180 Angles on a straight line add up to 180

Question 41

35 cm^2

½ (6+8)x5 or ½ x2x5 + 6x5	35	2	M1 A1

Question 42

(2, 1⅓, 1)	2	M1 for finding coordinates of P (6, 4, 3) or $OT = \frac{1}{3}\ OP$ or 2 correct coordinate values A1 oe

Question 43

120000 cm^2

100^2 or 10 000			M1 e.g. 12×100^2
	120 000	2	A1

Question 44

65 hours

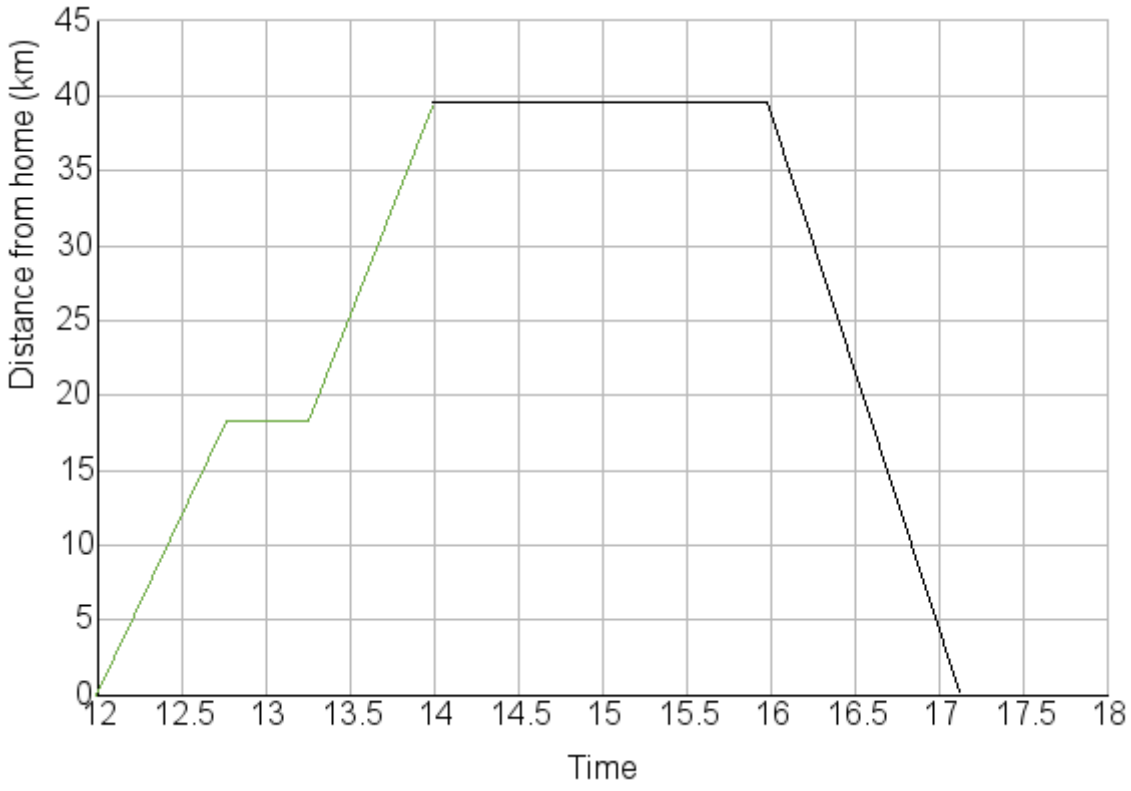
65	5	M1 for splitting up the cross section into separate areas and a method to find the area of one part OR for splitting up the pool into smaller prisms and a method to find the volume of one small prism, e.g. a cuboid M1 (dep) for a complete method to find the area of the cross section [with correct dimensions] OR for a method to find the total volume of more than one correct prism M1 (dep) for a complete method to find the volume of the pool [with correct dimensions] (= 195) M1 for "195" × 1000 ÷ 50 (=3900) oe where "195" comes from a volume A1 cao

Question 45

8.4 g/cm ^{3}

8.4	3	M1 for using $d = m/v$ e.g. $11.34 = 74 / V$ or vol. of lead (= 6.5(25...) or vol. of tin (= 17.2(3...) M1 (dep) for a complete method using 200 ÷ "total volume" A1 for answer in range 8.4 to 8.44

Question 46



Horizontal line from (1400,39) to (1600,39) Line from ("1600", 39) to (1715, 0)	2	B1 B1ft		ft if line finishes at (17 15, 0) (± 5 mins) and starts at height 39km

Question 47

135 cm

$13.5^2 + 60^2$ or 182.25 + 3600 or 3782.25 $\sqrt{"3782.25"}$ or awrt 61.5 13.5 + 60 + $\sqrt{"3782.25"}$ or 13.5 + 60 + 61.5	135	4	M1 M1 M1 A1	For squaring and adding (Dep) for square root Dep cao NB: A0 if 61.5 is rounded from an inexact value (eg 61.505…)
Alternative method – using Trigonometry Eg $A = 77.3(196\ldots)$ **and** sin"77.3" = $\frac{60}{AC}$ $(AC =) \frac{60}{\sin"77.3"}$ or awrt 61.5 13.5 + 60 + $\frac{60}{\sin"77.3"}$ or 13.5 + 60 + 61.5	135	4	M1 M1 M1 A1	For finding a correct angle **AND** a correct trig statement (Dep) For an expression for AC Dep cao NB: A0 if 61.5 is rounded from an inexact value (eg 61.505…)

Question 48

$x = 11.8$ or $x = 2.20$

(length =) $\frac{28-2x}{2}$ **or** $14 - x$ **or** $\sqrt{12^2 - x^2}$			M1	correct expression for length of rectangle **OR** a pair of correct simultaneous equations eg. $x^2 + y^2 = 12^2$ and $2x + 2y = 28$
$12^2 = x^2 + (14 - x)^2$ oe			M1	for correct equation in one variable accept other forms eg. $2\sqrt{12^2 - x^2} + 2x = 28$
$144 = x^2 + 196 - 28x + x^2$ **or** $144 = x^2 + \frac{784 - 112x + 4x^2}{4}$			M1	(indep) for expansion of brackets $196 - 28x + x^2$ **or** $\frac{784 - 112x + 4x^2}{4}$
$2x^2 - 28x + 52 = 0$ **or** $x^2 - 14x + 26 = 0$			A1	for a correct simplified quadratic equation
eg. $x = \frac{--14 \pm \sqrt{(-14)^2 - 4 \times 1 \times 26}}{2 \times 1}$			M1	ft for correct substitution into quadratic formula for their quadratic (condone one sign error; condone missing brackets and 14^2)
eg. $\frac{14 \pm \sqrt{92}}{2}$ **or** $7 \pm \sqrt{23}$			M1	(indep) correct simplification of discriminant for correct quadratic equation
	11.8, 2.20	7	A1	answers in the ranges 11.7 - 11.8 and 2.2 - 2.21 dep on a correct quadratic equation and at least M4

Question 49

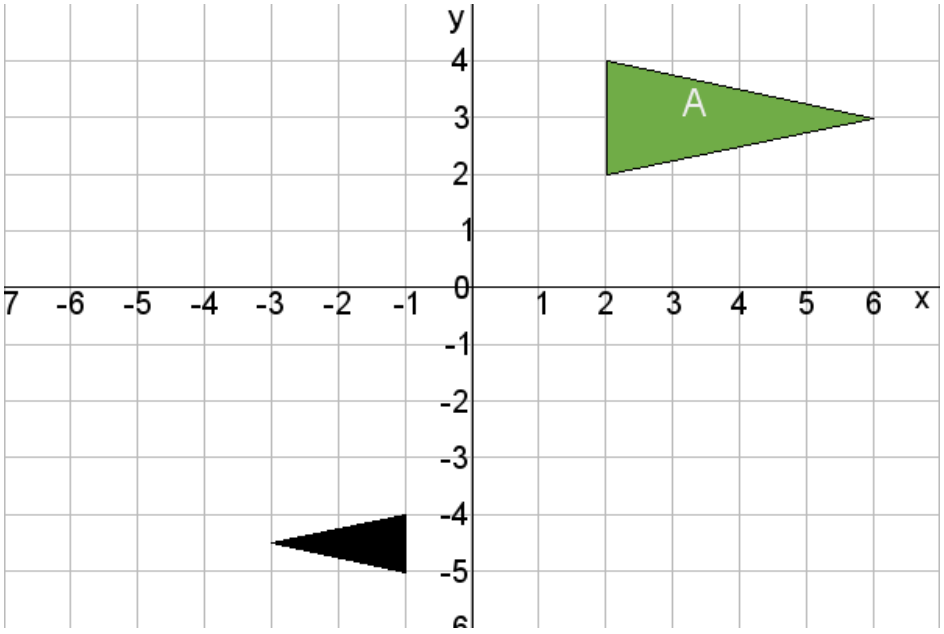
Proof	3	M1 for one pair of equal angles or sides with reason M1 for second pair of equal angles or sides with reason C1 for proof completed correctly with full reasons and reason for congruence Acceptable reasons: *AD* common (oe eg both same) Angle *BAD* = angle *CDA* (angles in a semicircle are 90°) Angle *ABO* = angle *DCA* (angles in the same segment are equal) Triangle *ABD* and triangle *DCA* are congruent - ASA **OR** *BD* = *CA* (diameters of the circle) Angle *BAD* = angle *CDA* (angles in a semicircle are 90°.) *AD* common Triangle *ABD* and triangle *DCA* are congruent - RHS **OR** *BD* = *CA* (diameters of the circle) *AD* is common Angle *ADB* = angle *CAD* (base angles of an isosceles triangle are equal.) Triangle *ABD* and triangle *DCA* are congruent - SAS

Question 50

$EC =$ 4.7 cm

eg. 28.2 − 28.2 ÷ "1.2" **or** 28.2 ÷ 6 oe			M1ft	for a complete method ft from "1.2" used in (a) which must come from a correct method
	4.7	2	A1	

Question 51



Triangle with vertices at (−1,−4), (−1,−5), (−3,−4.5)	2	M1 for correct shape and size and the correct orientation in the wrong position or two vertices correct A1 cao

Question 52

56.3 cm ^{2}

$\frac{\sin 47}{13.8} = \frac{\sin MLN}{8.5}$			AO2	M1	Or method using a right angled triangle to find length MX (MX is perpendicular to LN) $\sin 47 = \frac{MX}{8.5}$
$MLN = \sin^{-1}\left(\frac{\sin 47 \times 8.5}{13.8}\right)$				M1	Or $\cos^{-1} = \frac{8.5\sin 47}{13.8}$
$MLN = 26.7(73...)$				A1	$LMX = 63.232$
$LMN = 180 - 47 - '26.7...'$ or 106(.2260622…)				M1	$LMN = 63.232 + (180 - (90+47))\ldots$ or 106(.2260622…)
$\frac{1}{2} \times 8.5 \times 13.8 \times \sin("106")$				M1	
	56.3	6		A1	Accept an answer that rounds to 56.3 or 56.4 unless clearly obtained from incorrect working.

Question 53

6.66 cm

$\frac{AB}{\sin 28} = \frac{10.2}{\sin 134}$				M1
(AB =) $\sin 28 \times \frac{10.2}{\sin 134}$				M1 isolate AB correctly (14.17 or 14.18 or 14.2 for $\frac{10.2}{\sin 134}$)
	6.66	3		A1 (6.65695....) awrt 6.66

Question 54

Correct statement	C1	for substituting both 1 and 2 into $x^3 + x$ or into $x^3 + x - 7$	All arithmetic shown must be correct. Ignore any additional trials shown.
	C1	for values 2 and 10 plus explanation that these are above and below 7, or for values -5 and 3 plus explanation that there is a change of sign, thus implying a solution lies between 1 and 2	

Question 55

1.74	M1	for substitution of 2 into the formula eg $\sqrt[3]{7-2}$ (= 1.70997…)	$x_1 = 1.70997....$ $x_2 = 1.74241....$ $x_3 = 1.73884....$ Accept an accuracy of 2 dp or more rounded or truncated for values of x_1 and x_2 Award the marks for 1.7 on the answer line provided correct iterations are shown in the working space.
	M1	for a substitution of x_1 to give x_2 (= 1.74241...)	
	A1	for answer in the range 1.738 to 1.74	

Question 56

(a)		2	M1	for start to express the common ratio algebraically, eg $1/(\sqrt{x} - 1)$ or $(\sqrt{x} + 1)/1$ or $\sqrt{x} + 1 = k \times 1$ or $1 = k \times (\sqrt{x} - 1)$
			M1	for setting up an appropriate equation in x, eg $1/(\sqrt{x} - 1) = (\sqrt{x} + 1)/1$
			C1	for convincing argument to show $x = 2$

Question 57

0.98	B1	cao