



Oxford Cambridge and RSA

H

GCSE (9–1) Mathematics
J560/05 Paper 5 (Higher Tier)
Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 30 minutes



You may use:

- Geometrical instruments
- Tracing paper

Do not use:

- A calculator



First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS

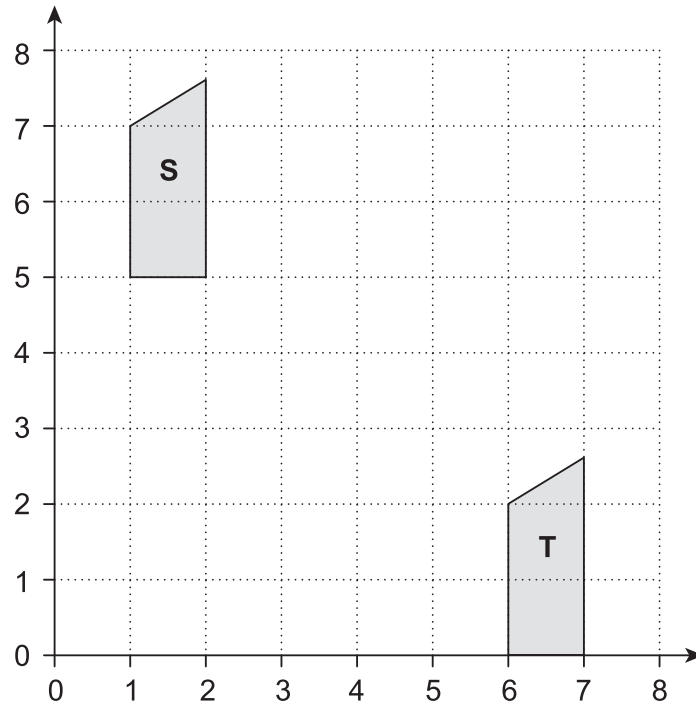
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [].
- This document consists of **20** pages.

Answer **all** the questions

- 1 (a) Here is a coordinate grid.

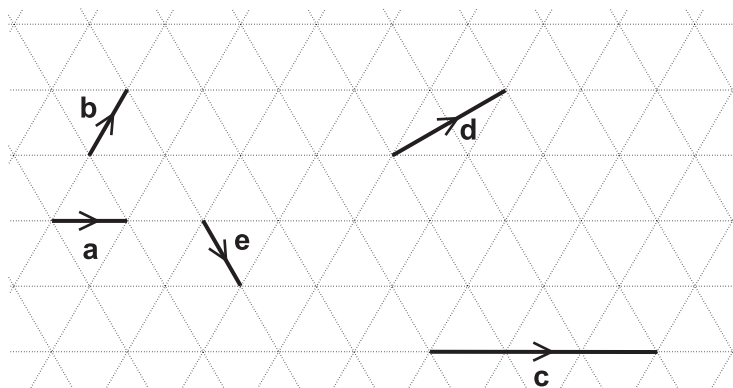


Shape S is translated to Shape T using vector $\begin{pmatrix} p \\ q \end{pmatrix}$.

Write down the values of p and q .

(a) $p = \dots\dots\dots$
 $q = \dots\dots\dots$ [2]

- (b) Vectors **a**, **b**, **c**, **d** and **e** are drawn on an isometric grid.



Write each of the vectors **c**, **d** and **e** in terms of **a** and/or **b**.

c = $\dots\dots\dots$
d = $\dots\dots\dots$
e = $\dots\dots\dots$

[3]

- 2 Sam and two friends put letters in envelopes on Monday.
The three of them take two hours to put 600 letters in envelopes.

(a) On Tuesday Sam has three friends helping.

Working at the same rate, how many letters should the **four** of them be able to put in envelopes in two hours?

(a) [2]

- (b) Working at the same rate, how much longer would it take **four** people to put 1000 letters in envelopes than it would take **five** people?

(b) [4]

(c) Sam says

It took two hours for three people to put 600 letters in envelopes.

If I assume they work all day, then in one day three people will put 7200 letters in envelopes because $600 \times 12 = 7200$.

Why is Sam's assumption not reasonable?

What effect has Sam's assumption had on her answer?

.....
..... [2]

- 3 Abi, Ben and Carl each drop a number of identical drawing pins, and count how many land with the pin upwards. The table shows some of their results.

	Number of pins dropped	Number landing 'pin up'
Abi	10	4
Ben	30	9
Carl	100	35

- (a) Abi says

As a drawing pin can only land with its pin up or with its pin down,
the probability of a drawing pin landing 'pin up' is $\frac{1}{2}$.

Criticise her statement.

.....
..... [1]

- (b) Carl's results give the best estimate of the probability of a drawing pin landing 'pin up'.
Explain why.

.....
..... [1]

- (c) Two pins are dropped.

Estimate the probability that both pins land 'pin up'.

(c) [2]

- 4 John is going to make chocolate squares to sell.

There are just three ingredients, chocolate, peanut butter and crisped rice, mixed in the ratio 4 : 2 : 3 respectively.

- (a) How much of each ingredient will he need to make 900 g of mixture?

(a) chocolate g
 peanut butter g
 crisped rice g
 [2]

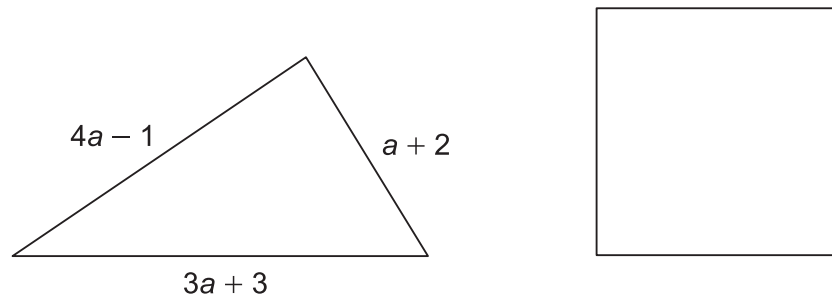
- (b) A bar of chocolate weighs 200 g and costs £2.50.
 A jar of peanut butter contains 250 g and costs £1.70.
 A packet of crisped rice contains 300 g and costs £2.00.

John makes 4.5 kg of mixture, from which he can cut 100 chocolate squares.
 He charges 60p for each square and sells all 100 squares.

How much **profit** does he make?

(b) £ [5]

- 5 The perimeter of the triangle is the same length as the perimeter of the square.



Find an expression for the length of one side of the square in terms of a .
Give your answer in its simplest form.

..... [4]

- 6 A bag contains only red and blue marbles.

Yasmine takes one marble at random from the bag.

The probability that she takes a red marble is $\frac{1}{5}$.

Yasmine returns the marble to the bag and adds five more red marbles to the bag.

The probability that she takes one red marble at random is now $\frac{1}{3}$.

How many marbles of each colour were originally in the bag?

..... red marbles

..... blue marbles

[3]

- 7 The lengths of the sides of two squares are integers, when measured in cm.
The difference between the areas of the two squares is 36 cm^2 .

Find the lengths of the sides of the two squares.

..... cm

..... cm

[3]

- 8 Safety rules on a campsite require Sarah to set up her barbecue at least 4 m from her tent.
She decides to measure this distance using her stride length.
Sarah knows that her stride length is 0.8 m, rounded to the nearest 0.1 m.

Find the minimum number of strides Sarah will need to take to **guarantee** that her barbecue is a safe distance from her tent.

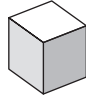
..... **[3]**

- 9 A sculptor needs to lift a piece of marble.
It is a cuboid with dimensions 1 m by 0.5 m by 0.2 m.
Marble has a density of 2.7 g/cm^3 .
The sculptor's lifting gear can lift a maximum load of 300 kg.

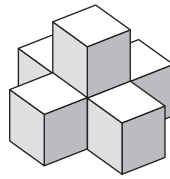
Can the lifting gear be used to lift the marble?
Justify your decision.

.....
..... [4]

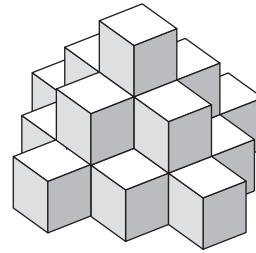
- 10** Here is a picture of three towers.
Not all the cubes can be seen in the towers.



Tower 1



Tower 2



Tower 3

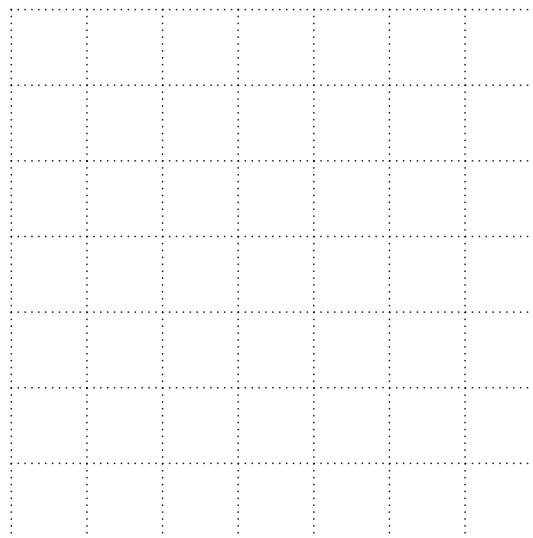
Edith uses 1 cube to build tower 1.

Edith uses 6 cubes to build tower 2. There are 5 cubes on the bottom layer.

- (a)** Write down the total number of cubes in tower 3.

(a) [1]

- (b)** Draw a plan view of the arrangement of cubes Edith will use for the bottom layer of tower 4.



[1]

(c) Continue this sequence to show the number of cubes used for the bottom layer of each tower.

Tower 1	Tower 2	Tower 3	Tower 4
1	5

[2]

(d) Find an expression for the number of cubes used in the bottom layer of tower n .

(d) [4]

- 11** A toy car is placed on the floor of a sports hall.

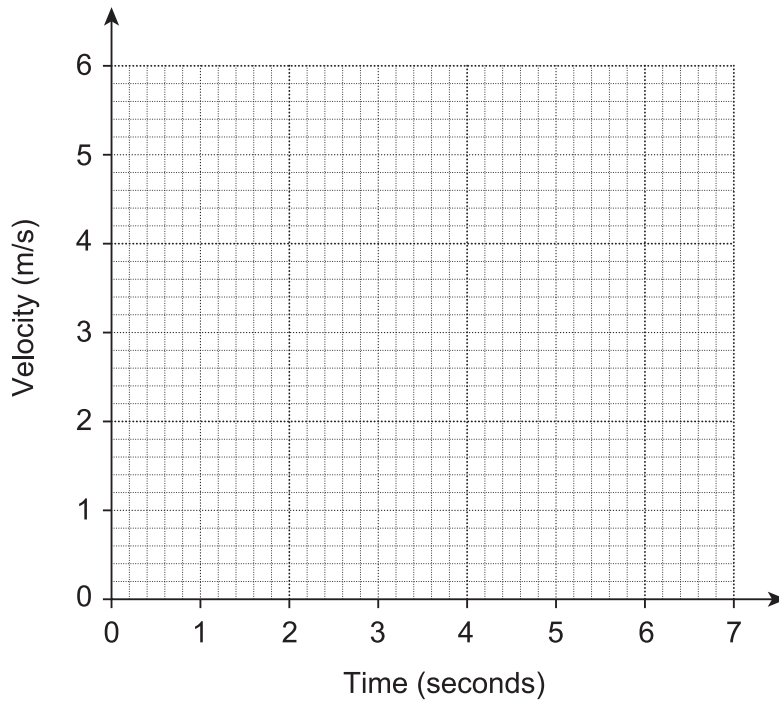
It moves in a straight line starting from rest.

It travels with constant acceleration for 4 seconds reaching a velocity of 5 m/s.

It then slows down with constant deceleration of 1 m/s^2 for 2 seconds.

It then hits a wall and stops.

- (a)** Draw a velocity-time graph for the toy car.

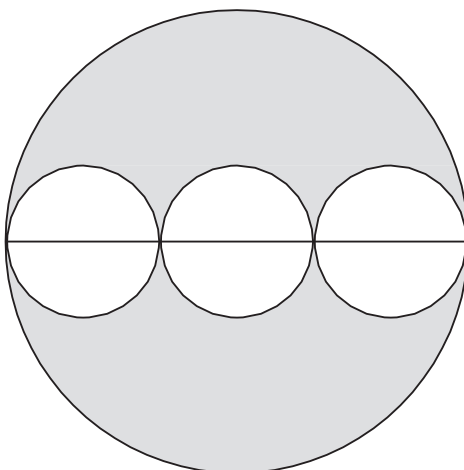


[3]

- (b)** Work out the total distance travelled by the toy car.

(b) m **[3]**

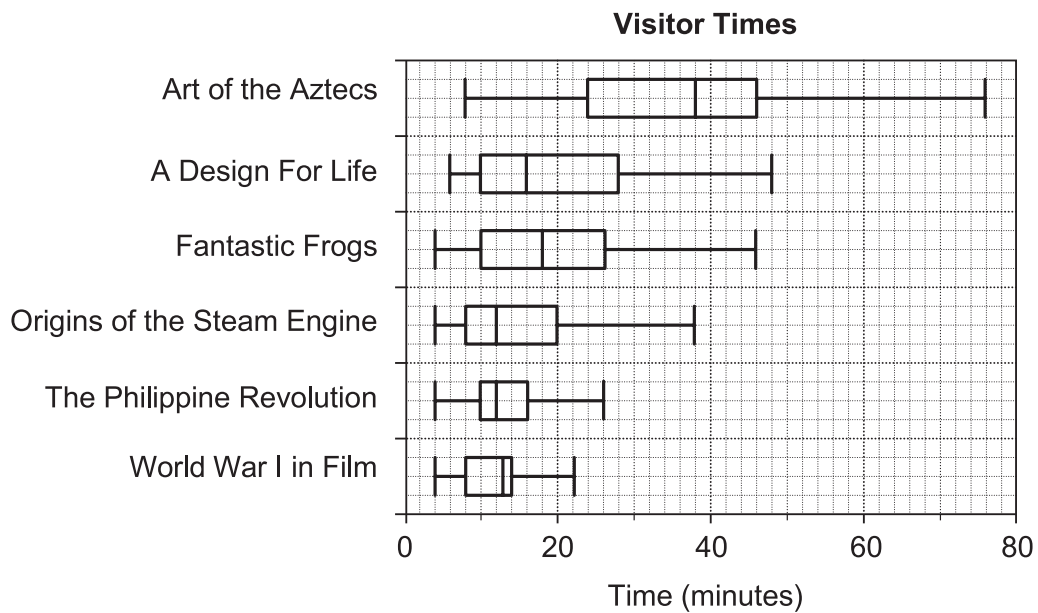
- 12** Three identical small circles are drawn inside one large circle, as shown in the diagram. The centres of the small circles lie on the diameter of the large circle.



Find the fraction of the large circle that is shaded.

..... **[3]**

- 13 One day a museum monitored the time spent by visitors at six exhibitions. The visitor times are summarised in the box plots below.



- (a) Work out the **range** in visitor times at the **Fantastic Frogs** exhibition.

(a) [2]

- (b) At which exhibition were visitor times the most consistent?
Give a reason for your answer.

.....

.....

..... [2]

- (c) Give one similarity and one difference between the **distributions** of the visitor times for **Origins of the Steam Engine** and **The Philippine Revolution**.

Similarity

.....

Difference

.....

[2]

- (d) Is it possible to work out from the box plots which exhibition had the most visitors?
Justify your answer.

.....

.....

.....

..... [2]

- 14 Show that line $3y = 4x - 14$ is perpendicular to line $4y = -3x + 48$.

[4]

- 15 (a)** Write this list of numbers in order, smallest first.

$$\sqrt{35}, \quad \frac{20}{3}, \quad 2.5^2, \quad 6.83$$

(a) [2]
smallest

- (b)** Write $(1 + \sqrt{3})^2$ in the form $a + b\sqrt{3}$.

(b) [3]

- 16** Bethany says that $(2x)^2$ is always greater than or equal to $2x$.

Decide whether she is correct or not.

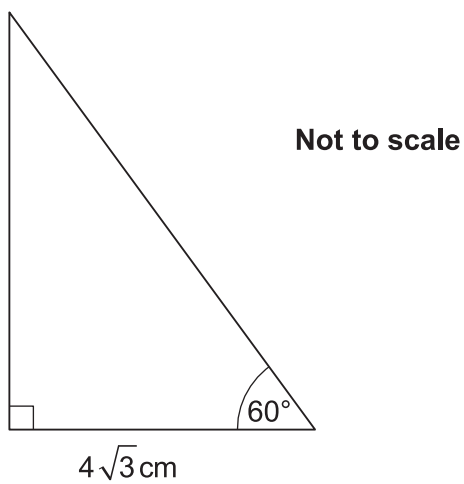
Show your working to justify your decision.

[3]

17 (a) Write down the exact value of $\tan 60^\circ$.

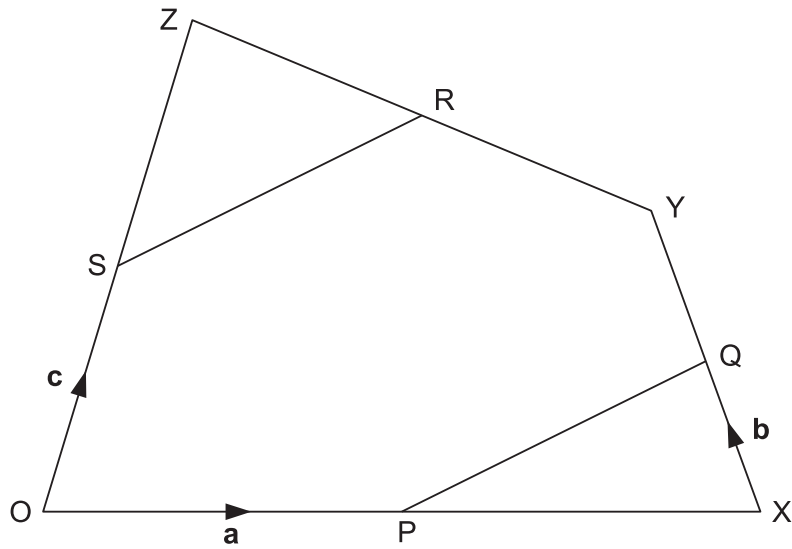
(a) [1]

(b) Find the exact area of this triangle.



(b) cm^2 [4]

18 P, Q, R and S are the midpoints of OX, XY, YZ and OZ respectively.



$\vec{OP} = \mathbf{a}$, $\vec{XQ} = \mathbf{b}$ and $\vec{OS} = \mathbf{c}$.

Show that PQ is parallel to SR.

[5]

- 19** The prices of two phones are in the ratio $x : y$.

When the prices are both increased by £20, the ratio becomes $5 : 2$.

When the prices are both reduced by £5, the ratio becomes $5 : 1$.

Express the ratio $x : y$ in its lowest terms.

..... : **[6]**

20 (a) Find the interval for which $x^2 - 7x + 10 \leq 0$.

(a) $\leq x \leq$ [3]

(b) The point $(-3, -4)$ is the turning point of the graph of $y = x^2 + ax + b$, where a and b are integers.

Find the values of a and b .

(b) $a =$ $b =$ [3]

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Date – Morning/Afternoon

GCSE (9–1) Mathematics

J560/05 Paper 5 (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 100

DRAFT

This document consists of 13 pages

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.
2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.
3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, e.g. FT $180 \times (\text{their '37' + 16})$, or FT $300 - \sqrt{(\text{their '5^2 + 7^2'})}$. Answers to part questions which are being followed through are indicated by e.g. FT $3 \times \text{their (a)}$.

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.
4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.
5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point e.g. 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
 - **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
 - **nfw** means **not from wrong working**.
 - **oe** means **or equivalent**.
 - **rot** means **rounded or truncated**.
 - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.

- **soi** means **seen or implied**.

6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7. In questions with a final answer line following working space:

- (i) If the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
- (ii) If the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
- (iii) If the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✕ next to the wrong answer.

8. In questions with a final answer line:

- (i) If one answer is provided on the answer line, mark the method that leads to that answer.
- (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
- (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.

9. In questions with no final answer line:

- (i) If a single response is provided, mark as usual.
- (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.

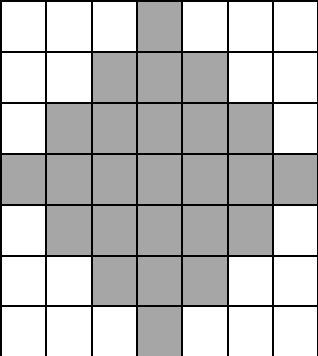
10. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

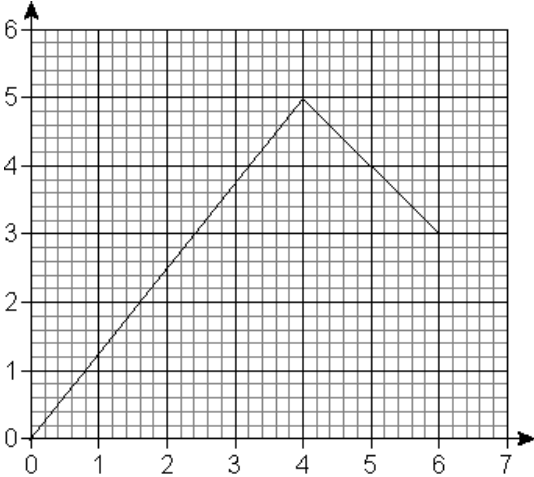
11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.
12. Ranges of answers given in the mark scheme are always inclusive.
13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
14. Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

Question			Answer	Marks	Part marks and guidance	
1	(a)		$[p =] 5$ $[q =] -5$	2 1 AO1.2 1 AO1.3a	B1 for each	
	(b)		$c = 3a$ $d = a + b$ $e = a - b$	3 3 AO1.3a	B1 for each	
2	(a)		800	2 1 AO1.3b 1 AO3.1c	M1 for unitary work, e.g. 1 person does 200 letters in 2 hours	
	(b)		30 minutes oe	4 2 AO2.1a 2 AO3.1d	M1 for 1 person does 100 letters in 1 hour M1 for 5 people do 1000 letters in 2 hours M1 for 4 people do 1000 letters in 2.5 hours FT from <i>their</i> rate in (a) throughout	
	(c)		Correct comment on the reasonableness of her assumption e.g. 'She has assumed that 'all day' means 'for 24 hours', but it is not reasonable for them to work without a break.' Correct comment on the effect it will have on the answer e.g. 'They can't work at that rate for that long, so her answer is an over-estimate.'	2 1 AO3.4a 1 AO3.5	B1 for each	
3	(a)		Outcomes not equally likely oe	1 1 AO3.4b		

Question			Answer	Marks	Part marks and guidance	
	(b)		Larger number of trials	1 1 AO3.4a		
	(c)		0.09 - 0.16	2 1 AO1.3a 1 AO2.1b	M1 for $\left(\frac{48}{150}\right)^2$ or 0.35^2 or any reasonable estimate (FT <i>their</i> (b))	
4	(a)		400 g 200 g 300 g	2 1 AO1.3a 1 AO3.1c	M1 for 9 soi	
	(b)		Profit = £18.20	5 2 AO1.3b 2 AO3.1d 1 AO3.3	M1 Multiply <i>their</i> weights by 5 M1 Find number of each required M1* calculate total cost *M1 dep subtract from £60	
5			$2a + 1$	4 1 AO1.3b 2 AO3.1b 1 AO3.2	M1 for $a + 2 + 3a + 3 + 4a - 1$ M1 for collecting terms M1 for dividing <i>their</i> ' $8a + 4$ ' by 4	
6			5 red 20 blue	3 1 AO1.3b 1 AO3.1b 1 AO3.2	M1 for listing at least two pairs of red and blue marbles giving a probability $\frac{1}{5}$ M1 for at adding 5 red marbles to at least two pairs SC2 for 10 and 20 pairing seen	

Question			Answer	Marks	Part marks and guidance	
7			8 cm 10 cm	3 1 AO1.3a 1 AO3.1b 1 AO3.2	M1 for listing square numbers and finding differences M1 for square rooting <i>their</i> pair of square numbers	
8			6	3 1 AO1.3b 1 AO3.1d 1 AO3.3	B1 for 0.75 m M1 for $\frac{4}{\text{their '0.75'}}$ Or $5 \times 0.75 = 3.75$	
9			Volume of cuboid = $100\,000\text{ cm}^3$ Mass of cuboid = 270 kg Yes, because $270 < 300\text{ kg}$	4 1 AO1.3b 2 AO3.1d 1 AO3.3	B3 for 270 kg or M1 for $100\,000\text{ cm}^3$ OR 0.1 m^3 OR $100\text{ cm} \times 50\text{ cm} \times 20\text{ cm}$ OR $1\text{ m} \times 0.5\text{ m} \times 0.2\text{ m}$ M1 for $2.7 \times \text{their '100\,000'}$ OR $2\,700\,000 \times \text{their '0.1'}$	
10	(a)		19	1 1 AO2.3a		

Question			Answer	Marks	Part marks and guidance	
	(b)			1 1 AO2.3b		
	(c)		13 25	2 2 AO2.1a	M1 for 13 or 25	FT <i>their</i> bottom layer in (b) and <i>their</i> number of cubes in (a)
	(d)		$2n^2 - 2n + 1$ oe	4 2 AO1.3b 2 AO2.1a	M3 for expression with $2n^2 - 2n$ oe or M2 for expression with $2n^2$ or M1 for expression with n^2 or first differences	

Question		Answer	Marks	Part marks and guidance	
11	(a)	Both sections of graph correct 	3 1 AO1.3b 2 AO2.3b	B1 for plotting a line segment from the origin to (4, 5) B1 for plotting a line segment from <i>their</i> '(4, 5)' to <i>their</i> '(4' + 2, '5' – 2)	
	(b)	18	3 2 AO1.3a 1 AO2.3a	M2 for $\frac{1}{2}(5 \times 4) + \frac{1}{2}(5 + 3) \times 2$ or M1 for attempt to find area under graph	Accept alt ways to split area FT <i>their</i> graph
12		$\frac{2}{3}$	3 1 AO1.3a 1 AO3.1b 1 AO3.2	B1 for radius of large circle = 3 × radius of small circle M1 for $\frac{9\pi r^2 - 3(\pi r^2)}{9\pi r^2}$ oe	
13	(a)	42	2 1 AO1.3a 1 AO2.3a	M1 for 46 or 4 seen	
	(b)	World War I in film Smallest range / IQR	2 2 AO2.1b	M1 M1	

Question			Answer	Marks	Part marks and guidance	
	(c)		Correct similarity Correct difference	2 1 AO2.3a 1 AO2.3b	B1 for similarity B1 for difference	Exemplar response: Similarity: They have the same median value Difference: There was less variation in the visitor times for The Philippine Revolution than for Origins of the Steam Engine To be awarded both marks at least one statement must be in context
	(d)		No, as there is no indication of total numbers who visited each	2 1 AO2.4a 1 AO2.5b	M1 for 'No' with insufficient reason	
14			Fully correct explanation, finding gradients of both lines and showing that the gradients' product equals -1	4 1 AO1.3a 2 AO2.2 1 AO2.4b	B1 for gradient of first line is $\frac{4}{3}$ B1 for gradient of second line is $-\frac{3}{4}$ M1 for finding the product of <i>their</i> gradients oe	
15	(a)		$\sqrt{35}$, 2.5^2 , $\frac{20}{3}$, 6.83	2 2 AO1.3b	B1 if one is in the wrong place, but others are in the correct order or reverse order	
	(b)		$4 + 2\sqrt{3}$	3 3 AO1.3a	M1 for expanding $(1 + \sqrt{3})^2 = 1 + \sqrt{3} + \sqrt{3} + \sqrt{3} \times \sqrt{3}$ B1 for $\sqrt{3} \times \sqrt{3} = 3$ soi	

Question			Answer	Marks	Part marks and guidance	
16			e.g. When $x = 0.1$ $(2x)^2 = 0.04$ $2x = 0.2$ So $(2x)^2 < 2x$ which contradicts Bethany's statement So it is not always true	3 2 AO2.4a 1 AO2.5a	M1 for attempting to demonstrate that for some value of x in range $0 < x < \frac{1}{2}$ it is not true A1 for complete working A1 for explanation or M1 for attempt including squaring bracket A1 for complete solution for either $x < 0$ or $x \geq \frac{1}{2}$ A1 for explanation or B1 for a counter example given without working	
17	(a)		$\sqrt{3}$	1 1 AO1.1		
	(b)		$24\sqrt{3}$	4 4 AO1.3b	M1* for $\frac{\text{height}}{4\sqrt{3}} = \text{their } \tan 60^\circ$ A1 for 12 or $4\sqrt{3} \times \sqrt{3}$ *M1 Dep for $\frac{1}{2} \times 4\sqrt{3} \times \text{their '12'}$	

Question			Answer	Marks	Part marks and guidance	
18			$\vec{ZY} = -2\mathbf{c} + 2\mathbf{a} + 2\mathbf{b}$ $\vec{SR} = \mathbf{c} + (-\mathbf{c} + \mathbf{a} + \mathbf{b})$ so $\vec{SR} = \mathbf{a} + \mathbf{b}$ $\vec{PQ} = \mathbf{a} + \mathbf{b}$ $\vec{SR} = \vec{PQ}$ so they are parallel	5 1 AO1.3a 2 AO2.2 2 AO2.4b	M1 for $\vec{ZY} = -2\mathbf{c} + 2\mathbf{a} + 2\mathbf{b}$ M1 for $\vec{SR} = \mathbf{c} + (-\mathbf{c} + \mathbf{a} + \mathbf{b})$ M1 for $\vec{SR} = \mathbf{a} + \mathbf{b}$ M1 for $\vec{PQ} = \mathbf{a} + \mathbf{b}$	
19			4 : 1	6 2 AO1.3b 4 AO3.1d	M1 for $(x + 20) : (y + 20) = 5 : 2$ or $(x - 5) : (y - 5) = 5 : 1$ A1 for $\frac{x + 20}{y + 20} = \frac{5}{2}$ oe A1 for $\frac{x - 5}{y - 5} = \frac{5}{1}$ oe M1 for solving <i>their</i> simultaneous equations A1 for $x = 80$ or $y = 20$	Do not accept wrong notation for ratio in the final mark, e.g. for 4/1, 4, etc
20	(a)		$2 \leq x \leq 5$	3 3 AO1.3b	M1 for factorising $(x - 5)(x - 2)$ soi A1 for 2 and 5	Answer may be on a number line in which case the ends must be clearly seen
	(b)		$[a =] 6$ $[b =] 5$	3 1 AO1.3b 1 AO2.1a 1 AO3.1b	M1 for $y = (x + 3)^2 - 4$ M1 for multiplying out and simplifying <i>their</i> $y = (x + 3)^2 - 4$	

Assessment Objectives (AO) Grid

Question	AO1	AO2	AO3	Total
1(a)	2			2
1(b)	3			3
2(a)	1		1	2
2(b)		2	2	4
2(c)			2	2
3(a)			1	1
3(b)			1	1
3(c)	1	1		2
4(a)	1		1	2
4(b)	2		3	5
5	1		3	4
6	1		2	3
7	1		2	3
8	1		2	3
9	1		3	4
10(a)		1		1
10(b)		1		1
10(c)		2		2
10(d)	2	2		4
11(a)	1	2		3
11(b)	2	1		3
12	1		2	3
13(a)	1	1		2
13(b)		2		2
13(c)		2		2
13(d)		2		2
14	1	3		4
15(a)	2			2
15(b)	3			3
16		3		3
17(a)	1			1
17(b)	4			4
18	1	4		5
19	2		4	6
20(a)	3			3
20(b)	1	1	1	3
Totals	40	30	30	100