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EDEXCEL GCSE (9-1) MATHS: QUESTIONS BY TOPIC

Powers, Roots, Standard Form & Surds (N3)

GCSE (9-1) Mathematics (1MA1) · Higher tier

58 questions · 191 marks · Mark schemes included

Past papers June 2017 - June 2025 · 3 sub-topics

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

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QUESTIONS

58 questions · 191 marks · 3 sub-topics

SUB-TOPIC N3a

POWERS, ROOTS & INDEX LAWS

Sub-topic N3a · 25 questions · 83 marks · lowest tariff first



11 In May 2019, the distance between Earth and Mars was 3.9×10^7 km.

In May 2019, a signal was sent from Earth to Mars.

Assuming that the signal sent from Earth to Mars travelled at a speed of 3×10^5 km per second,

(a) how long did the signal take to get to Mars?

..... seconds
(2)

The speed of the signal sent from Earth to Mars in May 2019 was actually less than 3×10^5 km per second.

(b) How will this affect your answer to part (a)?

.....
(1)

(Total for Question 11 is 3 marks)

12 Patrick has to work out the exact value of $64^{\frac{1}{4}}$

Patrick says,

“ $\frac{1}{4}$ of 64 is 16 so $64^{\frac{1}{4}} = 16$ ”

Explain what is wrong with what Patrick says.

.....
(Total for Question 12 is 1 mark)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$

(Total for Question 1 is 2 marks)

2 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

(2)

(b) Make s the subject of $v^2 = u^2 + 2as$

(2)

(Total for Question 2 is 4 marks)



11 Freya writes down the value of x , correct to 1 decimal place.

She writes $x = 6.4$

Complete the error interval for x .

..... $\leq x <$

(Total for Question 11 is 2 marks)

12 $(ax^6)^{\frac{1}{n}} = 7x^3$

Work out the value of a and the value of n .

$a =$

$n =$

(Total for Question 12 is 2 marks)



3 Simplify $(2^{-5} \times 2^8)^2$

Give your answer as a power of 2

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

(Total for Question 4 is 2 marks)



17 Work out the value of $\left(\frac{8}{27}\right)^{\frac{4}{3}}$

.....
(Total for Question 17 is 2 marks)



- 9 $3x^{-1}(4x - x^3) = a + bx^n$ for all the values of x that are not zero.

Find the value of a , the value of b and the value of n .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

$$n = \dots\dots\dots$$

(Total for Question 9 is 2 marks)

- 10 Solve $\frac{14 - x}{3} = 3x$

$$x = \dots\dots\dots$$

(Total for Question 10 is 2 marks)



18 $16^{\frac{1}{5}} \times 2^x = 8^{\frac{3}{4}}$

Work out the exact value of x .

(Total for Question 18 is 3 marks)



10 (a) Write down the value of $100^{\frac{1}{2}}$

.....
(1)

(b) Find the value of $125^{\frac{2}{3}}$

.....
(2)

(Total for Question 10 is 3 marks)

- 11 3 teas and 2 coffees have a total cost of £7.80
5 teas and 4 coffees have a total cost of £14.20

Work out the cost of one tea and the cost of one coffee.

tea £.....

coffee £.....

(Total for Question 11 is 4 marks)



7 (a) Simplify $(p^2)^5$

.....
(1)

(b) Simplify $12x^7y^3 \div 6x^3y$

.....
(2)

(Total for Question 7 is 3 marks)



- 19 Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of x .

$x =$

(Total for Question 19 is 3 marks)



11 Write $\frac{(6x^5y^3)^2}{3x^2y^7 \times 4xy^{-3}}$ in the form ax^by^c where a , b and c are integers.

(Total for Question 11 is 3 marks)



14 Work out the value of $27^{\frac{2}{3}} + \left(\frac{1}{2}\right)^{-3}$

(Total for Question 14 is 3 marks)



20 $2^x = \frac{2^n}{\sqrt[3]{2}}$ $2^y = (\sqrt{2})^5$

Given that $x + y = 8$

work out the value of n .

$$n = \dots\dots\dots$$

(Total for Question 20 is 3 marks)



12 (a) Find the value of $81^{-\frac{1}{2}}$

.....
(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

.....
(2)

(Total for Question 12 is 4 marks)

13 The table shows a set of values for x and y .

x	1	2	3	4
y	9	$2\frac{1}{4}$	1	$\frac{9}{16}$

y is inversely proportional to the square of x .

(a) Find an equation for y in terms of x .

.....
(2)

(b) Find the positive value of x when $y = 16$

.....
(2)

(Total for Question 13 is 4 marks)

6 $p^3 \times p^x = p^9$

(a) Find the value of x .

$$x = \dots\dots\dots (1)$$

$$(7^2)^y = 7^{10}$$

(b) Find the value of y .

$$y = \dots\dots\dots (1)$$

$100^a \times 1000^b$ can be written in the form 10^w

(c) Show that $w = 2a + 3b$

(2)

(Total for Question 6 is 4 marks)



9 (a) Write down the value of $36^{\frac{1}{2}}$

.....
(1)

(b) Write down the value of 23^0

.....
(1)

(c) Work out the value of $27^{-\frac{2}{3}}$

.....
(2)

(Total for Question 9 is 4 marks)



14 (a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}}$

.....
(2)

$$3^a = \frac{1}{9} \quad 3^b = 9\sqrt{3} \quad 3^c = \frac{1}{\sqrt{3}}$$

(b) Work out the value of $a + b + c$

.....
(2)

(Total for Question 14 is 4 marks)



8 Solve $x^2 = 5x + 24$

(Total for Question 8 is 3 marks)

9 (a) Write down the value of 7^0

(1)

(b) Find the value of $3 \times 3^6 \times 3^{-6}$

(1)

(c) Find the value of 2^{-4}

(1)

(d) Find the value of $27^{\frac{1}{3}}$

(1)

(Total for Question 9 is 4 marks)



18 Work out the value of $\frac{\left(5\frac{4}{9}\right)^{-\frac{1}{2}} \times \left(4\frac{2}{3}\right)}{2^{-3}}$

You must show all your working.

(Total for Question 18 is 4 marks)



9 (a) Express $\sqrt{\frac{10^{360}}{10^{150} \times 10^{90}}}$ as a power of 10

.....
(3)

Liam was asked to express $(12^{50})^2$ as a power of 12

Liam wrote $(12^{50})^2 = 12^{50^2} = 12^{2500}$

Liam's method is wrong.

(b) Explain why.

.....
.....
.....
(1)

(Total for Question 9 is 4 marks)



13 y is directly proportional to x .

$$y = 24 \text{ when } x = 1.5$$

Work out the value of y when $x = 5$

$$y = \dots\dots\dots$$

(Total for Question 13 is 3 marks)

14 (a) Write $\frac{1}{16}$ in the form 4^n where n is an integer.

.....
(1)

(b) Work out the value of $8^{\frac{5}{3}} - 9^{\frac{3}{2}}$

.....
(3)

(Total for Question 14 is 4 marks)



2 (a) (i) Write down the value of 5^0

.....
(1)

(ii) Write down the value of 5^{-2}

.....
(1)

(b) Write $\frac{2^5 \times 2^4}{2^3}$ in the form 2^n where n is an integer.

.....
(2)

(Total for Question 2 is 4 marks)



11 $\frac{3^n \times 3^{20}}{3^8} = 3^{14}$

(a) Find the value of n .

$n = \dots\dots\dots$
(2)

(b) Write $(64m^{12})^{\frac{2}{3}}$ in the form am^b where a and b are integers.

$\dots\dots\dots$
(2)

(Total for Question 11 is 4 marks)

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $m^3 \times m^4$

.....
(1)

(b) Simplify $(5np^3)^3$

.....
(2)

(c) Simplify $\frac{32q^9r^4}{4q^3r}$

.....
(2)

(Total for Question 1 is 5 marks)



11 (a) Find the value of $\sqrt[4]{81 \times 10^8}$

.....
(2)

(b) Find the value of $64^{-\frac{1}{2}}$

.....
(2)

(c) Write $\frac{3^n}{9^{n-1}}$ as a power of 3

.....
(2)

(Total for Question 11 is 6 marks)



SUB-TOPIC N3b

STANDARD FORM

Sub-topic N3b · 20 questions · 58 marks · lowest tariff first



- 7 Work out $(13.8 \times 10^7) \times (5.4 \times 10^{-12})$
Give your answer as an ordinary number.

(Total for Question 7 is 2 marks)



7 £360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2 : 7

Chloe and Denesh each get 1.5 times the amount Abby gets.

Work out the amount of money that Ben gets.

£.....

(Total for Question 7 is 4 marks)

8 (a) Write 0.00562 in standard form.

.....
(1)

(b) Write 1.452×10^3 as an ordinary number.

.....
(1)

(Total for Question 8 is 2 marks)



6 The n th term of a sequence is $2n^2 - 1$

The n th term of a different sequence is $40 - n^2$

Show that there is only one number that is in both of these sequences.

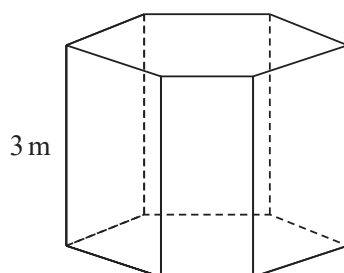
(Total for Question 6 is 3 marks)

7 Work out $(3.42 \times 10^{-7}) \div (7.5 \times 10^{-6})$
Give your answer in standard form.

(Total for Question 7 is 2 marks)



- 8 The diagram shows a prism placed on a horizontal floor.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The prism has height 3 m

The volume of the prism is 18 m^3

The pressure on the floor due to the prism is 75 newtons/m^2

Work out the force exerted by the prism on the floor.

..... newtons

(Total for Question 8 is 3 marks)

- 9 Write these numbers in order of size.
Start with the smallest number.

6.72×10^5

67.2×10^{-4}

672×10^4

$0.000\,672$

.....

(Total for Question 9 is 2 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** (a) Write 468 000 in standard form.

.....
(1)

- (b) Write 5.037×10^{-4} as an ordinary number.

.....
(1)

(Total for Question 1 is 2 marks)



8 $1.25 \times 10^{-12} = k \times (4 \times 10^{-20})$

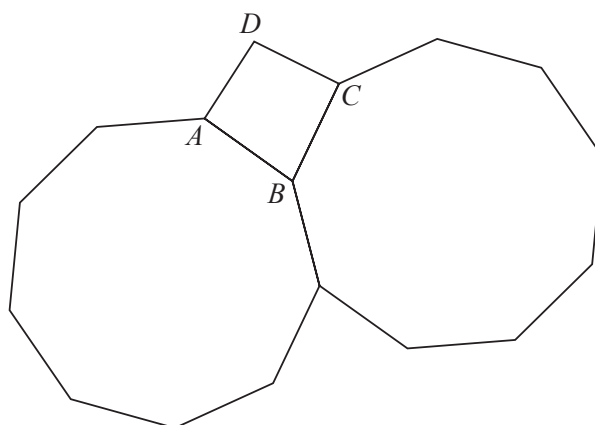
Work out the value of k .

Give your answer in standard form.

$k = \dots\dots\dots$

(Total for Question 8 is 2 marks)

- 9 The diagram shows two congruent regular 9-sided polygons.
 $ABCD$ is a quadrilateral.



Show that $ABCD$ is **not** a square.

(Total for Question 9 is 3 marks)

- 2 (a) Write 3.402×10^5 as an ordinary number.

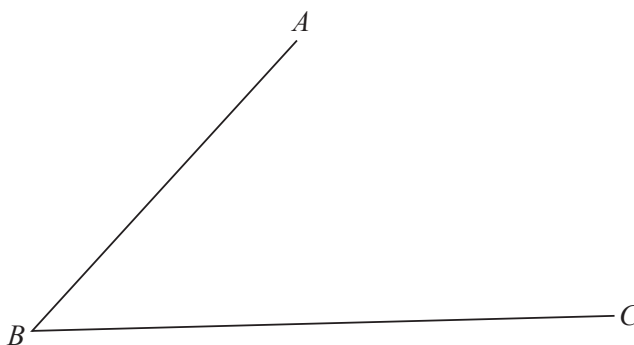
.....
(1)

- (b) Write 0.8026 in standard form.

.....
(1)

(Total for Question 2 is 2 marks)

- 3 Use ruler and compasses to construct the bisector of angle ABC .
You must show your construction lines.



(Total for Question 3 is 2 marks)

- 9 (a) Write 5.73×10^6 as an ordinary number.

.....
(1)

- (b) Write 0.035 in standard form.

.....
(1)

(Total for Question 9 is 2 marks)

- 10 Use your calculator to work out $\frac{(1.8^3 \times \cos 35^\circ)^2}{\sqrt[3]{17.4 - \tan 85^\circ}}$

Give your answer correct to 3 significant figures.

.....
(Total for Question 10 is 2 marks)



- 7 There are 10 boys and 20 girls in a class.
The class has a test.

The mean mark for all the class is 60

The mean mark for the girls is 54

Work out the mean mark for the boys.

.....
(Total for Question 7 is 3 marks)

- 8 (a) Write 7.97×10^{-6} as an ordinary number.

.....
(1)

- (b) Work out the value of $(2.52 \times 10^5) \div (4 \times 10^{-3})$
Give your answer in standard form.

.....
(2)

.....
(Total for Question 8 is 3 marks)



- 7 (a) Write the number 0.000 086 23 in standard form.

.....
(1)

(b) Work out $\frac{3.2 \times 10^3 + 5.1 \times 10^{-2}}{4.3 \times 10^{-4}}$

Give your answer in standard form, correct to 3 significant figures.

.....
(2)

(Total for Question 7 is 3 marks)



11 In May 2019, the distance between Earth and Mars was 3.9×10^7 km.

In May 2019, a signal was sent from Earth to Mars.

Assuming that the signal sent from Earth to Mars travelled at a speed of 3×10^5 km per second,

(a) how long did the signal take to get to Mars?

..... seconds
(2)

The speed of the signal sent from Earth to Mars in May 2019 was actually less than 3×10^5 km per second.

(b) How will this affect your answer to part (a)?

.....
(1)

(Total for Question 11 is 3 marks)

12 Patrick has to work out the exact value of $64^{\frac{1}{4}}$

Patrick says,

“ $\frac{1}{4}$ of 64 is 16 so $64^{\frac{1}{4}} = 16$ ”

Explain what is wrong with what Patrick says.

.....
.....
.....
(Total for Question 12 is 1 mark)



7 (a) Write 32 460 000 in standard form.

.....
(1)

(b) Write 4.96×10^{-3} as an ordinary number.

.....
(1)

Asma was asked to compare the following two numbers.

$$A = 6.212 \times 10^8 \quad \text{and} \quad B = 4.73 \times 10^9$$

She says,

“6.212 is bigger than 4.73 so A is bigger than B .”

(c) Is Asma correct?

You must give a reason for your answer.

.....
.....
.....
(1)

(Total for Question 7 is 3 marks)



9 (a) Write 6.75×10^{-4} as an ordinary number.

.....
(1)

(b) Work out $\frac{2.56 \times 10^6 \times 4.12 \times 10^{-3}}{1.6 \times 10^{-2}}$
Give your answer in standard form.

.....
(2)

(Total for Question 9 is 3 marks)



- 5 Work out $5.7 \times 10^2 + 9.8 \times 10^3$
Give your answer in standard form.

(Total for Question 5 is 3 marks)



10 The table shows some information about eight planets.

Planet	Distance from Earth (km)	Mass (kg)
Earth	0	5.97×10^{24}
Jupiter	6.29×10^8	1.898×10^{27}
Mars	7.83×10^7	6.42×10^{23}
Mercury	9.17×10^7	3.302×10^{23}
Neptune	4.35×10^9	1.024×10^{26}
Saturn	1.28×10^9	5.68×10^{26}
Uranus	2.72×10^9	8.683×10^{25}
Venus	4.14×10^7	4.869×10^{24}

(a) Write down the name of the planet with the greatest mass.

.....
(1)

(b) Find the difference between the mass of Venus and the mass of Mercury.

..... kg
(1)

Nishat says that Neptune is over a hundred times further away from Earth than Venus is.

(c) Is Nishat right?

You must show how you get your answer.

.....
(2)

(Total for Question 10 is 4 marks)



9 $T = \sqrt{\frac{w}{d^3}}$

$$w = 5.6 \times 10^{-5}$$

$$d = 1.4 \times 10^{-4}$$

- (a) Work out the value of T .

Give your answer in standard form correct to 3 significant figures.

$$T = \dots\dots\dots (2)$$

w is increased by 10%

d is increased by 5%

Lottie says,

“The value of T will increase because both w and d are increased.”

- (b) Lottie is wrong.

Explain why.

.....
.....
(2)

(Total for Question 9 is 4 marks)



- 10** A person's heart beats approximately 10^5 times each day.
A person lives for approximately 81 years.

- (a) Work out an estimate for the number of times a person's heart beats in their lifetime.
Give your answer in standard form correct to 2 significant figures.

.....
(2)

2×10^{12} red blood cells have a total mass of 90 grams.

- (b) Work out the average mass of 1 red blood cell.
Give your answer in standard form.

..... grams
(2)

(Total for Question 10 is 4 marks)



3 (a) Write 4.5×10^5 as an ordinary number.

.....
(1)

(b) Write 0.007 in standard form.

.....
(1)

(c) Work out $4.2 \times 10^3 + 5.3 \times 10^2$
Give your answer in standard form.

.....
(2)

(Total for Question 3 is 4 marks)



4 (a) Write 1.63×10^{-3} as an ordinary number.

.....
(1)

(b) Write 438 000 in standard form.

.....
(1)

(c) Work out $(4 \times 10^3) \times (6 \times 10^{-5})$
Give your answer in standard form.

.....
(2)

(Total for Question 4 is 4 marks)



2 (a) (i) Write 5.3×10^4 as an ordinary number.

.....
(1)

(ii) Write 7.4×10^{-5} as an ordinary number.

.....
(1)

(b) Calculate the value of $9.7 \times 10^6 + 2.45 \times 10^7$
Give your answer in standard form.

.....
(2)

(Total for Question 2 is 4 marks)



SUB-TOPIC N3c

SURDS

Sub-topic N3c · 13 questions · 50 marks · lowest tariff first



20 Martin did this question.

Rationalise the denominator of $\frac{14}{2 + \sqrt{3}}$

Here is how he answered the question.

$$\begin{aligned}\frac{14}{2 + \sqrt{3}} &= \frac{14 \times (2 - \sqrt{3})}{(2 + \sqrt{3})(2 - \sqrt{3})} \\ &= \frac{28 - 14\sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} + 3} \\ &= \frac{28 - 14\sqrt{3}}{7} \\ &= 4 - 2\sqrt{3}\end{aligned}$$

Martin's answer is wrong.

(a) Find Martin's mistake.

(1)

Sian did this question.

Rationalise the denominator of $\frac{5}{\sqrt{12}}$

Here is how she answered the question.

$$\begin{aligned}\frac{5}{\sqrt{12}} &= \frac{5\sqrt{12}}{\sqrt{12} \times \sqrt{12}} \\ &= \frac{5 \times 3\sqrt{2}}{12} \\ &= \frac{5\sqrt{2}}{4}\end{aligned}$$

Sian's answer is wrong.

(b) Find Sian's mistake.

(1)

(Total for Question 20 is 2 marks)



- (b) Work out an estimate for the distance the car travels in the first 6 seconds after it starts to slow down.
Use 3 strips of equal width.

..... m

(3)

(Total for Question 14 is 6 marks)

- 15 Given that a is a prime number, rationalise the denominator of $\frac{1}{\sqrt{a} + 1}$
Give your answer in its simplest form.

.....

(Total for Question 15 is 2 marks)



20 The table shows some values of x and y that satisfy the equation $y = a \cos x^\circ + b$

x	0	30	60	90	120	150	180
y	3	$1 + \sqrt{3}$	2	1	0	$1 - \sqrt{3}$	-1

Find the value of y when $x = 45$

(Total for Question 20 is 4 marks)

21 Show that $\frac{6 - \sqrt{8}}{\sqrt{2} - 1}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

(Total for Question 21 is 3 marks)



12 Prove that the square of an odd number is always 1 more than a multiple of 4

(Total for Question 12 is 4 marks)

13 $\sqrt{5}(\sqrt{8} + \sqrt{18})$ can be written in the form $a\sqrt{10}$ where a is an integer.

Find the value of a .

$a = \dots\dots\dots$

(Total for Question 13 is 3 marks)



20 Show that $\frac{(\sqrt{18} + \sqrt{2})^2}{\sqrt{8} - 2}$ can be written in the form $a(b + \sqrt{2})$ where a and b are integers.

(Total for Question 20 is 3 marks)



16 There are only n orange sweets and 1 white sweet in a bag.

Saira takes at random a sweet from the bag and eats the sweet.

She then takes at random another sweet from the bag and eats this sweet.

Show that the probability that Saira eats two orange sweets is $\frac{n-1}{n+1}$

(Total for Question 16 is 2 marks)

17 (a) Rationalise the denominator of $\frac{1}{\sqrt{7}}$

.....
(1)

(b) Simplify fully $\sqrt{80} - \sqrt{5}$

.....
(2)

(Total for Question 17 is 3 marks)



20 Show that $\frac{\sqrt{180} - 2\sqrt{5}}{5\sqrt{5} - 5}$ can be written in the form $a + \frac{\sqrt{5}}{b}$ where a and b are integers.

(Total for Question 20 is 4 marks)



19 Show that $\frac{8 + \sqrt{12}}{5 + \sqrt{3}}$ can be written in the form $\frac{a + \sqrt{3}}{b}$, where a and b are integers.

(Total for Question 19 is 4 marks)



23 Write $\frac{3\sqrt{3}}{4 - \sqrt{3}} - \frac{2}{\sqrt{3}}$ in the form $\frac{a\sqrt{3} + b}{c}$ where a , b and c are integers.

(Total for Question 23 is 4 marks)



18 (a) Express $\sqrt{3} + \sqrt{12}$ in the form $a\sqrt{3}$ where a is an integer.

.....
(2)

(b) Express $\left(\frac{1}{\sqrt{3}}\right)^7$ in the form $\frac{\sqrt{b}}{c}$ where b and c are integers.

.....
(3)

(Total for Question 18 is 5 marks)



- 15 Express $0.4\dot{1}\dot{8}$ as a fraction.
You must show all your working.

(Total for Question 15 is 3 marks)

- 16 (a) Rationalise the denominator of $\frac{22}{\sqrt{11}}$
Give your answer in its simplest form.

(2)

- (b) Show that $\frac{\sqrt{3}}{2\sqrt{3}-1}$ can be written in the form $\frac{a+\sqrt{3}}{b}$ where a and b are integers.

(3)

(Total for Question 16 is 5 marks)



- 16 (a) Rationalise the denominator of $\frac{15}{\sqrt{5}}$
Give your answer in its simplest form.

.....
(2)

- (b) Write $\frac{\sqrt{75} - 2}{1 + 2\sqrt{3}}$ in the form $\frac{a - b\sqrt{3}}{c}$ where a , b and c are integers.

.....
(4)

(Total for Question 16 is 6 marks)



- 16 (a) Rationalise the denominator of $\frac{35}{\sqrt{7}}$
Give your answer in its simplest form.

.....
(2)

$\frac{\sqrt{27}-1}{2-\sqrt{3}}$ can be written in the form $a + b\sqrt{3}$ where a and b are integers.

- (b) Work out the value of a and the value of b .

$a =$

$b =$

(4)

(Total for Question 16 is 6 marks)

Turn over for Question 17



MARK SCHEMES

official mark schemes, in the same order as the questions



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)	130	P1	for process to divide eg $(3.9 \times 10^7) \div (3 \times 10^5)$	Condone missing brackets
		A1	cao	Accept 1.3×10^2
(b)	Explanation	C1	Explanation referring to the time Acceptable examples The time will be more It will take longer The answer will be bigger Not acceptable examples The answer will be wrong The answer will be different	
12	Explanation	C1	for explanation eg needs to find 4th root or gives the correct answer of 2.828... Acceptable examples: He needs to find $\sqrt[4]{64}$ It should be 2.8... (or $2\sqrt{2}$) It is not asking for $64 \div 4$, it is asking what number to the power of 4 = 64 $64^{\frac{1}{4}}$ means the fourth root not a quarter of 64 $64^{\frac{1}{4}}$ means square root and square root again, not divide by 4 Not acceptable examples: It should be 2 The expression is 64 to the power of $\frac{1}{4}$ $64^{\frac{1}{4}}$ is not a $\frac{1}{4}$ of 64	



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	9	M1 A1	for a correct first step, using the laws of indices to simplify eg. 3^2 or $3^{7+ -2}$ or 3^{7-3} or 3^{-2-3} OR for using exact values, eg. $2187 \times \frac{1}{9}$ (= 243) or $2187 \div 27$ (= 81) or $\frac{1}{27 \times 9}$ (= $\frac{1}{243}$) cao	
2	(a) 6 or -6	M1 A1	for $12^2 + 2 \times -3 \times 18$ (= 36) for 6 or -6, accept ± 6	Terms may be partially evaluated. Only one value is required for full marks
	(b) $s = \frac{v^2 - u^2}{2a}$	M1 A1	for subtracting u^2 from both sides or dividing all terms by $2a$ as the first step $s = \frac{v^2 - u^2}{2a}$ oe	Must see this step carried out, not just the intention shown



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	6.35, 6.45	B1	for 6.35 in the correct position	Accept 6.449 oe or 6.4499... oe
		B1	for 6.45 in the correct position	
12	49, 2	P1	for setting up $6 \div n = 3$ oe or $7^n = a$ oe or one correct answer	Accept the figures written as a complete statement eg $(49x^6)^{\frac{1}{2}}$
		A1	cao	
13	(9, 8)	P1	for setting up an equation for one dimension (width) of the pattern eg $2b - a = 8$ oe or $2x + y = 8$ oe	a and b are the width and length x is the difference between the length and width, y is the width of the rectangle Both values correct implies this mark Award 0 marks for a correct answer with no supportive working.
		P1	for setting up an equation for the other dimension (height) of the pattern eg $2b + a = 16$ oe or $2x + 3y = 16$ oe	
		P1	(dep P2) for a full process to solve for both variables eg $4b = 24$, $b = 6$ and $12 - a = 8$, $a = 4$ or $8 = 2y$, $y = 4$ and $8 = 2x + y$, $x = 2$	
		P1	(dep P3) for a full process to find one of the coordinates of C eg $3 + 6 (= 9)$ or $4 + 4 (= 8)$ or $3 + 2 + 4 (= 9)$ or $4 + 4 (= 8)$	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
3	2^6	M1 A1	for the start of a method of simplification, eg $2^{-5+8} (= 2^3)$ or $2^{-5 \times 2} (= 2^{-10})$ or $2^{8 \times 2} (= 2^{16})$ cao SC B1 for answer of 64 or 8^2 or 4^3 if M0 scored.	
4	0.00128	M1 A1	for digits 128 or for correct placement of the decimal point following one arithmetical error, eg $32 \times 4 = 138$ with an answer of 0.00138 for 0.00128 or 1.28×10^{-3}	
5	7500	M1 A1	for method to find expected number of model B, eg $\frac{15}{80} \times 40000$ oe or $\frac{15}{23+15+30+12} \times 40000$ oe cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	$\frac{16}{81}$	M1	for showing the cube root of 8 = 2 and the cube root of 27 = 3 or an intention to find the cube root and raise to power 4 eg $\sqrt[3]{\left(\frac{8}{27}\right)^4}$ or $\left(\sqrt[3]{\frac{8}{27}}\right)^4$ or $\left(\frac{2}{3}\right)^4$	
		A1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	60.3	M1	for a correct trig statement, eg $\tan x = \frac{7}{4}$	Other methods are possible but only award this mark at the point of an equation with x as the only unknown
		A1	60.2 to 60.42	
8	25	P1	for working with density eg $8 \times 1500 (= 12\,000)$ or [density] $\times 1500$	P marks can be awarded in either order [density] is 8×10^3 Condone $8 \times 1500 \times 300$ for this mark only P marks can be awarded in either order [mass] must be what they believe to be mass following a calculation that uses 8 and 1500 but not 300
		P1	for a conversion, eg “12 000” $\div 1000 (= 12)$ or $\frac{8}{1000} (= 0.008)$ or $300 \times 1000 (= 300\,000)$ or [mass] $\div 1000$	
		A1	cao	
9	12, – 3, 2	B2	all correct	12 – 3 x^2 seen in working space gets B2 unless contradicted May be seen in an expression of the correct form, eg $a + bx^n$
		(B1	for one or two correct)	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
17		66.5	B1 P1 P1 P1 A1	for recognising an angle of 60 at AOB for a process to find the area of the sector, e.g. $\frac{60}{360} \times \pi \times 11^2$ (= 63.3.. or $\frac{121\pi}{6}$) for a process to find the area of the triangle, e.g. $\frac{1}{2} \times 7^2 \times \sin 60$ (=21.2.. or $\frac{49\sqrt{3}}{4}$) for a process to find the required percentage, e.g. $\frac{63.3.. - 21.2..}{63.3..} \times 100$ for answer in the range 66.5 to 66.6
18		1.45	P1 P1 A1 P1 A2	for converting to a common base with at least one correct conversion, eg. $(16 \Rightarrow) 2^4$ or $(8 \Rightarrow) 2^3$ (dep) for correct use of index laws to derive an equation, eg. $4 \times \frac{1}{5} + x = 3 \times \frac{3}{4}$ oe for 1.45 oe (accept $2^{1.45}$) OR for a process to find the value of 2^x , eg. $8^{\frac{3}{4}} \div 16^{\frac{1}{5}} = 2.73...$ for 1.45 oe (accept $2^{1.45}$)
19		$a = 4, b = -42$	M1 M1 M1 A1	for at least two terms from $2(x-3)(x+3)$, $(x+2)(x+3)$, $(x-6)(x-3)$ (dep) for the correct expansion of at least two expressions, irrespective of signs, eg. $2x^2 - 18$, $x^2 + 2x + 3x + 6$, $x^2 - 6x - 3x + 18$ oe for $2x^2 - 18 - x^2 - 5x - 6 - x^2 + 9x - 18$ for $a = 4, b = -42$ (accept $4x - 42$)

Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
7		Comment	B1	for correct mathematical comment eg line segments not a curve or should draw freehand or should not use a ruler, or should be a curve NB Do not accept statements about scale or plotting accuracy.
8		0.246, 0. $\dot{2}46$ 0. $\dot{2}4\dot{6}$, 0.24 $\dot{6}$	M1 A1	for correct use of recurring symbol eg $0.2\dot{4}6 = 0.24646\dots$ or 3 terms in the correct relative position cao
9		22.5	P1 P1 P1 P1 A1	for process to find James' speed eg $50 \div 2.5 (=20)$ or $50 \div 150 (= \frac{1}{3})$ for process to find James' time for 15 km eg $15 \div "20" (=0.75)$ or $15 \div \frac{1}{3} (=45)$ for process to find Peter's time for 15 km eg $"45" - 5 (=40)$ for process to find Peter's speed eg $15 \div "40"$ or $15 \div \frac{"40"}{60}$ oe
10 (a)		10	B1	accept ± 10
(b)		25	M1 A1	for $(\sqrt[3]{125})^2$ or $\sqrt[3]{125} = 5$ or $125^2 = 15625$ or $\sqrt[3]{125^2}$ cao



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
7 (a)	p^{10}	B1	cao	
		M1	for any two of $12 \div 6 (= 2)$, $x^7 \div 3 (= x^4)$, $y^3 \div 1 (= y^2)$ in a single product or written as a fraction with complete and correct cancelling of at least two terms	
		A1	cao	
8 (i)	Distance in the range 20 to 23	P1	for a process to draw a bearing of 070° , eg. a line drawn 70° from the North line at P	Accept a line of any length as long as the intention is clear.
		P1	for a process to work out the distance PQ , eg. $12 \times 1.5 (= 18)$	
		P1	(dep previous P1) for the process to use the given scale, eg. " 18 " $\div 4 (= 4.5 \text{ cm})$	
		A1	(dep P3) for distance in the range 20 to 23	
		A1	(dep P3) for bearing in the range 317 to 330	
8 (ii)	Bearing in the range 317 to 330			Award P3 for Q shown in the correct place on the diagram. 4.5 scores 2 marks provided there is a link to $12 \times 1.5 (= 18)$
				Award no marks if no supportive processes Award no marks if no supportive processes Award A0A0 if Q is not in the correct place



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	Shown	C1	for $f^{-1}(x) = \sqrt[3]{\frac{x+4}{2}}$ OR for $2x^3 - 4 = 50$ OR for substituting $x = 3$ to find $f(3)$	
(b)	$x = -1$ and $x = 2.5$	C1	for substituting $x = 50$ to show the result giving $f^{-1}(50) = 3$ OR solving for x to give $x = 3$ OR for showing that $f(3) = 50$	
		P1	for $hg(x) = (x + 2)^2$	
		P1	(dep) for start to a process to derive a quadratic equation eg. $x^2 + 4x + 4 = 3x^2 + x - 1$	$(x + 2)^2$ must be correctly expanded
		P1	for a process to solve the quadratic equation $2x^2 - 3x - 5 = 0$ eg $(2x - 5)(x + 1) (= 0)$ or $\frac{-3 \pm \sqrt{(-3)^2 - 4 \times 2 \times -5}}{2 \times 2}$ or $2\left[\left(x - \frac{3}{4}\right)^2 - \frac{9}{16} - \frac{5}{2}\right] (= 0)$	
		A1	for $x = -1$ and $x = 2.5$	2.5 or $2\frac{1}{2}$ or $\frac{5}{2}$ acceptable
19	$\frac{3}{4}$ oe	P1	for a first step to converting to a common base with one correct conversion, eg. $9^{-\frac{1}{2}} = 3^{-1}$ or $\frac{1}{3}$ or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe	$9^{-\frac{1}{2}} = 3^{-1}$ (or $\frac{1}{3}$) oe or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe seen alone gets the P1
		P1	(dep) for $3^{-1} = 3^{\frac{3}{4}} \div 3^{x+1}$ oe	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	$3x^7y^2$	M1	for full evaluation of numerator or denominator with at least 2 of 3 terms correct in a product, eg $36x^{10}y^6$ or $12x^3y^4$ or full evaluation of $\frac{6x^5y^3}{3x^2y^7}$ or $\frac{6x^5y^3}{4xy^{-3}}$ with at least 2 of 3 terms correct in a product, eg $2x^3y^{-4}$ or $1.5x^4y^6$	
		M1	for correct evaluation of numerator and denominator, eg $36x^{10}y^6$ and $12x^3y^4$ or for full evaluation of numerator and denominator with no more than one error and a final answer of the form ax^by^c with two of a , b and c correct or for correct evaluation of $\frac{6x^5y^3}{3x^2y^7}$ and $\frac{6x^5y^3}{4xy^{-3}}$ eg $2x^3y^{-4}$ and $1.5x^4y^6$ or for full evaluation of $\frac{6x^5y^3}{3x^2y^7}$ and $\frac{6x^5y^3}{4xy^{-3}}$ with no more than one error and a final answer of the form ax^by^c with two of a , b and c correct	
		A1	for $3x^7y^2$ oe	Accept $a = 3$, $b = 7$, $c = 2$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	187.5	M1	for $\left(\frac{5}{2}\right)^3$ or $\left(\frac{2}{5}\right)^3$ or 2.5^3 or $\left(\frac{1}{2.5}\right)^3$ or $2^3 : 5^3$	Accept $\frac{375}{2}$
		M1	for a complete method, eg $12 \div 8 \times 125$ or 12×2.5^3	
		A1	oe	
14	17	M1	for $27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2$ or 3^2 or $\sqrt[3]{27^2}$ or $\sqrt[3]{729}$ or $\left(\frac{1}{2}\right)^{-3} = \frac{1}{\left(\frac{1}{2}\right)^3}$ or 2^3	
		M1	for a full method eg “3” ² + “2” ³ or for correctly evaluating $27^{\frac{2}{3}}$ or $\left(\frac{1}{2}\right)^{-3}$ eg 9 or 8 seen	
		A1	cao	
15	25	M1	for a tangent drawn at $t = 3$	A tangent must be seen to award any marks
		M1	for a complete method to find the gradient from tangent eg $50 \div (4 - 2)$	This mark can be awarded if the tangent is drawn at $t \neq 3$
		A1	for answer in the range 22 to 28 or ft acceptable tangent	Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	2 : 5	P1	for using similar triangles to form an equation eg $\frac{AB}{BC} = \frac{AD}{AB}$ oe or $\frac{AB}{4} = \frac{25}{AB}$ oe or $\frac{AB}{4k} = \frac{25k}{AB}$ oe or $AB : 4 = 25 : AB$ oe or $BC \times sf = BD \div sf$ oe or $4 \times sf = 25 \div sf$ oe or for working with the perpendicular height of triangle ABC eg $(h^2 =) 25^2 - 23^2 (= 96)$ or $(h =) \sqrt{25^2 - 23^2} (= \sqrt{96})$	May use x or any other letter for AB Accept $AB = 4 \times sf$, $AB = 25 \div sf$
		P1	for process to find AB eg $(AB =) \sqrt{4 \times 25} (= 10)$ oe or $\sqrt{96} \div 2 (= 10)$ or for process to find the scale factor eg $\sqrt{\frac{25}{4}} (= \frac{5}{2})$ oe	
		A1	oe	
20	$5\frac{5}{6}$	P1	for $2^x = 2^{n-\frac{1}{3}}$ or $2^y = 2^{\frac{5}{3}}$ or $x = n - \frac{1}{3}$ oe or $y = \frac{5}{3}$ oe or for $(2^{x+y}) = \frac{2^n}{\sqrt[3]{2}} \times (\sqrt{2})^5$	
		P1	for $2^{x+y} = 2^{n-\frac{1}{3}+\frac{5}{2}}$ or $x + y = n - \frac{1}{3} + \frac{5}{2}$ oe or $\frac{11}{2} = n - \frac{1}{3}$ oe	
		A1	oe eg $\frac{35}{6}$	



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
11 (a)		1, -3	B1	cao
(b)		-0.75, 2.75	B1	accept -0.7 to -0.8, 2.7 to 2.8
(c)		-2.8	B1	cao
12 (a)		$\frac{1}{9}$	M1	for showing a method using either reciprocal or square root e.g. $\frac{1}{n}$ or 9 seen
			A1	cao Accept $\pm\frac{1}{9}$ or 0.1 recurring
(b)		$\frac{16}{25}$	M1	for showing cube root of 64 as 4 and the cube root of 125 as 5 or $\frac{16}{n}$ ($n \neq 25$) or $\frac{n}{25}$ ($n \neq 16$) or an intention to find the cube root and square.
			A1	cao Accept 0.64
13 (a)		$y = \frac{9}{x^2}$	M1	begins to work with $y = \frac{k}{x^2}$ oe e.g. subs of a pair of numbers into $y = \frac{k}{x^2}$ or states $k=9$
			A1	for $y = \frac{9}{x^2}$ Accept $y = 9x^{-2}$
(b)		$\frac{3}{4}$	M1	fit (dep on previous M1) subs $y = 16$ into proportional formula of the form $y = \frac{k}{x^2}$ oe
			A1	oe

Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
6 (a)		6	B1	cao
(b)		5	B1	cao
(c)		Shown	M1	for writing 100^2 or 1000^5 as a power of 10 ($=10^{2a}$ or 10^{3b}) or 10^{2a+3b} or $100 = 10^2$ and $1000 = 10^3$
			C1	for complete chain of reasoning leading to conclusion



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
8	216	P1	for process to work with ratio eg $72 \div (3 + 4 + 5) (= 6)$ or $72 \div 12 (= 6)$	
		P1	for process to find length of base or height of triangle eg $3 \times "6" (= 18)$ or $4 \times "6" (= 24)$ OR process to find area scale factor eg $"6" \times "6" (= 36)$	
		P1	complete process to find the area of the triangle eg $\frac{1}{2} \times "18" \times "24"$ or $\frac{1}{2} \times 3 \times 4 \times "6"{}^2$	
		A1	cao	
9 (a)	6	B1	cao	Accept ± 6
(b)	1	B1	cao	
(c)	$\frac{1}{9}$	M1	for evidence of working with a cube root eg $\sqrt[3]{27}$ or $\sqrt[3]{729}$ OR evidence of working with a reciprocal eg $\frac{1}{27^{2/3}}$ or $\left(\frac{1}{27}\right)^{\frac{2}{3}}$	
		A1	cao	



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
14 (a)	$\frac{8}{27}$	M1	for showing the 4th root of 16 as 2 and the 4th root of 81 as 3 or $\frac{8}{n}$ ($n \neq 27$) or $\frac{n}{27}$ ($n \neq 8$) or an intention to find the 4th root and cube, eg. $\sqrt[4]{\left(\frac{16}{81}\right)^3}$ or $\left(\sqrt[4]{\frac{16}{81}}\right)^3$ oe	
		A1	cao	
		M1	for writing $\frac{1}{9} = 3^{-2}$, $9\sqrt{3} = 3^{2.5}$, $\frac{1}{\sqrt{3}} = 3^{-0.5}$ as powers of 3, with at least 2 correct or for working out $\frac{1}{9} \times 9\sqrt{3} \times \frac{1}{\sqrt{3}} = 1$	
		A1	cao	
15	3 : 10	P1	process to find ratio of lengths A:B = $\sqrt{4}:\sqrt{25}$ (= 2:5 or $\frac{2}{5}$ or 2, 5)	Accept working in fractions for the award of process marks but the final answer must be in correct simplified ratio notation
		P1	for process to find ratio of lengths B:C = $\sqrt[3]{27}:\sqrt[3]{64}$ (= 3:4 or $\frac{3}{4}$ or 3, 4)	
		P1	for process to write as one ratio eg. finding a common multiple of 3 and 5 or 6 : 15 : 20 oe	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
8	8 and -3	M1 M1 A1	for rearranging to get $x^2 - 5x - 24 (= 0)$ or $-x^2 + 5x + 24 (= 0)$ for $(x \pm 8)(x \pm 3)$ or $(x + a)(x + b)$ where $ab = -24$ or $a + b = -5$ or substitution into formula, condoning one sign error eg $(x =) \frac{- -5 \pm \sqrt{(-5)^2 - 4 \times 1 \times -24}}{2 \times 1}$	Can be implied by $(x - 8)(x + 3)$ or $(-x + 8)(x + 3)$
9 (a)	1	B1	cao	
(b)	3	B1	cao	
(c)	$\frac{1}{16}$	B1	oe	
(d)	3	B1	cao	
10 (a)	30	P1 P1 A1	for a start to the process, eg $5406 \div 6 (= 901)$ or $5400 \div 6 (= 900)$ or $5000 \div 6 (= 833.33..)$ or $5410 \div 6 (= 901.66..)$ for a process to find the length of one side, eg $\sqrt{901}$ or $\sqrt{900}$ or $\sqrt{833.33..}$ or $\sqrt{901.66..}$	
(b)	Explanation	C1	for 30 for a correct explanation based on their working in (a), eg underestimate because I rounded the total area down	Must be based on the use of a rounded value in a calculation



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	16	M1	for working with square root or with reciprocal in $\left(5\frac{4}{9}\right)^{\frac{1}{2}}$ eg $\left(\frac{9}{49}\right)^{\frac{1}{2}}$ or $\frac{1}{\sqrt{\frac{49}{9}}}$ or $\frac{1}{\left(\frac{49}{9}\right)^{\frac{1}{2}}}$ or $\left(\frac{7}{3}\right)^{-1}$ or $\frac{3}{7}$	
		M1	for a full method to simplify the numerator eg $\frac{3}{7} \times \frac{14}{3} (= 2)$	
		M1	for showing $\div 2^{-3}$ as $\times 8$, eg $\frac{3}{7} \times \frac{14}{3} \times 8$ or for $2^1 \div 2^{-3} (= 2^4)$ or for correctly reducing the expression to a single calculation, eg $\frac{336}{21}$ or $\frac{112}{7}$ or $2 \div \frac{1}{8}$	May be seen at any time during the calculation
		A1	cao	Award 0 marks for a correct answer with no supportive working

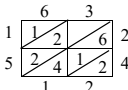


Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	10^{60}	M1	for a correct first step using one of the rules of indices, eg. $10^{150} \times 10^{90} = 10^{240}$ or $10^{360} \div 10^{150} = 10^{210}$ or $10^{360} \div 10^{90} = 10^{270}$ or $\sqrt{10^{360}} = 10^{180}$ or $\sqrt{10^{150}} = 10^{75}$ or $\sqrt{10^{90}} = 10^{45}$	
		M1	for correct use of rules of indices leading as far as $\sqrt{10^{120}}$ or $\frac{10^{180}}{10^{120}}$	
		A1	cao	
	(b) reason	C1	for correct reasoning Acceptable examples eg should do 50×2 (not 50^2) because $(12^{50})^2 = 12^{100}$ because when you have a power inside and outside the bracket you times them because $(a^b)^c = a^{bc}$ (not a^{b^c}) Not acceptable examples because you need to multiply everything in the brackets by 2 because he should have squared 12 as well you add the powers instead of timesing	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
14 (a)	4^{-2}	B1	for 4^{-2}	Accept $n = -2$
(b)	5	M1	for $8^{\frac{5}{3}} = (\sqrt[3]{8})^5$ or 2^5 or $\sqrt[3]{8^5}$ or $\sqrt[3]{32768}$ or $9^{\frac{3}{2}} = (\sqrt{9})^3$ or 3^3 or $\sqrt{9^3}$ or $\sqrt{729}$	
		M1	for correctly evaluating $8^{\frac{5}{3}}$ or $9^{\frac{3}{2}}$, eg 32 or 27 seen	
		A1	cao	
15	3	P1	for process to make the y term the subject of $6y + kx - 12 = 0$ eg $6y = 12 - kx$ or $y = 2 - \frac{k}{6}x$	A correct answer with no supportive working gets 0 marks
		P1	for process to find gradient of line perpendicular to L_1 , eg $2 \times m = -1$ or $m = -\frac{1}{2}$ or for process to find k, eg $-\frac{k}{6} \times 2 = -1$	
		A1	cao	



Paper: 1MA1/1H													
Question	Answer	Mark	Mark scheme	Additional guidance									
1	15.12	M1	for a complete method with relative place value correct including an intention to add all the appropriate elements of the calculation	252 1260 1512  <table border="1" data-bbox="1077 1034 1246 1097"><tr><td></td><td>60</td><td>3</td></tr><tr><td>20</td><td>1200</td><td>60</td></tr><tr><td>4</td><td>240</td><td>12</td></tr></table> 1200 + 60 + 240 + 12 = 1512		60	3	20	1200	60	4	240	12
			60	3									
		20	1200	60									
4	240	12											
A1	for digits 1512												
A1	(dep on M1) for correct placement of the decimal point into their final answer												
2	(a)(i)	1	B1	cao									
	(ii)	$\frac{1}{25}$	B1	oe									
	(b)	2^6	M1	for a correct first step using a rule of indices, eg $2^{5+4} (= 2^9)$ or $2^{5-3} (= 2^2)$ or $2^{4-3} (= 2^1)$ or for $2 \times 2 \times 2 \times 2 \times 2 \times 2$ or 64									
			A1	for 2^6	Accept $n = 6$								



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)	2	M1	for a correct start, using one rule of indices, eg $3^n \times 3^{12} = 3^{14}$ or $3^n \times 3^{20} = 3^{22}$ or $3^{20} \div 3^8 = 3^{12}$ or $3^{14} \times 3^8 = 3^{22}$ or $\frac{3^{n+20}}{3^8} = 3^{14}$ or $3^{n-8} \times 3^{20} = 3^{14}$ or for forming an equation in n , eg $n + 20 - 8 = 14$ oe or $(n =) 14 + 8 - 20$	
		A1	cao	Allow an answer of $3^n = 3^2$
			SCB1 for an answer of 3^2 if M0 scored	An answer of 9 or $3^n = 9$, $n \neq 2$ on its own is to be awarded 0 marks
(b)	$16m^8$	M1	for an intention to find the cube root and square, eg $\sqrt[3]{64m^{12}}^2$ or $\sqrt{(64m^{12})^2}$ or $(4m^4)^2$ or $\sqrt[3]{4096m^{24}}$ or for am^8 with $a \neq 16$ or $16m^b$ with $b \neq 8$	Do not condone missing brackets 16 or m^8 imply M1 Allow multiplication sign for M1
		A1	cao	Accept $a = 16$, $b = 8$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	(a) m^7	B1	cao	
	(b) $125n^3p^9$	B2	cao	Allow multiplication signs
		(B1)	for 2 of 3 terms correct in a single product)	$125n^3p^x$ or $125n^x p^9$ where $x \neq 0$ or an^3p^9 where a is a number
	(c) $8q^6r^3$	B2	cao	Allow multiplication signs
		(B1)	for 2 of 3 terms correct in a single product)	$8q^6r^x$ or $8q^x r^3$ where $x \neq 0$ or aq^6r^3 where a is a number
2	(a) 280	M1	for listing at least 3 multiples of both 40 and 56 OR finds the prime factors of both 40 and 56	40, 80, 120, ... 56, 112, 168, ... OR 2,2,2,5 and 2,2,2,7
		A1	cao	
	(b) 60	B1	60 or $2^2 \times 3 \times 5$ oe	$2^2, 3, 5$ not enough ie must be a product
3	$y = 3x - 6$	M1	for a correct method to find the gradient of the line, or $m = 3$ OR identifies -6 as the intercept in words or in a partial equation OR $y - b = m(x - a)$ where $m \neq 3$ and (a, b) is a correct coordinate	Just ringing -6 is insufficient
		M1	for $y = 3x + c$ or (L=) $3x - 6$ or $y = "3"x - 6$ OR $y - y_1 = 3(x - x_1)$ or $y - b = "3"(x - a)$ where (a, b) is a correct coordinate	Award of this mark implies the first M1 c must be seen either as a letter or a number
		A1	accept $y = 3x + -6$ oe	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)	300	M1	for working out $\sqrt[4]{81}$ as 3 or $\sqrt[4]{10^5}$ as 10^2 or 100	Mark may be awarded if operations are attempted on 8100000000 eg 300000000
		A1	for 300 or 3×10^2 or 3×100	
(b)	$\frac{1}{8}$	M1	for showing a square root of 64 as 8 or recognition of the reciprocal eg $\frac{1}{n}$ or shows expressions that show an understanding of the $\frac{1}{2}$ index and the minus index eg $\frac{1}{\sqrt{64}}$ or other equivalent forms	
		A1	oe	
(c)	3^{2-n}	M1	for $3^{2(n-1)}$ or 3^{2n-2} or $(3^2)^{n-1}$	
		A1	for 3^{2-n} oe eg $3^{n-2(n-1)}$	Accept $\pm \frac{1}{8}$ oe

Paper: 1MA1/3H				
Question	Working	Answer	Mark	Notes
4		15	P1	strategy to start the problem, eg 8:20 and 20:5
			P1	process to solve the problem, eg $\frac{5}{33} \times 100$ or 24:60:15
			A1	cao
5 (a) (b)		0.625 $9.75 \leq x < 9.85$	B1	cao
			B2	for $9.75 \leq x < 9.85$
			[B1	for 9.75 or 9.85 (or 9.849)]
6		147	P1	starts process, eg uses x and $x + 7$
			P1	starts to work with at least 6 correct sides, may be on the diagram or in an expression
			P1	(dep on previous P1) gives a correct expression for the perimeter, eg $x + x + 7 + x + 7 + x + 7 + x + x + 7 + x + 7 + x + 7$ or adds at least 6 correct sides and equates to 70
			A1	for width = 3.5 oe and length = 10.5 oe
			B1	ft (dep P2) for correct area for their x
7		0.0007452	M1	digits 7452 seen
			A1	cao



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	9.85	M1 A1	for $\sin(38) = \frac{AB}{16}$ oe or alternative method to find AB for an answer in the range 9.76 to 9.92	
6	8.3 and 8.4	B1 B1	for 8.3 in the correct position for 8.4 in the correct position	Accept 8.39 or 8.399...
7	168	P1 P1 P1 A1	for working with ratio to find the amount for C or D eg $1.5 \times 2 (=3)$ or (A, B, C, D =) 2, 7, 3, 3 oe OR for suitable expressions linking A with C or D, eg. $A = x$, $C = 1.5x$ for “2 + 3 + 3 + 7” (=15) OR adds 4 suitable expressions, eg. “ $x + 3.5x + 1.5x + 1.5x$ ” (= 7.5x) for a complete process to find the amount of money eg $360 \div “15” \times 7$ OR $360 \div “7.5” \times 3.5$ cao	
8	(a) 5.62×10^{-3}	B1	cao	
	(b) 1452	B1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	4.56×10^{-2}	M1 A1	for $0.000000342 \div 0.0000075$ OR for 0.0456 oe eg 0.456×10^{-1} or 45.6×10^{-3} or $\frac{57}{1250}$ OR for an answer of 4.56×10^n cao	
8	6	M1 M1 A1	for $720 \div 40 (= 18)$ or $720 \div 30 (= 24)$ for a complete process eg $(720 \div 30) - (720 \div 40)$ or $"18" \times 4/3 - "18"$ or $"24" - "24" \times 3/4$ cao	
9	No (supported)	P1 P1 P1 P1 A1	for finding the area of 3 or more faces of the cuboid and adding eg $(6 \times 8) + (8 \times 18) + (6 \times 18) \dots$ or $"48" + "144" + "108" \dots (= 300)$ complete process to find surface area of cuboid, eg $6 \times 8 \times 2 + 6 \times 18 \times 2 + 8 \times 18 \times 2 (= 600)$ for process to find side length of cube, eg [surface area] $\div 6$ and square rooting ($= 10$) (dep on previous P1) for processes to find volume of cube and volume of cuboid, eg [side length] ³ ($= 1000$) and $6 \times 8 \times 18 (= 864)$ for a process to find the volume of the cuboid $6 \times 8 \times 18 (= 864)$ and cube rooting ($= 9.52\dots$) to find a side length (dep on previous P1) for process to find surface area of cube, eg. $("9.52\dots")^2 \times 6 (= 544.28\dots)$ No with 1000 and 864 OR No with 600 and 544(.28...)	Could be an addition of <i>any</i> three faces eg $48 + 48 + 144$ etc. [surface area] must come from the addition of at least three attempts at area, but not from volume.



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	20 or 24 or 168	B1	for identification of the range of the girls (20) or the range (24) or the median (168) of the boys	
	Comparison	C2	for a correct comparison of medians and a correct comparison of ranges supported by correct figures eg the median height for girls (165) is less than the median height for boys (168) and the range for girls (20) is less than the range for boys (24) At least one comparison must be in context referring to height or quoting cm.	Simply quoting values for median, range is insufficient; they must be compared.
		(C1	for a correct comparison of medians or a correct comparison of ranges that could fit their incorrect figure(s))	Context not necessary for C1
8	450	M1	for $18 \div 3 (=6)$	Ignore units
		M1	for substitution eg. $75 = \frac{F}{"6"}$ or $75 \times "6"$	
		A1	cao	
9	0.000 672, 67.2×10^{-4} 6.72×10^5 672×10^4	B2	cao	Accept correct numbers in any form
		(B1	for correct conversions to same format, condoning one error or for 3 numbers in the correct order (ignoring one) or for all 4 numbers listed in reverse order)	



Paper: 1MA1/3H					
Question	Answer	Mark	Mark scheme	Additional guidance	
1 (a)	4.68×10^5	B1	cao		
	0.000 503 7	B1	cao		
2	80	M1	for complete method, eg 200×0.4 or for $\frac{80}{200}$ for the answer		
		A1	cao		
3 (a)	24.6	M1	for finding 5 products within intervals (including end points) with not more than one error, may be seen near table. eg $2 \times 12.5 (= 25)$, $8 \times 17.5 (= 140)$, $13 \times 22.5 (= 292.5)$, $21 \times 27.5 (= 577.5)$, $6 \times 32.5 (= 195)$ or for 1230	Min fx	Max fx
				20	30
				120	160
		M1		260	325
				525	630
				180	210
A1	for $\Sigma fx \div \Sigma f$ eg $(\text{"25"} + \text{"140"} + \text{"292.5"} + \text{"577.5"} + \text{"195"}) \div \text{"50"}$ or $\text{"1230"} \div \text{"50"}$	Σfx must come from 5 products, fx within intervals (including end points)			
				A1	for 24.6 oe

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
8	3.125×10^7	M1	for $(k =) (1.25 \times 10^{-12}) \div (4 \times 10^{-20})$ or for the digits 3125	Can condone missing brackets on division 3.1×10^7 or 3.12×10^7 or 3.13×10^7 will score M1A0
		A1	cao	
9	shown	M1	for method to find the interior angle eg $(9 - 2) \times 180 \div 9 (= 140)$ or exterior angle eg $360 \div 9 (= 40)$ of a regular nonagon	Angles may be shown on the diagram Any angle labelled correctly as 140 or 40 and not contradicted scores this mark
		M1	for a complete method to find the interior angle <i>ABC</i> , eg $360 - "140" - "140" (= 80)$ or $"40" \times 2 (= 80)$ or finds the angle sum assuming a square, eg $90 + "140" + "140" (= 370)$	
		A1	for complete solution with correct conclusion, eg interior angle of a square is 90, not 80 or angles around a point sum to 360 not 370	
10	$x = -2.5, y = -6$	M1	for a correct method to eliminate one variable (condone one arithmetic error)	Fractions do not need to be in simplest form
		A1	for either $x = -2.5$ or $y = -6$ oe	
		M1	(dep M1) for substituting found value into one of the equations or correct method after starting again (condone one arithmetic error)	Fractions do not need to be in simplest form
		A1	for either $x = -2.5$ and $y = -6$ oe SCB2 for both correct answers if no more than 1 mark awarded SCB1 for one correct answer if no marks awarded	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	Points plotted at (130, 12) (150, 28) (170, 30) (190, 22) (210, 8) and joined with line segments	B2 (B1)	for correct plotting of 5 points and joining with line segments for points plotted correctly at midpoints or for a frequency polygon with one point incorrect or for a frequency polygon with first and last point joined directly or for joining the points with line segments at the correct heights consistent within intervals (including end points))	Ignore any histogram drawn Ignore any part of the frequency polygon outside of the range of the first and last point plotted. for example, at 120, 140, 160, 180, 200 or at 140, 160, 180, 200, 220
2 (a)	340 200	B1	cao	
(b)	8.026×10^{-1}	B1	cao	
3	Drawn	B2 (B1)	for a correct construction with all relevant arcs drawn for all relevant arcs drawn or for a bisector within guidelines but with no or insufficient arcs)	
4 (a)	(0.3) 0.7 0.3 0.7 0.3 0.7	B2 (B1)	all probabilities correctly placed for 0.7 correctly placed for Game 1)	Accept equivalent fractions or percentages for probabilities
(b)	0.49	M1 A1	for a correct method, ft their tree diagram eg 0.7×0.7 only oe, ft their tree diagram	ft their diagram provided probabilities are less than 1 An answer of $\frac{0.49}{1}$ scores M1A0 unless 0.49 seen



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	5 730 000	B1	cao	
	(b) 3.5×10^{-2}	B1	cao	
10	12.6	M1	for partial evaluation, eg $(4.777(294722))^2$ or $\sqrt[3]{5.969(47697)}$ or 22.822(54486) or 1.814(081699)	12.58077014 If an answer is shown in the range in working and then incorrectly rounded award full marks
		A1	for answer in the range 12.58 to 12.6	



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
5		70.5	P1 P1 P1 P1 A1	starts process of Pythagoras e.g. $5^2 + 12^2$ complete process for Pythagoras e.g. $\sqrt{5^2 + 12^2}$ or $\sqrt{25 + 144}$ or $\sqrt{169}$ (=13) (dep P1 for Pythagoras) process of adding all the lengths e.g. $5 + 5 + 12 + 12 + "13"$ (=47) (indep) process of multiplying at least 2 lengths by 1.5 cao SC: any evidence of working with Pythagoras award the P1 or P2
6		comparison	M1 A1	starts to manipulate expression e.g. $3y = 9x - 6$ or $3y = 9x - 5$ gives equation(s) which can be used to show that the gradients of the two lines are the same e.g. $y = 3x - 5/3$
7		72	P1 P1 A1	for showing the process of 30×60 (=1800) or 20×54 (=1080) (dep P1) for showing the complete process e.g. $("1800" - "1080") \div 10$ concluding the answer is 72 (and not 66)
8 (a) (b)		0.00000797 6.3×10^7	B1 M1 A1	cao for partial calculation involving powers of 10 e.g. $0.63 \times 10^{5-3}$ or 6.3×10^n where $n \neq 7$ or for $n \times 10^8$ or for 63000000 cao
9		500	M1 A1	recognition of 1.2 or 120% oe eg $600 \div 1.2$ oe $x \times 1.2 = 600$ oe or $120\% = 600$ cao
10		$x^3 + 6x^2 + 11x + 6$	M1 M1 A1	for method to find the product of any two linear expressions (3 correct terms) e.g. $x^2 + x + 2x + 2$ or $x^2 + 2x + 3x + 6$ or $x^2 + x + 3x + 3$ for method of multiplying out remaining products, half of which are correct (ft their first product) e.g. $x^3 + x^2 + 2x^2 + 3x^2 + 2x + 3x + 6x + 6$ cao



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	7	P1 P1 A1	process to use gradient eg $y=3x+c$ or $c = -6$ or $\frac{15-9}{d-5}$ or $(15-9) \div 3$ or (6, 12) (dep) full process to rearrange equation formed to isolate d eg rearrangement of $15 = 3d - 6$ or $3 = \frac{15-9}{d-5}$ or for $5 + \frac{15-9}{3}$ cao	Condone use of a letter other than d , for d Must show processes to get as far as $d =$ Award P2 for an answer of (7, 15)
7	(a) 8.623×10^{-5} (b) 7.44×10^6	B1 M1 A1	cao for $\frac{3200+0.051}{0.00043}$ or $\frac{3200.051}{0.00043}$ or performs an operation eg shows 163.2, 7441860.5, 118.6(...) or an answer or $7.44(\dots) \times 10^n$ where $n \neq 6$ or 7441979(...) or an answer of 7.4×10^6 for $7.44(1979\dots) \times 10^6$	7441979.0689... If a correct answer is shown in working and then rounded incorrectly, award full marks. Answer need only be given correctly to 3 sig fig; if following digits are incorrect ignore them.
8	Rotation 90° anticlockwise centre $(-1,1)$	M1 A1 A1	stating rotation or for showing R [(1,1), (1,-3), (3,-3)] for rotation of 90° anticlockwise for centre $(-1, 1)$ given as a coordinate.	Award for a triangle in the correct position without the label R as long as this is the only triangle in lower right quadrant. Accept rotation of 270° clockwise Can be given as a coordinate alone. Do not award A marks if there is evidence of other transformations in the description, or other ambiguity in the answer given.

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
7 (a)	3.246×10^7	B1	cao	Decision eg “No” may be seen by the question. “She is incorrect” is equivalent to “no”
(b)	0.00496	B1	cao	
(c)	No with explanation	C1	No and explanation that B is bigger as the power of 10 is bigger. Acceptable examples She is incorrect as 10^8 is smaller than 10^9 No, because B has more digits than A No, A is millions but B is billions No, if you subtract A from B the answer is positive (but if you subtract B from A the answer is negative) A= 621200000, B=4730000000, B is bigger No because she did not take into account standard form No as when you find the ordinary number B is greater than A Not acceptable examples Yes... A = 5 zeros after the number where as B = 7 zeros after the number No as 4.73×10^9 is one more than 6.212×10^8 6.212 is to the power of 8 and 4.73 is to the power of 9 so there is an extra digit Asma is wrong because she has more numbers behind the decimal point which means that it will be bigger than A No B has more zeros	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	(a)	B1	cao	If the answer (for 2 marks) is seen in working and then rounded or truncated, award full marks.
	(b)	M1	for 10.5472×10^3 oe or 1.6×10^8 oe or 2.575×10^{-1} oe or for 6.592×10^n where $n \neq 5$ or for 6.59×10^5 or for 6.6×10^5 or for 659200 oe	
		A1	cao	
10	Explanation	C1	for full explanation indicating the problem with the negative signs Acceptable examples He should have $+2x + 4$ on the second line He should have done -4 and $-2x$ $3x - -2x = 5x$, not $1x$ Two minuses make a plus which he didn't account for Not acceptable examples He has not expanded the brackets Peter has to factorise first He did not collect the terms He didn't include the x^2	
11	5, 6, 7	M1	for identification of possible values of x (4,5,6,7) or of y (5,6,7,8,9)	Could be shown on a number line or using a Venn diagram This mark can be awarded for an answer of 4, 5, 6, 7 Answers may be given in any order.
		A1	cao	
12	1.2, 1.3	B1	for 1.2 in the correct position	Accept $1.2\dot{9}$ or 1.299... must be 9 recurring.
		B1	for 1.3 in the correct position	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	1.037×10^4	M1	for 570 or 9800 or 0.57×10^3 or 98×10^2	
		A1	for 10370 oe eg 10.37×10^3 or 103.7×10^2	
		A1	for 1.037×10^4	
6	12	P1	for (interior angle $\Rightarrow$) $(180 \div 3) + (360 \div 4)$ ($= 150$)	150 may be seen on diagram. May be seen on diagram Exterior angle of 30 implies P1P1 A correct answer with no supportive working gets 0 marks Minimum supportive working is P1P1 or Trials of interior angle sum Finding $1800 \div 150 = 12$ oe with 12 as answer scores P1P1P1A1
		P1	for (exterior angle $\Rightarrow$) $180 - "150"$ ($= 30$) or for $"150" = \frac{(n-2) \times 180}{n}$ oe	
		P1	for $360 \div "30"$ or for a correct process to solve the equation as far as $"30"n = 360$	
		A1	cao	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
10 (a)		Jupiter	B1	for Jupiter (accept 1.898×10^{27})
(b)		4.5388×10^{24}	B1	for 4.5388×10^{24} oe (e.g. 45.388×10^{23})
(c)		Yes (supported)	M1	for $(4.35 \times 10^9) \div (4.14 \times 10^7)$ (= 105(.07..)) or $(4.14 \times 10^7) \times 100$ (= 4.14×10^9) or $(4.35 \times 10^9) \div 100$ (= 4.35×10^7)
			A1	for Yes with correct supporting evidence
11		$9\frac{1}{3}$	M1	for writing at least 2 fractions with a common denominator eg. $\frac{3(3x-2)}{12}, \frac{4(2x+5)}{12}, \frac{2(1-x)}{12}$ with at least one correct numerator or for $\frac{3x}{4} - \frac{2}{4} - \frac{2x}{3} - \frac{5}{3} = \frac{1}{6} - \frac{x}{6}$ (accept $+\frac{5}{3}$ instead of $-\frac{5}{3}$)
			M1	(dep) for a method to eliminate all fractions in an equation, ignore errors in any expanded terms eg. $3(3x - 2) - 4(2x + 5) = 2(1 - x)$ or $6 \times [3(3x - 2) - 4(2x + 5)] = 12 \times [1 - x]$ or $3 \times 3x - 3 \times 2 - 4 \times 2x - 4 \times 5 = 2 \times 1 - 2 \times x$
				OR for the correct expansion of brackets leading to $\frac{9x-6-8x-20}{12} = \frac{2-2x}{12}$
			M1	(dep on M2) for correctly isolating terms in x and number terms of their linear equation e.g. $9x - 8x + 2x = 2 + 6 + 20$
			A1	for $9\frac{1}{3}$ oe

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	4.52×10^3	M1	for $2.04... \times 10^7$ oe eg $2.04... \times 10^{-5} \div 10^{-12}$ or $20.4... \times 10^6$ or 204(08163.27) or for correct value of T , 4517.(53....), not written in standard form, eg 4520	May be given correct to 3 sig figs or more
		A1	for answer in the range 4.51×10^3 to 4.52×10^3 (SC B1 for $6.32... \times 10^{-1}$)	
	Explanation	M1	for method to find the scale factor or decreased value in T , eg $\sqrt{\frac{1.1}{1.05}}$ (= 0.97.....) oe or $\sqrt{\frac{5.6 \times 10^{-3} \times 1.1}{(1.4 \times 10^{-4} \times 1.05)}}$ (= $4.40... \times 10^3$) oe	Award mark for a correct method to calculate the scale factor or the percentage increases in w and d^3 or the decreased value of T
		C1	(dep M1) for explanation eg value of scale factor less than 1, so a decrease in T OR compares $4.40... \times 10^3$ with their value of T from (a) provided answer to (a) is greater	
10	10	P1	for start to a process to find the LCM of 20, 45 and 120 (= 360), eg $45 = 3 \times 3 \times 5$ or $20 = 2 \times 2 \times 5$ or $120 = 2 \times 2 \times 2 \times 3 \times 5$ or writes down at least 3 multiples of 45 and 120	Could be presented as complete prime factor trees for 45 or 120
		P1	(dep) for a process to find number of times/hour using their LCM, eg $3600 \div 360$ or $3600 \div 720$	
		A1	for 10 or 11	



Paper: IMA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	3.0×10^9	P1	for correct process, eg $10^5 \times 365 \times 81$ or for a correct answer not written in standard form, eg 2956500000 or $2.9(565) \times 10^n$ where $n \neq 9$ or	Values may be rounded. Allow 350, 360, 366, 370, 400 and 80, 100
		A1	for an answer in the range 2.8×10^9 to 4.0×10^9	
	4.5×10^{-11}	P1	for correct process, eg $\frac{90}{2 \times 10^{12}}$ or for correct answer not written in standard form, eg 45×10^{-12} or 0.45×10^{-10} or 4.5×10^n where $n \neq -11$	Allow $90 \div 2 \times 10^{12}$
		A1	cao	
11 (a)	rotation of 180° about (2.5, -1)	M1	for method to find position of Q , eg shape drawn at (-1, -2), (-1, -5) and (-2, -5) or for method to find position of R , eg shape drawn at (4, -4), (4, -7) and (3, -7) or for method to translate their Q correctly	The method mark is awarded if no working is shown but at least 2 of the 3 aspects are correct in the description Cannot award A marks for a combination of transformations With no extra incorrect aspects
		A2	for rotation of 180° about (2.5, -1) or enlargement by scale factor -1, centre (2.5, -1)	
		(A1	for any 2 of the 3 aspects)	
		B1	for (2.5, -1) ft from rotation or enlargement in (a)	
(b)	(2.5, -1)	B1	for (2.5, -1) ft from rotation or enlargement in (a)	No follow through from a combined transformation in part (a)



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
2	12.85 or 12.86 or 13.5(0)	P1 P1 P1 A1	for $9 + 2 + 1$ (= 12) for working out how many lots of 175g are needed eg $6000 \div "12" \times 2 \div 175$ (= 5.71...) for a complete process eg $"5.71..." \times 2.25$ (= 12.857...) for 12.85 or 12.86 or 13.5(0)	Award this mark for sight of 4500, 1000 or 500 Process may lead to 5 or 6 instead of 5.71... "5.71..." (ft) may be rounded or truncated.eg "6"
3	(a) 450 000 (b) 7×10^{-3} (c) 4.73×10^3	B1 B1 M1 A1	cao cao for 4730 oe or for 4.73×10^n where $n \neq 3$ cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
3	30	P1	for $160 \div (3+7) (= 16)$ or $\frac{3}{3+7} (= \frac{3}{10})$	Award no marks for a correct answer with no supportive working
		P1	for “16” $\times 3 (= 48)$ or “ $\frac{3}{10}$ ” $\times 160 (= 48)$	
		P1	for a correct step using 48 eg “48” $\div 8 (= 6)$ or “48” $\times 25 \div 100 (= 12)$ or (indep) for combining $\frac{1}{8}$ and 25%, eg $\frac{1}{8} + \frac{1}{4} (= \frac{3}{8})$ or “0.125” + “0.25” $(= 0.375)$ or “12.5”(%) + 25(%) $(= 37.5(\%))$	
		P1	for a complete process to find the number of petrol cars, eg “48” – “6” – “12” oe $(1 - \frac{3}{8}) \times “48”$ oe or “ $\frac{3}{10}$ ” $\times (1 - \frac{3}{8}) \times 160$ oe	
		A1	cao SC B2 for an answer of 100 if P0 scored	
4 (a)	0.00163	B1	cao	
(b)	4.38×10^5	B1	cao	
(c)	2.4×10^{-1}	M1	for $4 \times 6 \times 10^{3-5}$ or 0.24 oe eg 24×10^{-2} or 2.4×10^n where $n \neq -1$	
		A1	cao	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	21	M1 A1	for a complete factor tree for 63 or 105 with no more than one arithmetic error or for listing at least 4 correct factors (with no more than 1 incorrect) of 63 or 105, could be in factor pairs or for the prime factors of 63 (3, 3, 7) or 105 (3, 5, 7) cao SCB1 for an answer of 3 or 7 or 3×7 if M0 scored	Condone the inclusion of 1 for this mark May be seen in different ways, 1, 3, 7, 9, 21, 63 1, 3, 5, 7, 15, 21, 35, 105 Prime factors may be seen in a diagram eg a Venn diagram
2	(a)(i) 53 000 (ii) 0.000 074 (b) 3.42×10^7	B1 B1 M1 A1	cao cao for $9\,700\,000 + 24\,500\,000 (= 34\,200\,000)$ or 3.42×10^n ($n \neq 7$) oe or 3.4×10^7 or correct answer in incorrect form eg 34.2×10^6 or both in a form ready for addition, eg $9.7 \times 10^6 + 24.5 \times 10^6$ cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	905	P1	for correct use of formula for the volume of a sphere eg $\frac{1}{4} \times \frac{4}{3} \times \pi \times r^3$ (= 576 π or 1809...) OR $576\pi \times 4$ or 2304 π or 7238... ($\frac{4}{3} \times \pi \times r^3$)	We do not need to see what is in the brackets to award this mark. The contents of the bracket alone would score P0
		P1	for a complete correct process to find r , eg $r = \sqrt[3]{\frac{576 \times 4 \times 3}{4}}$ or $r = 12$	Could be shown in several stages $\sqrt[3]{\frac{576 \times 4 \times 3}{4}} = \sqrt[3]{1728}$
		P1	for a process to find the curved surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4}$ (=144 π or 452...) OR the surface area of both flat surfaces eg $(2 \times \frac{\pi \times [\text{radius}]^2}{2})$ OR complete expression for the total surface area eg $\frac{4\pi r^2}{4} + \frac{\pi r^2}{2} \times 2$ oe	Radius used must be clearly identified as their radius of the solid
		P1	for process to find the complete surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4} + (2 \times \frac{\pi \times [\text{radius}]^2}{2})$	
		A1	answer in the range 904.7 – 905 or 288 π (SCB2 for an answer in the range 358.1 – 359.2)	If an answer is given in the range but then incorrectly rounded, award full marks.
20	(a) explanation	C1	for a correct explanation, eg $\sqrt{3} \times -\sqrt{3} = -3$, not 3	
	(b) explanation	C1	for correct explanation, eg $\sqrt{12} = 2\sqrt{3}$, not $3\sqrt{2}$	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$\frac{\sqrt{a}-1}{a-1}$	M1 A1	for a correct method to rationalise the denominator, eg, $\frac{1}{\sqrt{a}+1} \times \frac{\sqrt{a}-1}{\sqrt{a}-1}$ or $\frac{1}{\sqrt{a}+1} \times \frac{1-\sqrt{a}}{1-\sqrt{a}}$ for $\frac{\sqrt{a}-1}{a-1}$ or $\frac{1-\sqrt{a}}{1-a}$	Condone use of a prime number in place of a for the M1 Do not ISW
16	$-5 < x < \frac{3}{4}$	M1 A1	for critical values -5 and $\frac{3}{4}$ oe oe	Could be written as two separate expressions, eg $x > -5$ and $x < \frac{3}{4}$ oe



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
21	$\frac{6-\sqrt{8}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$ $\frac{6\sqrt{2}+6-\sqrt{8}\sqrt{2}-\sqrt{8}}{2-1}$ $=6\sqrt{2}+6-4-2\sqrt{2}$	$2+4\sqrt{2}$	M1	for correct first step eg multiplies numerator and denominator by $\sqrt{2}+1$ condone missing brackets
			M1	(dep) for expansion of numerator with 4 terms correct with or without signs or 3 out of exactly 4 terms correct
			A1	for $2+4\sqrt{2}$ oe or for stating $a=2$ and $b=4$
22		2, 14.5	P1	for scale factor of $\frac{12}{3}$ or $\frac{3}{12}$ or $\frac{15}{12}$ or $\frac{12}{15}$ or $\frac{8}{12}$ or $\frac{12}{8}$ or $\frac{15}{8}$ oe or correctly identifies 2 pairs of corresponding sides
			A1	for $x=2$
			P1	for complete method to find other value for x eg $\frac{15}{8} \times 12 = 8$
			A1	for $x = 14.5$
23		$x > 2$	C1	Describes both assumptions for similarity
			P1	for process to derive algebraic expressions for area of both rectangle and triangle eg $(x-1)(3x-2)$ and $(2x \times x) \div 2$ (condone missing brackets)
			M1	for method to rearrange inequality to $2x^2-5x+2 > 0$ oe providing in the form $ax^2+bx+c > 0$
			M1	for a correct method to solve $2x^2-5x+2 > 0$
			M1	for establishing critical values 2 and $\frac{1}{2}$
			A1	$x > 2$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	Statement supported by algebra	B1	writing a general expression for an odd number eg $2n+1$	Could be $2n-1$, $2n+3$, etc
		M1	(dep) for expanding ("odd number") ² with at least 3 out of 4 correct terms	Note that $4n^2 + 4n + 2$ or $2n^2 + 4n + 1$ in expansion of $(2n+1)^2$ is to be regarded as 3 correct terms
		A1	for correct simplified expansion, eg $4n^2 + 4n + 1$	
		C1	(dep A1) for a concluding statement eg $4(n^2 + n) + 1$ (is one more than a multiple of 4)	
13	5	M1	for $\sqrt{40}$ or $\sqrt{90}$ OR $2\sqrt{2}$ or $3\sqrt{2}$	Answer of $5\sqrt{10}$ from correct working gets M2 A0
		M1	for $2\sqrt{10}$ or $3\sqrt{10}$ or $\sqrt{4} \times \sqrt{10}$ or $\sqrt{9} \times \sqrt{10}$ or $\sqrt{4 \times 10}$ or $\sqrt{9 \times 10}$ OR $2\sqrt{2} + 3\sqrt{2}$	
		A1	cao	



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	fully correct working leading to $16(1+\sqrt{2})$	C1	for expanding the numerator, eg $18 + 2\sqrt{2}\sqrt{18} + 2$ or $\sqrt{324} + \sqrt{36} + \sqrt{36} + \sqrt{4}$ (= 32) or for simplifying $\sqrt{18}$, eg. $\sqrt{18} = 3\sqrt{2}$ or $\sqrt{18} + \sqrt{2} = 4\sqrt{2}$	Expanded terms need not be simplified
		C1	(indep) for method to rationalise the denominator, eg. $\frac{\text{"numerator"}}{\sqrt{8}-2} \times \frac{\sqrt{8}+2}{\sqrt{8}+2}$	
		C1	for fully correct working leading to $16(1+\sqrt{2})$	Accept $a = 16, b = 1$
21	3 : 4	P1	starts process eg $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ oe	
		P1	for process to find $\overrightarrow{OM} = \mathbf{a} + \frac{1}{2} "(\mathbf{b} - \mathbf{a})"$ oe ($= \frac{1}{2}(\mathbf{a} + \mathbf{b})$)	
		P1	for process to find $\overrightarrow{AP} = -\mathbf{a} + \frac{3}{5} "(\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b})"$ oe or (indep) for $\overrightarrow{AN} = -\mathbf{a} + "k"\mathbf{b}$	
		P1	process to find "k" using $\overrightarrow{AN} = -\mathbf{a} + "k"\mathbf{b}$ as a multiple of $\overrightarrow{AP}$	
		A1	cao	
		P1	ALTERNATIVE for producing OM to C such that AC is parallel to OB	
		P1	for process to show that $MC = OM$, using congruent triangles ACM and BOM	Formal geometric reasoning relating to congruent and similar triangles is not required
		P1	for process to find PC as a multiple of $OM/5$ ($= 7OM/5$)	
		P1	for process to find ON as a multiple of $AC(OB)$ ($= 3OB/7$) using similar triangles ACP and NOP	
		A1	cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	15π	P2 P1 P1 A1	for process to find size of the angle eg $\frac{5\pi \times 360}{2 \times \pi \times 6}$ oe (= 150) or for working with proportion eg $\frac{5\pi}{12\pi} (= \frac{5}{12})$ or $\frac{12\pi}{5\pi} (= \frac{12}{5})$ (P1 for a first step eg $\frac{x}{360} \times 2 \times \pi \times 6 = 5\pi$) (dep on P2) for process to find the area eg $\frac{150}{360} \times \pi \times 6^2$ or $\frac{5\pi}{12\pi} \times \pi \times 6^2$ cao	
16	Shown	M1 A1	for $\frac{n}{n+1}$ or $\frac{n-1}{n}$ (dep) for $\frac{n}{n+1} \times \frac{n-1}{n}$ oe = $\frac{n-1}{n+1}$	Do not award A1 if errors seen
17 (a)	$\frac{\sqrt{7}}{7}$	B1	for $\frac{\sqrt{7}}{7}$ or $\frac{k\sqrt{7}}{7k}$ or $\frac{\sqrt{7k^2}}{7k}$ where k is an integer not equal to 0	
(b)	$3\sqrt{5}$	M1 A1	for writing $\sqrt{80}$ as $\sqrt{16 \times 5}$ or $\sqrt{16} \times \sqrt{5}$ or $4\sqrt{5}$ for $3\sqrt{5}$ or $\sqrt{45}$	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	33	B1	cao	
(b)	27	M1	for $f(9) = 12 \div \sqrt{9}$ (=4) and a clear intention to find $g(“4”)$ or for $3 \times (2 \times \frac{12}{\sqrt{9}} + 1)$ or for stating gf eg $3(2 \times \frac{12}{\sqrt{x}} + 1)$ oe	
(c)	$\frac{1}{2}$	A1	cao	
		M1	for g^{-1} as $\frac{x-3}{6}$ oe or for starting to solve $3(2x+1)=6$	Accept $\frac{y-3}{6}$
		A1	for $\frac{1}{2}$ oe	
20	$1 + \frac{\sqrt{5}}{5}$	P1	for writing $\sqrt{180}$ as $6\sqrt{5}$	
		P1	for process to rationalising the denominator eg $\frac{\sqrt{180}-2\sqrt{5}}{5\sqrt{5}-5} \times \frac{5\sqrt{5}+5}{5\sqrt{5}+5}$ or $\frac{4\sqrt{5}}{5\sqrt{5}-5} \times \frac{5\sqrt{5}+5}{5\sqrt{5}+5}$ oe	This process mark can be awarded whenever this is seen, which might be later in the process.
		P1	(dep on previous P1) for expanding terms eg $\frac{5\sqrt{5}\sqrt{180}+5\sqrt{180}-50-10\sqrt{5}}{125-25}$ or $\frac{100+20\sqrt{5}}{100}$ oe	
		A1	for $1 + \frac{\sqrt{5}}{5}$	Accept written as $a = 1, b = 5$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	Result shown	M1	(indep) for writing $\sqrt{12}$ as $2\sqrt{3}$	This mark can be awarded whenever this is seen, which might be later in the process.
		M1	for method to rationalise the denominator eg $\frac{8+\sqrt{12}}{5+\sqrt{3}} \times \frac{5-\sqrt{3}}{5-\sqrt{3}}$ or $\frac{8+2\sqrt{3}}{5+\sqrt{3}} \times \frac{5-\sqrt{3}}{5-\sqrt{3}}$ oe	
		M1	(dep on previous M1) for expanding terms, condone one error in numerator or denominator eg $\frac{40-8\sqrt{3}+5\sqrt{12}-\sqrt{12}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ or $\frac{40-8\sqrt{3}+10\sqrt{3}-2\sqrt{3}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ or $\frac{34+2\sqrt{3}}{22}$ oe	
		A1	for a complete chain of reasoning leading to $\frac{17+\sqrt{3}}{11}$	
20	$x = 2.1, y = 5.1$ $x = -2.9, y = -4.7$	M1	for drawing the graph of $y - 2x = 1$	For both A marks accept answers in the ranges $x = 2.0$ to $2.2, y = 5.0$ to 5.2 $x = -2.8$ to $-3.0, y = -4.6$ to -4.8 Accept values given as coordinates
		A1	for one correct pair of values or for both correct x values, or for both correct y values	
		A1	for both correct pairs, correctly matched	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
23	$\frac{10\sqrt{3} + 27}{39}$	M1	for method to rationalise one of the fractions, eg $\frac{3\sqrt{3}}{4-\sqrt{3}} \times \frac{4+\sqrt{3}}{4+\sqrt{3}} (= \frac{12\sqrt{3}+9}{16-3})$ or $\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} (= \frac{2\sqrt{3}}{3})$ oe	for method to write fractions with a common denominator, eg $\frac{3\sqrt{3} \times \sqrt{3}}{\sqrt{3}(4-\sqrt{3})} - \frac{2 \times (4-\sqrt{3})}{\sqrt{3}(4-\sqrt{3})}$ oe
		M1	for method to rationalise both of the fractions eg $\frac{3\sqrt{3}}{4-\sqrt{3}} \times \frac{4+\sqrt{3}}{4+\sqrt{3}} (= \frac{12\sqrt{3}+9}{16-3})$ and $\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} (= \frac{2\sqrt{3}}{3})$ oe	for writing as a correct single fraction without brackets, eg $\frac{9-8+2\sqrt{3}}{4\sqrt{3}-3}$ oe
		M1	for method to write correct fractions with a common denominator eg $\frac{3(12\sqrt{3}+9)}{13 \times 3} - \frac{13 \times 2\sqrt{3}}{13 \times 3}$ or $\frac{36\sqrt{3}+27}{39} - \frac{26\sqrt{3}}{39}$ oe	for method to rationalise a fraction of the form $\frac{a+b\sqrt{3}}{c\sqrt{3}-d}$ where a, b, c and d are integers, eg $\frac{1+2\sqrt{3}}{4\sqrt{3}-3} \times \frac{4\sqrt{3}+3}{4\sqrt{3}+3}$ or $\frac{4\sqrt{3}+3+24+6\sqrt{3}}{48+12\sqrt{3}-12\sqrt{3}-9}$ oe
		A1	for $\frac{10\sqrt{3}+27}{39}$ oe	

Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	$3\sqrt{3}$	M1	for working unambiguously with $\sqrt{12}$, eg $\sqrt{4 \times 3}$ or $\sqrt{4} \times \sqrt{3}$ or $2\sqrt{3}$	
		A1	cao	
		M1	for simplifying the power eg $(\sqrt{3})^7 = 27\sqrt{3}$	
		M1	for method to rationalise the denominator eg multiplying by $\frac{\sqrt{3}}{\sqrt{3}}$	
18 (b)	$\frac{\sqrt{3}}{81}$	M1	for simplifying the power eg $(\sqrt{3})^7 = 27\sqrt{3}$	May be seen as the first step
		M1	for method to rationalise the denominator eg multiplying by $\frac{\sqrt{3}}{\sqrt{3}}$	
		A1	for $\frac{\sqrt{3}}{81}$ or equivalent fraction in form $\frac{\sqrt{b}}{c}$, eg $\frac{\sqrt{2187}}{2187}$	
		A1	for $\frac{\sqrt{3}}{81}$ or equivalent fraction in form $\frac{\sqrt{b}}{c}$, eg $\frac{\sqrt{2187}}{2187}$	
19 (i)	3, 8	M1	for $a = 3$, may be seen in working or as part of an expression, eg $(x - 3)^2 - 9$	9 does not have to be seen for this mark
		A1	for $a = 3, b = 8$	
		B1	for 3, -8 or ft (i)	
		B1	for 3, -8 or ft (i)	
19 (ii)	3, -8	B1	for 3, -8 or ft (i)	
		B1	for 3, -8 or ft (i)	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$\frac{414}{990}$	M1 M1 A1	for $(x =) 0.41818\ldots$ or $(10x =) 4.\dot{1}8$ or $4.1818\ldots$ or $(100x =) 41.\dot{8}1$ or $41.818\ldots$ or $(1000x =) 418.\dot{1}8$ or $418.18\ldots$ for using two recurring decimals with a terminating decimal difference, eg. $(1000x - 10x =) 418.\dot{1}8 - 4.\dot{1}8$ or $418.18\ldots - 4.1818\ldots (= 414)$ for $\frac{414}{990}$ oe, eg $\frac{23}{55}$	Accept $(100x - x =) 41.\dot{8}1 - 0.4\dot{1}8$ or $41.818\ldots - 0.41818\ldots (= 41.4)$ $\frac{41.4}{99}$ must be simplified to gain the accuracy mark
16 (a)	$2\sqrt{11}$	M1 A1	for method to multiply numerator and denominator by $\sqrt{11}$ or a multiple of $\sqrt{11}$, eg $\frac{22}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}}$ for $2\sqrt{11}$	
(b)	$\frac{6 + \sqrt{3}}{11}$	M1 M1 A1	for method to multiply numerator and denominator by $2\sqrt{3} + 1$ or a multiple of $2\sqrt{3} + 1$, eg $\frac{\sqrt{3}}{2\sqrt{3} - 1} \times \frac{2\sqrt{3} + 1}{2\sqrt{3} + 1}$ (dep) for $\sqrt{3} \times 2\sqrt{3} = 6$ or $2\sqrt{3} \times 2\sqrt{3} = 12$ for $\frac{6 + \sqrt{3}}{11}$ (accept $a = 6$ and $b = 11$)	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	$3\sqrt{5}$	M1	for $\frac{15}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{15}{\sqrt{5}} \times \frac{-\sqrt{5}}{-\sqrt{5}}$	This mark can be awarded whenever this is seen, which might be later in the process.
		A1	for $3\sqrt{5}$ or $\sqrt{45}$	
	$\frac{32-9\sqrt{3}}{11}$	M1	(indep) for writing $\sqrt{75}$ as $5\sqrt{3}$	
		M1	for method to rationalise the denominator, eg $\frac{\sqrt{75}-2}{1+2\sqrt{3}} \times \frac{1-2\sqrt{3}}{1-2\sqrt{3}}$ or $\frac{5\sqrt{3}-2}{1+2\sqrt{3}} \times \frac{1-2\sqrt{3}}{1-2\sqrt{3}}$	
		M1	(dep on previous M1) for expanding terms, condone one error in numerator or denominator eg $\frac{\sqrt{75}-2\sqrt{75}\sqrt{3}-2+4\sqrt{3}}{1-2\sqrt{3}+2\sqrt{3}-4\sqrt{3}\sqrt{3}}$ or $\frac{5\sqrt{3}-10\sqrt{3}\sqrt{3}-2+4\sqrt{3}}{1-2\sqrt{3}+2\sqrt{3}-4\sqrt{3}\sqrt{3}}$	
		A1	for $\frac{32-9\sqrt{3}}{11}$ oe eg $\frac{-32+9\sqrt{3}}{-11}$	
(b)				Accept $a = 32, b = 9, c = 11$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	$5\sqrt{7}$	M1	for $\frac{35}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} (= \frac{35\sqrt{7}}{7})$ or $\frac{35}{\sqrt{7}} \times \frac{-\sqrt{7}}{-\sqrt{7}} (= \frac{-35\sqrt{7}}{-7})$	
		A1	for $5\sqrt{7}$ or $\sqrt{175}$	
(b)	$a = 7, b = 5$	B1	for $\sqrt{27} = 3\sqrt{3}$ or $2\sqrt{27} = 6\sqrt{3}$	B1 can be awarded whenever this is seen, which might be later in the process.
		P1	for process to rationalise the denominator, eg $\frac{\sqrt{27}-1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}}$ or $\frac{3\sqrt{3}-1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}}$ oe	
		P1	(dep on previous P1) for expanding terms, condone one error in numerator or denominator, eg $\frac{2\sqrt{27} + \sqrt{27}\sqrt{3} - 2 - \sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} - \sqrt{3}\sqrt{3}}$ or $\frac{6\sqrt{3} + 3\sqrt{3}\sqrt{3} - 2 - \sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} - \sqrt{3}\sqrt{3}}$ or $6\sqrt{3} + 9 - 2 - \sqrt{3}$ oe	
		A1	for $a = 7, b = 5$	Accept $7 + 5\sqrt{3}$

