

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE MATHEMATICS

# H

Higher Tier

Paper 1 Non-Calculator

Tuesday 6 November 2018

Morning

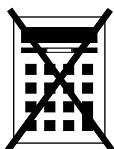
Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- mathematical instruments

You must **not** use a calculator.



## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use

Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
<b>TOTAL</b>	



N 0 V 1 8 8 3 0 0 1 H 0 1

Answer **all** questions in the spaces providedDo not write  
outside the  
box

- 1** Simplify  $(5^4)^2$   
Circle your answer.

**[1 mark]**

$5^6$

$5^8$

$25^6$

$25^8$

- 2** Circle the volume, in  $\text{cm}^3$ , of a cylinder with radius 5 cm and height 8 cm

**[1 mark]**

$40\pi$

$80\pi$

$200\pi$

$1600\pi$

- 3** Simplify  $16a^2 \div a + 3a \times 2$   
Circle your answer.

**[1 mark]**

$22a$

$8a$

$38a$

$2a$



- 4 Circle the value of  $\cos 30^\circ$

[1 mark]

$$\frac{1}{2}$$

$$\frac{\sqrt{3}}{2}$$

$$0$$

$$1$$

- 5 Work out  $8\frac{1}{2} \div 2\frac{2}{3}$

Give your answer as a mixed number.

[4 marks]

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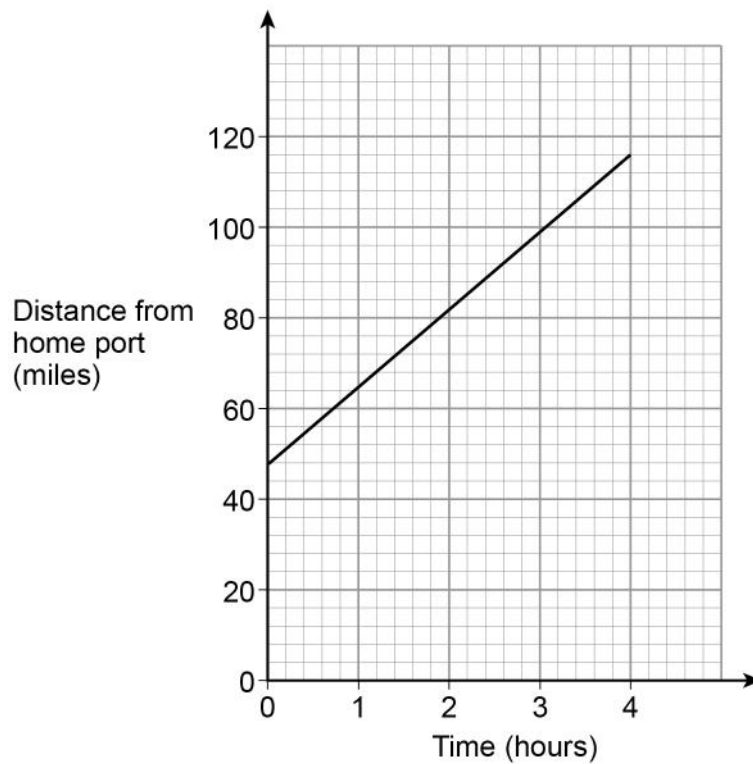
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Answer \_\_\_\_\_



6

A ship is sailing in a straight line from its home port.  
The distance-time graph shows 4 hours of the journey.



Work out the speed of the ship during these 4 hours.

[3 marks]

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Answer \_\_\_\_\_ mph



7

The sum of the angles in any quadrilateral is  $360^\circ$

For example, in a rectangle  $4 \times 90^\circ = 360^\circ$

Zak writes,

$5 \times 90^\circ = 450^\circ$  so the sum of the angles in any pentagon must be  $450^\circ$

Is he correct?

Tick a box.

☐

Yes

☐

No

Show working to support your answer.

[2 marks]

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Turn over for the next question



- 8** Kim works at an airport in the UK.  
She records the number of planes landing between 10 am and 2 pm each day.  
The table shows the data for the first 10 days in January.

Day	1	2	3	4	5	6	7	8	9	10
Number of planes	148	151	147	155	153	147	155	102	151	154

- 8 (a)** The airport was affected by fog on one of the days.

Which day do you think it was?

Give a reason for your answer.

**[1 mark]**

Day \_\_\_\_\_

Reason \_\_\_\_\_

- 8 (b)** Kim uses the data to predict how many planes will land at the airport in a year.

In her method, she

uses an estimate of 150 planes in each 4-hour period throughout the day

assumes the same number of planes each day.

Work out her prediction.

**[3 marks]**

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Answer \_\_\_\_\_



**8 (c)**

In fact,

fewer planes land in winter than in summer

fewer planes land at night than during the day.

What does this tell you about Kim's prediction?

Tick **one** box.☐

Her prediction is too low

☐

Her prediction is too high

☐

Her prediction could be too low or too high

Give a reason for your answer.

**[2 marks]**

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**Turn over for the next question****Turn over ►**

9

$$\sqrt{6^2 + 8^2} = \sqrt[3]{125a^3}$$

Work out the value of  $a$ .**[4 marks]**

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Answer \_\_\_\_\_

10

Work out the percentage increase from 80 to 280

**[3 marks]**

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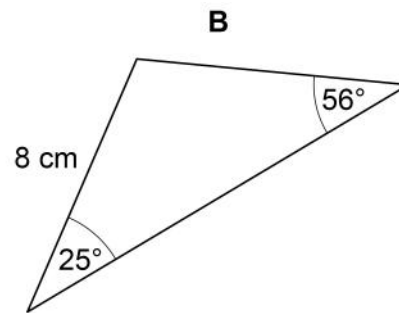
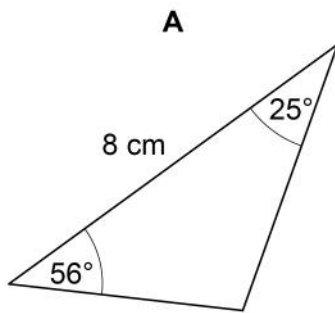
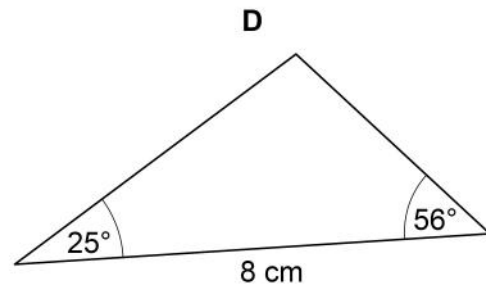
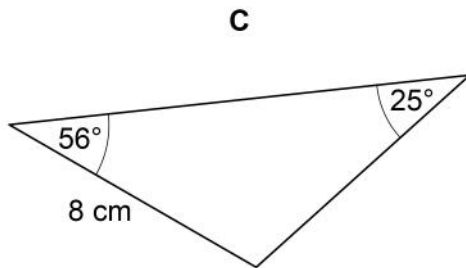
Answer \_\_\_\_\_ %





11

Here are four triangles.

Not drawn  
accurately

Which **two** triangles are congruent?  
Circle **two** letters below.

[1 mark]

A

B

C

D

Turn over for the next question

Turn over ►



**12** Solve  $x^2 - x - 12 = 0$

**[3 marks]**

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Answer \_\_\_\_\_

**13**  $e : f = 2 : 3$  and  $f : g = 5 : 4$

Work out  $e : g$

Give your answer in its simplest form.

**[3 marks]**

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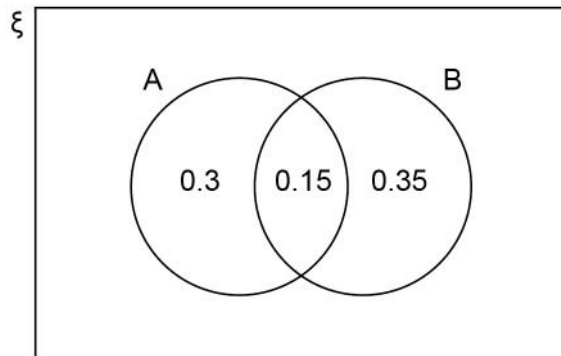
Answer \_\_\_\_\_ : \_\_\_\_\_



14

A and B are two events.

Some probabilities are shown on the Venn diagram.

Work out  $P(A' \cup B)$ **[2 marks]**

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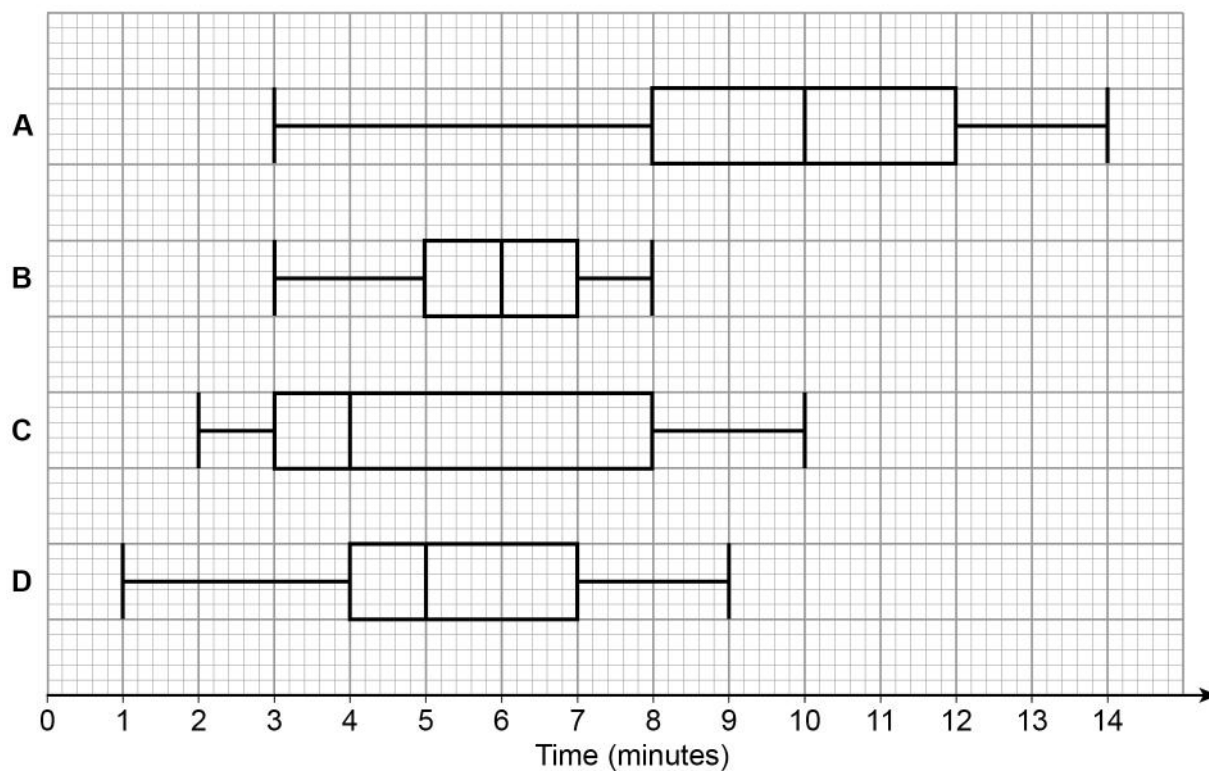
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Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

- 15** In a survey, queuing times at supermarket checkouts were recorded. One morning, samples of 50 customers were taken at supermarkets A, B, C and D. The box plots represent the results.

**Queuing times**



- 15 (a)** On average, which supermarket had the lowest queuing times?  
Give a reason for your answer.

**[2 marks]**

Supermarket \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_



- 15 (b)** At which supermarket were the queuing times most consistent?  
Give a reason for your answer.

**[2 marks]**

Supermarket \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

- 16** Circle the number that is closest to the value of  $29^3$

**[1 mark]**

27 000

90

2700

9000

- 17** Work out the exact value of  $\left(\frac{3}{4}\right)^{-3}$

**[2 marks]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

18

Beth and Mia translate documents from Spanish into English.

A set of documents that would take Beth 8 days would take Mia 10 days.

Beth starts to translate the documents.

After 2 days Beth and Mia both work on translating the documents.

How many **more** days will it take to complete the work?

You **must** show your working.

**[4 marks]**

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Answer \_\_\_\_\_ days



**19** In a chess club, there are  $x$  boys and  $y$  girls.

**19 (a)** If 5 more boys and 8 more girls join, there would be half as many boys as girls.

Show that  $y = 2x + 2$

**[2 marks]**

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**19 (b)** If instead,  
10 more boys and 1 more girl join, there would be the same number of boys and girls.

Work out  $x$  and  $y$ .

**[3 marks]**

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$x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_

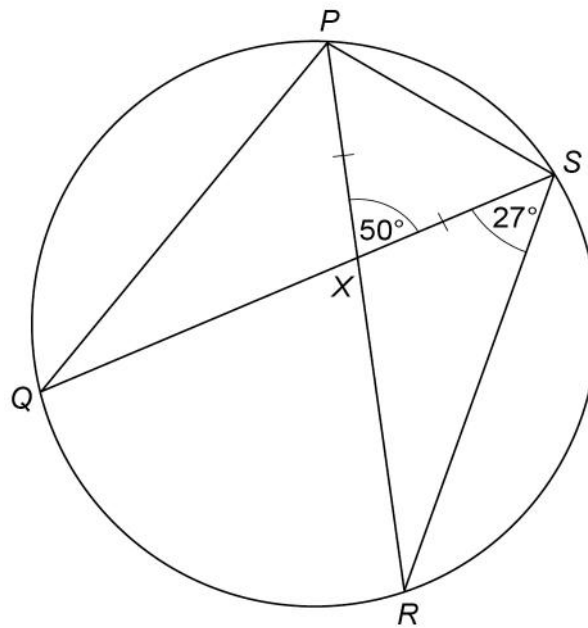


20

$P$ ,  $Q$ ,  $R$  and  $S$  are points on a circle.

$PXR$  and  $QXS$  are straight lines.

$PX = SX$



Not drawn  
accurately

Prove that  $QS$  is **not** a diameter of the circle.

[4 marks]

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Here are the first four terms of a quadratic sequence.

68

**[3 marks]**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

Answer \_\_\_\_\_

**Turn over for the next question**



22

Solve  $\frac{x}{x+4} + \frac{7}{x-2} = 1$

You **must** show your working.

[4 marks]

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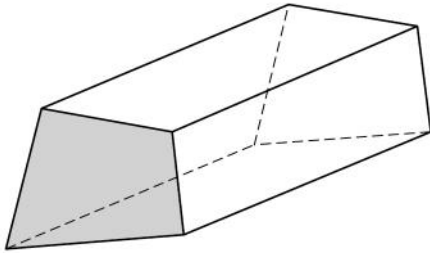
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$x =$  \_\_\_\_\_

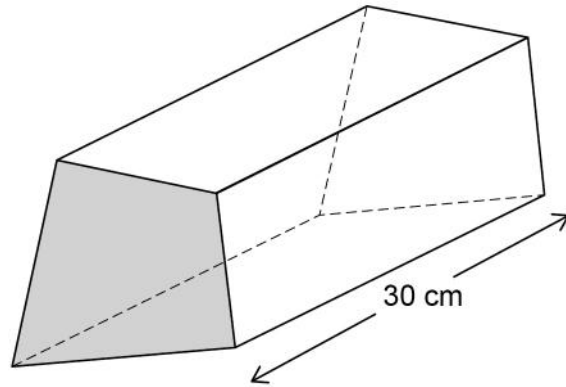


23

Prisms A and B are similar.  
The cross sections are shaded.

**Prism A**volume =  $480 \text{ cm}^3$ **Prism B**

length = 30 cm



area of the cross section of A : area of the cross section of B = 4 : 9

Work out the area of the cross section of B.

**[5 marks]**


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Answer \_\_\_\_\_  $\text{cm}^2$



- 24** Show that  $\frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}}$  can be written in the form  $\frac{c\sqrt{d}}{10}$   
where  $c$  and  $d$  are integers. **[3 marks]**

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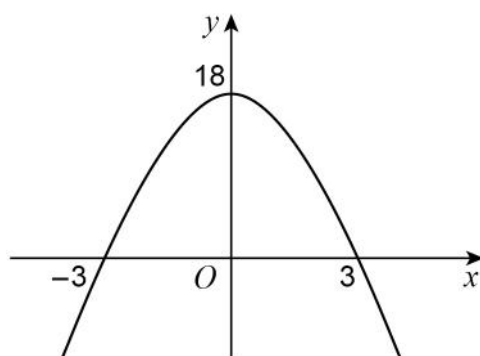
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25

A quadratic curve intersects the axes at  $(-3, 0)$ ,  $(3, 0)$  and  $(0, 18)$



Not drawn  
accurately

Work out the equation of the curve.

[3 marks]

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Answer \_\_\_\_\_

Turn over for the next question

Turn over ►



The area of this triangle is  $25\sqrt{3} \text{ cm}^2$

A triangle is shown with a horizontal base of 20 cm. The left side is labeled  $w$  cm and the right side is labeled  $x$  cm. The interior angle at the bottom right vertex is labeled  $60^\circ$ .

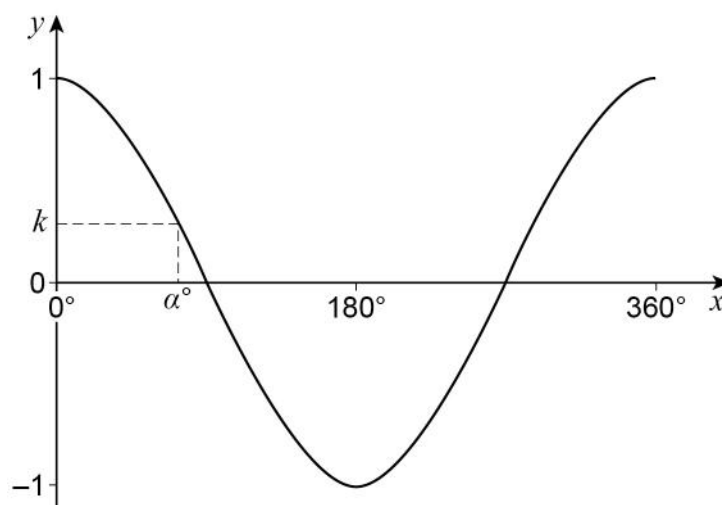
Give your answer in the form  $a\sqrt{b}$  where  $a$  and  $b$  are integers greater than 1

[illegible]

Answer



- 27** Here is a sketch of  $y = \cos x$  for values of  $x$  from  $0^\circ$  to  $360^\circ$



Not drawn  
accurately

$\alpha^\circ$  is an acute angle.

$$\cos \alpha^\circ = k$$

- 27 (a)** Circle the value of  $\cos (180^\circ - \alpha^\circ)$

[1 mark]

$1 - k$

$k$

$-k$

$-1 - k$

- 27 (b)** Circle the value of  $\cos (360^\circ + \alpha^\circ)$

[1 mark]

$k - 1$

$k + 1$

$-k$

$k$

**END OF QUESTIONS**



**There are no questions printed on this page**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

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# GCSE MATHEMATICS 8300/1H

Higher Tier Paper 1 Non-Calculator

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Mark scheme

November 2018

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Version: 1.0. Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from [aqa.org.uk](http://aqa.org.uk)

## Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
<b>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between a and b inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14 ...</b>	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
<b>Use of brackets</b>	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

### **Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

### **Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

### **Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

### **Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

### **Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

### **Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

### **Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

### **Work not replaced**

Erased or crossed out work that is still legible should be marked.

### **Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

### **Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

### **Continental notation**

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Question	Answer	Mark	Comments
1	$5^8$	B1	
2	$200\pi$	B1	
3	$22a$	B1	
4	$\frac{\sqrt{3}}{2}$	B1	

Question	Answer	Mark	Comments
5	<b>Alternative method 1</b>		
	$\frac{17}{2}$ or $\frac{8}{3}$	M1	oe fractions
	their $\frac{17}{2} \times$ their $\frac{3}{8}$	M1	conversion of both mixed numbers to improper fractions and multiplication of the conversion of $8\frac{1}{2}$ by the reciprocal of the conversion of $2\frac{2}{3}$
	$\frac{51}{16}$	A1	oe fraction or decimal
	$3\frac{3}{16}$	B1ft	oe mixed number ft correct conversion of their improper fraction to a mixed number
	<b>Alternative method 2</b>		
	$\frac{17}{2}$ or $\frac{8}{3}$	M1	oe fractions
	$\frac{51}{6} \div \frac{16}{6}$	M1	conversion of both mixed numbers to improper fractions, correct conversion to improper fractions with a common denominator and division of the conversion of $8\frac{1}{2}$ by the conversion of $2\frac{2}{3}$
	$\frac{51}{16}$	A1	oe fraction or decimal
	$3\frac{3}{16}$	B1ft	oe mixed number ft correct conversion of their improper fraction to a mixed number

The Additional Guidance for question 5 is on the next page

Question	Answer	Mark	Comments
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<b>5 cont</b>	<b>Additional Guidance</b>		
	Working with decimals		0, 3 or 4
	Ignore incorrect attempt to simplify a mixed number eg $3\frac{3}{16} = 3\frac{1}{8}$		M1M1A1B1
	$3\frac{3}{16}$ seen, then $\frac{51}{16}$ on answer line		M1M1A1B0
	$\frac{9}{2}$ and $\frac{8}{3}$ , $\frac{27}{6} \div \frac{16}{6}$ , $\frac{27}{16}$ , $1\frac{11}{16}$		M1M1A0B1ft
	$\frac{9}{2}$ and $\frac{8}{3}$ , $\frac{27}{6} \div \frac{16}{6}$ , $1\frac{11}{16}$		M1M1A0B1ft
	$\frac{9}{2}$ and $\frac{4}{3}$ , $\frac{27}{6} \div \frac{8}{6}$ , $\frac{27}{8}$ , $3\frac{3}{8}$		M0M1A0B1ft

Question	Answer	Mark	Comments
6	<b>Alternative method 1</b>		
	Correct reading of at least one value at 0 hours [46, 50] at 1 hour [63, 67] at 2 hours [80, 84] at 3 hours [96, 100] at 4 hours [114, 118]	M1	may be seen on graph
	$\frac{\text{subtraction of two values}}{\text{correct number of hours}}$	M1	division by 1 may be implied
	17	A1	SC1 29
	<b>Alternative method 2</b>		
	A difference in the range for 1 hour [15, 19] for 2 hours [32, 36] for 3 hours [49, 53] for 4 hours [66, 70]	M1	may be seen on graph
	$\frac{\text{difference}}{\text{correct number of hours}}$	M1	division by 1 may be implied
	17	A1	SC1 29
	<b>Additional Guidance</b>		
	$(119 - 42) \div 4 = 19.25$		M0M1A0
	for 2nd M1 in Alt 1, subtraction must be in the correct order unless recovered		
	17 does not imply three marks, so working must be checked eg $(110 - 42) \div 4 = 17$		M0M1A0



Question	Answer	Mark	Comments
7	<b>Alternative method 1</b>		
	$(5 - 2) \times 180$ or $3 \times 180$ or 540 or $180 - (360 \div 5)$ or $(180 - 72)$ or 108	M1	oe
	Ticks 'No' and 540 or Ticks 'No' and 108	A1	
	<b>Alternative method 2</b>		
	States that a pentagon cannot have five (or all) right angles or states that a pentagon can have five (or all) obtuse angles or states that the maximum number of right angles is three or draws a pentagon with exactly three right angles shown	M1	
	Ticks 'No' and states that a pentagon cannot have five (or all) right angles or states that the maximum number of right angles is three or states that a pentagon can have five (or all) obtuse angles and draws a correct diagram of an attempted pentagon with four right angles shown or draws a pentagon with exactly three right angles shown or draws a pentagon with five obtuse angles	A1	

The Additional Guidance for question 7 is on the next page

Question	Answer	Mark	Comments
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<b>7 cont</b>	<b>Additional Guidance</b>		
	If comparing $72^\circ$ to $90^\circ$ , they must state that they are referring to the exterior angles		
	If 'Yes' is ticked, M1 can still be scored		
	If neither box is ticked, 'No' must be implied by the explanation for M1A1		

<b>8(a)</b>	8 and lowest (value) or 8 and outlier	B1	oe Accept 102 for day 8
	<b>Additional Guidance</b>		
	8 and '(Only 102 landed whereas) All the other days were over 140'		B1
	8 and 'Fewer (less) planes landed (than the other days)'		B1
	8 and 'It's an anomaly'		B1
	8 and 'There was a (big) drop / reduction / decrease in the number of planes'		B1
	8 and 'There were only 102 planes'		B1
	8 and 'It's low' or 8 and 'It's lower' or 8 and 'It's too low'		B1
	8 and 'It doesn't follow the trend (or pattern)'		B1
	8 and 'It reduces a lot that day'		B1
	Ignore a non-contradictory statement with a correct statement eg 8 and 'It's the lowest, it dropped by 53'		B1
	Do not award B1 with a numerical error in the statement eg 8 and 'It's the lowest by 40'		B0
	8 and 'There were 102 planes'		B0
	8 and 'There's a drop of 53 (implies a point to point comparison)'		B0
	8 and 'It's below average'		B0
	8 and 'It's the odd one out'		B0

Question	Answer	Mark	Comments
8(b)	<b>Alternative method 1</b>		
	$150 \times 24 \div 4$ or $150 \times 6$ or 900	M1	oe
	their $900 \times 365$ or their $900 \times 7 \times 4 \times 12$ or their $900 \times 7 \times 52$ or 302 400 or 360 000	M1dep	for 365, allow 336, 360, 364, 366, 370 and 400
	324 000 or 327 600 or 328 500 or 329 400 or 333 000	A1	
	<b>Alternative method 2</b>		
	$365 \times 150$ or 54 750 or $365 \times$ any multiple of 150	M1	for 365, allow 336, 360, 364, 366, 370 and 400 for 54 750 allow 50 400, 54 000, 54 600, 54 900, 55 500 and 60 000
	their $54\,750 \times 24 \div 4$ or 302 400 or 360 000	M1dep	
	324 000 or 327 600 or 328 500 or 329 400 or 333 000	A1	
	<b>Alternative method 3</b>		
	$365 \times (24 \div 4)$ or $365 \times 6$ or 2190	M1	for 365, allow 336, 360, 364, 366, 370 and 400 for 2190, allow 2016, 2160, 2184, 2196, 2220 and 2400
	their $2190 \times 150$ or 302 400 or 360 000	M1dep	
	324 000 or 327 600 or 328 500 or 329 400 or 333 000	A1	

Question	Answer	Mark	Comments
8(c)	Ticks ‘Her prediction could be too low or too high’  and  explains that fewer landings in winter would make it too low, but fewer landings at night would make it too high  or states that the actual numbers are not given	B2	oe reason  B1  ticks ‘Her prediction could be too low or too high’
	<b>Additional Guidance</b>		
	Ticks ‘Her prediction could be too low or too high’ and states that there is not enough data	B1 only	

Question	Answer	Mark	Comments
9	<b>Alternative method 1</b>		
	$(6^2 =) 36$ or $(8^2 =) 64$ or 100 or $\sqrt{100}$	M1	
	10	A1	
	their $10 = 5a$ or $(\text{their } 10)^3 = 125a^3$ or $1000 = 125a^3$ or $8 = a^3$	M1	
	2	A1ft	ft their 10 with both method marks scored
	<b>Alternative method 2</b>		
	5 or $a$	M1	
	$5a$	A1	
	their $5a = \sqrt{100}$ or their $5a = 10$	M1	$(a =) \frac{\sqrt{100}}{5}$ or $(a =) \frac{10}{5}$ implies M1A1M1
	2	A1ft	ft their $5a$ with both method marks scored
	<b>Additional Guidance</b>		
	Use the scheme that gives the better mark eg1 $\sqrt{14^2} = 5a$ , $14 = 5a$ , $a = 2.8$ scores M0A0M1A0 on alt 1 and M1A1M0A0 on alt 2 eg2 $\sqrt{100} = 5a^3$ , $10 = 5a^3$ , $a = \sqrt[3]{2}$ scores M1A1M0A0 on alt 1 and M1A0M1A1ft on alt 2		Award M1A1M0A0  Award M1A0M1A1ft

Question	Answer	Mark	Comments
10	<b>Alternative method 1</b>		
	$280 - 80$ or $200$	M1	
	their $200 \div 80 (\times 100)$ or $2.5 (\times 100)$	M1dep	oe
	250	A1	
	<b>Alternative method 2</b>		
	$280 \div 80$ or $3.5$	M1	oe
	$280 \div 80 \times 100 (- 100)$ or their $3.5 \times 100 (- 100)$ or $350 (- 100)$ or $(\text{their } 3.5 - 1) (\times 100)$ or $2.5 (\times 100)$	M1dep	oe
	250	A1	
11	A and D	B1	

Question	Answer	Mark	Comments
12	<b>Alternative method 1</b>		
	$(x + a)(x + b)$	M1	where $ab = \pm 12$ or $a + b = -1$
	$(x - 4)(x + 3)$	A1	
	4 and -3	A1	SC1 4 or -3 with no or one incorrect answer
	<b>Alternative method 2</b>		
	$\frac{(- -)1 \pm \sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$ or $\frac{1 \pm \sqrt{1 + 48}}{2}$ or $\frac{1 \pm \sqrt{49}}{2}$	M1	oe allow one sign error
	$\frac{(- -)1 \pm \sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$ or $\frac{1 \pm \sqrt{1 + 48}}{2}$ or $\frac{1 \pm \sqrt{49}}{2}$	A1	oe fully correct
	4 and -3	A1	SC1 4 or -3 with no or one incorrect answer
	<b>Alternative method 3</b>		
	$\left(x - \frac{1}{2}\right)^2 \dots$	M1	
	$\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 12 (= 0)$	A1	oe equation
	4 and -3	A1	SC1 4 or -3 with no or one incorrect answer
	<b>Additional Guidance</b>		
	4 and -3 with no working	M1A1A1	
	M1 can be scored amongst incorrect attempts to factorise		
	Condone trailing bracket missing eg $(x - 4)(x + 3$	M1A1	

Question	Answer	Mark	Comments
13	<b>Alternative method 1</b>		
	$2 \times 5 : 3 \times 5$ or $10 : 15$ and $5 \times 3 : 4 \times 3$ or $15 : 12$	M1	oe common value for $f$ eg $10 : 15 : 12$ or $\frac{2}{3} : 1 : \frac{4}{5}$
	$10 : 12$	M1dep	oe unsimplified ratio condone fractions or decimals
	$5 : 6$	A1	
	<b>Alternative method 2</b>		
	$3e = 2f$ and $4f = 5g$	M1	oe equations
	$6e = 5g$	M1dep	oe equation
	$5 : 6$	A1	
	<b>Additional Guidance</b>		
	Variables in an otherwise correct answer: the same variable scores 2 marks, eg $5f : 6f$ different variables do not score, unless earlier marks can be awarded, eg $5e : 6g$ with no working worth M1 or M1M1		M1M1A0  M0M0A0
14	$1 - 0.3 - 0.15 - 0.35$ or $1 - 0.8$ or $0.2$ or $0.15 + 0.35 (+ 0.2)$ or $0.5 (+ 0.2)$ or $1 - 0.3$ or $A' \cup B$ clearly shaded on diagram	M1	oe
	$0.7$	A1	oe fraction, decimal or percentage
	<b>Additional Guidance</b>		
	Do not award M1 for $0.15 + 0.35$ or $0.5$ if it is then used in an incorrect calculation eg $0.15 + 0.35 = 0.5$ , $0.5 + 0.3 = 0.8$ (no further working)		M0



Question	Answer	Mark	Comments
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15(a)	C and 'lowest median'	B2	oe B1 C
	<b>Additional Guidance</b>		
	If the value of the median is given it must be 4 for B2		
	Accept midpoint oe for median		
	Do not accept mean for median		
	Only accept average for median if the value of 4 is also given		
	Accept mention of the lowest lower quartile with correct mention of the median for B2, but do not accept mention of any extra statistical measure as part of their justification		

15(b)	B and 'lowest interquartile range' or B and 'lowest range'	B2	oe B1 B
	<b>Additional Guidance</b>		
	If the value of the interquartile range is given it must be 2 for B2 If the value of the range is given it must be 5 for B2		
	For B2, do not accept non-statistical reasons, eg 'the narrowest box'		
	For B2, do not accept mention of any extra statistical measure as part of their justification		

Question	Answer	Mark	Comments
16	27 000	B1	
17	$\left(\frac{4}{3}\right)^3$ or $\frac{4^3}{3^3}$ or $\left(\frac{27}{64}\right)^{-1}$ or $\frac{1}{\frac{27}{64}}$ or $\frac{1}{\left(\frac{3}{4}\right)^3}$ or $\frac{1}{0.75^3}$ or $\left(\frac{1}{0.75}\right)^3$	M1	
	$\frac{64}{27}$ or $2\frac{10}{27}$	A1	oe fraction, mixed number or decimal
	<b>Additional Guidance</b>		
	$\frac{64}{27}$ followed by an incorrect attempt to convert to a mixed number		M1A1
	$\frac{27}{64}$		M0A0

Question	Answer	Mark	Comments
18	<b>Alternative method 1</b>		
	$\frac{1}{4}$ (completed) or $\frac{3}{4}$ (left)	M1	oe eg 25% (completed) or 75% (left)
	$\frac{1}{8} + \frac{1}{10}$ or $\frac{9}{40}$	M1	oe eg 12.5% + 10% or 22.5%
	$\frac{3}{4} \div \text{their } \frac{9}{40}$	M1dep	oe eg 75% $\div$ their 22.5% dep on M1M1
	$3\frac{1}{3}$ or 4 days with correct working seen	A1	oe
	<b>Alternative method 2 – assumes a number of pages (eg 80)</b>		
	$\frac{3}{4} \times \text{their } 80$ or 60	M1	oe
	$\frac{1}{8} \times \text{their } 80$ or 10 and $\frac{1}{10} \times \text{their } 80$ or 8	M1	oe
	their 60 $\div$ (their 10 + their 8)	M1dep	oe dep on M1M1
	$3\frac{1}{3}$ or 4 days with correct working seen	A1	oe
	<b>Additional Guidance</b>		
	8 – 2 = 6, 10 – 6 = 4, answer 4		MOMOM0A0
	In alt 1, for the third mark allow a build-up method in percentages, fractions or decimals showing that 3 days is not enough (and 4 is enough) eg 47.5%, 70%, 92.5%, (115%), answer 4		M1M1M1A1

Question	Answer	Mark	Comments
<b>19(a)</b>	$2(x + 5) = y + 8$ or $2x + 10 = y + 8$	M1	oe eg $\frac{x+5}{y+8} = \frac{1}{2}$ or $\frac{y+8}{x+5} = 2$
	$2x + 10 = y + 8$ and $y = 2x + 2$	A1	
<b>19(b)</b>	$x + 10 = y + 1$	M1	oe
	Eliminates $x$ or $y$ from their $(x + 10) = y + 1$ and $y = 2x + 2$	M1	their $(x + 10) = y + 1$ must be an equation in $x$ and $y$ eg $x + 10 = y - 1$ (and $y = 2x + 2$ ) followed by $x + 11 = 2x + 2$
	$x = 7$ and $y = 16$	A1	
	<b>Additional Guidance</b>		
	$x = 7$ or $y = 16$ with no value or an incorrect value for the other unknown and no working worth M marks		M0M0A0

Question	Answer	Mark	Comments
20	<b>Alternative method 1</b>		
	angle $QPR = 27$	M1	may be seen on diagram
	angle $XPS = \frac{180 - 50}{2}$ or 65	M1	may be seen on diagram
	angle $QPR = 27$ and angle $XPS = 65$ and angle $QPS = 92$ and angle in a semicircle is a right angle	A1	oe accept $92 \neq 90$
	all reasons for angle facts: angles in same segment (are equal) and angle sum of triangle (is 180) and base angles of isosceles triangle (are equal)	A1	oe oe oe

Question	Answer	Mark	Comments
20 cont	<b>Alternative method 2</b>		
	angle $SXR = 180 - 50$ or 130 and angle $XRS = 180 - \text{their } 130 - 27$ and angle $PQS = \text{their } 23$	M1	may be seen on diagram  angle $XRS = 23$
	angle $XSP = \frac{180 - 50}{2}$ or 65	M1	may be seen on diagram
	angle $SXR = 130$ and angle $XRS = 23$ and angle $PQS = 23$ and $XSP = 65$ and angle $QPS = 92$ and angle in a semicircle is a right angle	A1	         oe accept $92 \neq 90$
	all reasons for angle facts: angles on a straight line (add up to 180) and angle sum of triangle (is 180) and angles in same segment (are equal) and base angles of isosceles triangle (are equal)	A1	oe  oe  oe  oe

Question	Answer	Mark	Comments
21	<b>Alternative method 1</b>		
	(second differences =) 4 or $2n^2$ or $a = 2$	M1	second difference seen at least once and not contradicted
	$11 - 2 \times 1^2$ and $26 - 2 \times 2^2$ and $45 - 2 \times 3^2$ (and $68 - 2 \times 4^2$ ) or 9 and 18 and 27 (and 36) or $9n$	M1dep	
	$2n^2 + 9n$	A1	oe
	<b>Alternative method 2</b>		
	any two of $a + b + c = 11$ $4a + 2b + c = 26$ $9a + 3b + c = 45$ $16a + 4b + c = 68$	M1	
	$3a + b = 26 - 11$ and $5a + b = 45 - 26$ or $a = 2$ and $b = 9$ (and $c = 0$ )	M1dep	oe obtains two correct equations in same two variables from their equations
	$2n^2 + 9n$	A1	oe
	<b>Alternative method 3</b>		
	(second differences =) 4 or $2n^2$ or $a = 2$	M1	second difference seen at least once and not contradicted
	$3a + b = 26 - 11$ and substitutes $a = 2$ or $b = 9$ or $9n$	M1dep	
	$2n^2 + 9n$	A1	oe

Question	Answer	Mark	Comments
22	Any two of $x(x - 2)$ and $7(x + 4)$ and $(x - 2)(x + 4)$	M1	oe $x(x - 2)$ and $7(x + 4)$ cannot be denominators
	correct equation including $x(x - 2)$ and $7(x + 4)$ and $(x - 2)(x + 4)$	M1dep	
	$x^2 - 2x + 7x + 28 = x^2 + 4x - 2x - 8$	M1dep	oe all brackets must be expanded
	-12	A1	
	<b>Alternative method 2</b>		
	$\frac{x(x - 2)}{x + 4} + 7 = x - 2$	M1	
	$\frac{x(x - 2)}{x + 4} = x - 9$ or $x(x - 2) = (x - 9)(x + 4)$	M1dep	
	$x^2 - 2x = x^2 - 9x + 4x - 36$	M1dep	oe all brackets must be expanded
	-12	A1	
	<b>Alternative method 3</b>		
	$x + \frac{7(x + 4)}{x - 2} = x + 4$	M1	
	$\frac{7(x + 4)}{x - 2} = 4$ or $7(x + 4) = 4(x - 2)$	M1dep	
	$7x + 28 = 4x - 8$	M1dep	oe all brackets must be expanded
	-12	A1	
	<b>Additional Guidance</b>		
	In Alt 1, do not allow $x \times x - 2$ or $7 \times x + 4$ unless recovered		



Question	Answer	Mark	Comments
23	<b>Alternative method 1</b>		
	$\sqrt{4} : \sqrt{9}$ or $2 : 3$	M1	length A : length B
	$30 \div \text{their } 3 \times \text{their } 2$ or 20	M1dep	length A
	$480 \div \text{their } 20$ or 24	M1dep	area cross section A
	their $24 \div 4 \times 9$	M1dep	
	54	A1	
	<b>Alternative method 2</b>		
	$\sqrt{4} : \sqrt{9}$ or $2 : 3$	M1	length A : length B
	$(\sqrt{4})^3 : (\sqrt{9})^3$ or $8 : 27$	M1dep	volume A : volume B
	$480 \div \text{their } 8 \times \text{their } 27$ or 1620	M1dep	volume B
	their $1620 \div 30$	M1dep	
	54	A1	

Question	Answer	Mark	Comments
24	<b>Alternative method 1</b>		
	$\frac{2\sqrt{6}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{\sqrt{3}}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}}$	M1	
	$\frac{2\sqrt{30}}{5}$ or $\frac{4\sqrt{30}}{10}$ or $\frac{\sqrt{30}}{10}$	M1dep	
	$\frac{3\sqrt{30}}{10}$	A1	
	<b>Alternative method 2</b>		
	$\frac{2\sqrt{6}\sqrt{2}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$ or $\frac{2\sqrt{12}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$	M1	oe common denominator eg $\frac{2\sqrt{60}}{\sqrt{50}} - \frac{\sqrt{15}}{\sqrt{50}}$
	$\frac{4\sqrt{3}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$ or $\frac{3\sqrt{3}}{\sqrt{10}}$	M1dep	oe common denominator and common surd in numerator $\frac{4\sqrt{15}}{\sqrt{50}} - \frac{\sqrt{15}}{\sqrt{50}}$ or $\frac{3\sqrt{15}}{\sqrt{50}}$
	$\frac{3\sqrt{30}}{10}$	A1	
	<b>Additional Guidance</b>		
	Ignore an attempt at further simplification after $\frac{3\sqrt{30}}{10}$		M1M1A1

Question	Answer	Mark	Comments
25	<b>Alternative method 1</b>		
	$a(-3)^2 + b(-3) + c = 0$ or $a(3)^2 + b(3) + c = 0$	M1	oe
	any two of $(- )6b = 0, c = 18$ and $9a + 18 = 0$	M1dep	oe
	$y = 18 - 2x^2$	A1	oe equation
	<b>Alternative method 2</b>		
	$y = 18 - 2x^2$	B3	oe equation B2 correct equation missing $y =$ eg $18 - 2x^2$ B1 equation of a quadratic curve that passes through $(-3, 0)$ or $(3, 0)$ or $(0, 18)$ condone missing $y =$ eg $(y =) 18 - x^2$ or $(y =) (3 + x)(3 - x)$ or $(y =) x^2 - 2x - 3$ or $(y =) (x + 3)(x - 3)$
	<b>Additional Guidance</b>		
	Correct equations include $y = 2(3 + x)(3 - x)$ $y = -2(x + 3)(x - 3)$ $y = (6 + 2x)(3 - x)$ $y = (3 + x)(6 - 2x)$		
	For B3, B2 or B1 ignore incorrect expansion after correct equation or expression seen		

Question	Answer	Mark	Comments
26	<b>Alternative method 1</b>		
	$0.5 \times 20 \times x \times \sin 60$ or $10x \sin 60$ or $5\sqrt{3}x$	M1	oe
	$0.5 \times 20 \times x \times \sin 60 = 25\sqrt{3}$ or $x = 5$	M1dep	oe equation
	$(\text{their } 5)^2 + 20^2$ $- 2 \times \text{their } 5 \times 20 \times \cos 60$ or $25 + 400 - 200 \cos 60$ or 325	M1	oe their 5 must be their value of $x$
	$\sqrt{\text{their } 325}$	M1dep	dep on 3rd M1 their 325 can be unsimplified
	$5\sqrt{13}$	A1	
	<b>Alternative method 2</b>		
	$0.5 \times 20 \times h = 25\sqrt{3}$ or $h = \frac{5\sqrt{3}}{2}$	M1	oe any letter $h$ is perpendicular height for 20 cm base
	$\sin 60 = \frac{\text{their } \frac{5\sqrt{3}}{2}}{x}$ or $x = 5$	M1dep	oe
	$(\text{their } 5)^2 + 20^2$ $- 2 \times \text{their } 5 \times 20 \times \cos 60$ or $25 + 400 - 200 \cos 60$ or 325	M1	oe their 5 must be their value of $x$
	$\sqrt{\text{their } 325}$	M1dep	dep on 3rd M1 their 325 can be unsimplified
	$5\sqrt{13}$	A1	

Question	Answer	Mark	Comments
26 cont	<b>Alternative method 3</b>		
	$0.5 \times 20 \times h = 25\sqrt{3}$ or $h = \frac{5\sqrt{3}}{2}$	M1	oe any letter $h$ is perpendicular height for 20 cm base
	$\tan 60 = \frac{\text{their } h}{c}$ or $c = \frac{5}{2}$	M1dep	oe any letter $c$ is part of 20 cm base
	$\left(\text{their } \frac{5\sqrt{3}}{2}\right)^2 + \left(20 - \text{their } \frac{5}{2}\right)^2$ or $\left(\text{their } \frac{5\sqrt{3}}{2}\right)^2 + \left(\frac{35}{2}\right)^2$ or 325	M1dep	
	$\sqrt{\left(\text{their } \frac{5\sqrt{3}}{2}\right)^2 + \left(20 - \text{their } \frac{5}{2}\right)^2}$ or $\sqrt{\text{their } 325}$	M1dep	
	$5\sqrt{13}$	A1	
	<b>Additional Guidance</b>		
	Omitting 0.5 in area formula can score a maximum of M0M0M1M1A0		
	$\sqrt{(\text{their } 5)^2 + 20^2 - 2 \times \text{their } 5 \times 20 \times \cos 60}$		M0M0M1M1A0
27(a)	$-k$	B1	
27(b)	$k$	B1	