

Write your name here

Surname

Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9-1)

Centre Number

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Candidate Number

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Mathematics

Paper 2 (Calculator)

Higher Tier

Sample Assessment Materials for first teaching September 2015

Time: 1 hour 30 minutes

Paper Reference

1MA1/2H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out** with your **answer clearly identified** at the **end of your solution**.



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Formulae Sheet

Perimeter, area, surface area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

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

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

- 1** Ashten chooses three different whole numbers between 1 and 50

The first number is a prime number.

The second number is 4 times the first number.

The third number is 6 less than the second number.

The sum of the three numbers is greater than 57

Find the three numbers.

(Total for Question 1 is 3 marks)

- 2** Given that $3(x - c) = 2x + 5$ where c is an integer,
show that x cannot be a multiple of six.

(Total for Question 2 is 3 marks)

3 Jane made some almond biscuits which she sold at a fête.

She had:

- 5 kg of flour
- 3 kg of butter
- 2.5 kg of icing sugar
- 320 g of almonds

Here is the list of ingredients for making 24 almond biscuits.

Ingredients for 24 almond biscuits

- 150 g flour
- 100 g butter
- 75 g icing sugar
- 10 g almonds

Jane made as many almond biscuits as she could, using the ingredients she had.

(a) Work out how many almond biscuits she made.

(3)

Jane sold 70% of the biscuits she made for 25p each.
She sold the other 30% at 4 for 55p.

The ingredients Jane used cost her £45 and the total of all other costs was £27

(b) Work out the percentage profit.

(6)

(Total for Question 3 is 9 marks)

4 The diagrams show two identical squares.

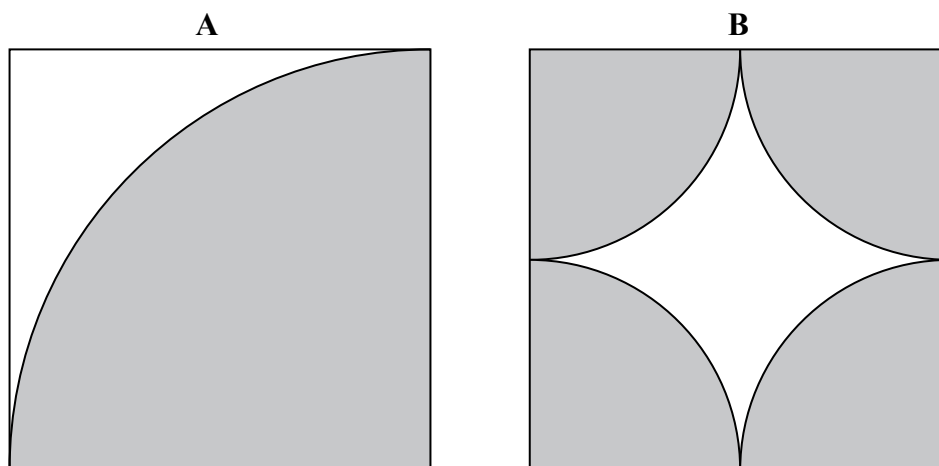


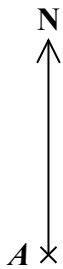
Diagram **A** shows a quarter of a circle shaded inside the square.

Diagram **B** shows four identical quarter circles shaded inside the square.

Show that the area of the region shaded in diagram **A** is equal to the area of the region shaded in diagram **B**.

(Total for Question 4 is 3 marks)

5 Here is part of a map showing the position of a port A .



B is a lighthouse 36 km from A on a bearing of 050°

- (a) (i) Construct a diagram to show the position of B .
Use a scale of 1 cm represents 4 km.
- (ii) Write down the bearing of A from B .

(3)

From the lighthouse at B , ships can be seen when they are within a range of 23 km of B .
A ship sails due East from A .

- (b) Show, **by calculation**, that on this course this ship will not be seen from the lighthouse at B .

You must not use a scale drawing.

(4)

(Total for Question 5 is 7 marks)

6 The n th term of an arithmetic sequence is $3n + 2$ where n is a positive integer.

(a) Determine whether 93 is a term in this arithmetic sequence.

(2)

(b) Find an expression for the sum of the n th term and the $(n + 1)$ th term of this sequence.
Give your answer in its simplest form.

(2)

The sum of two consecutive terms in this sequence is 91

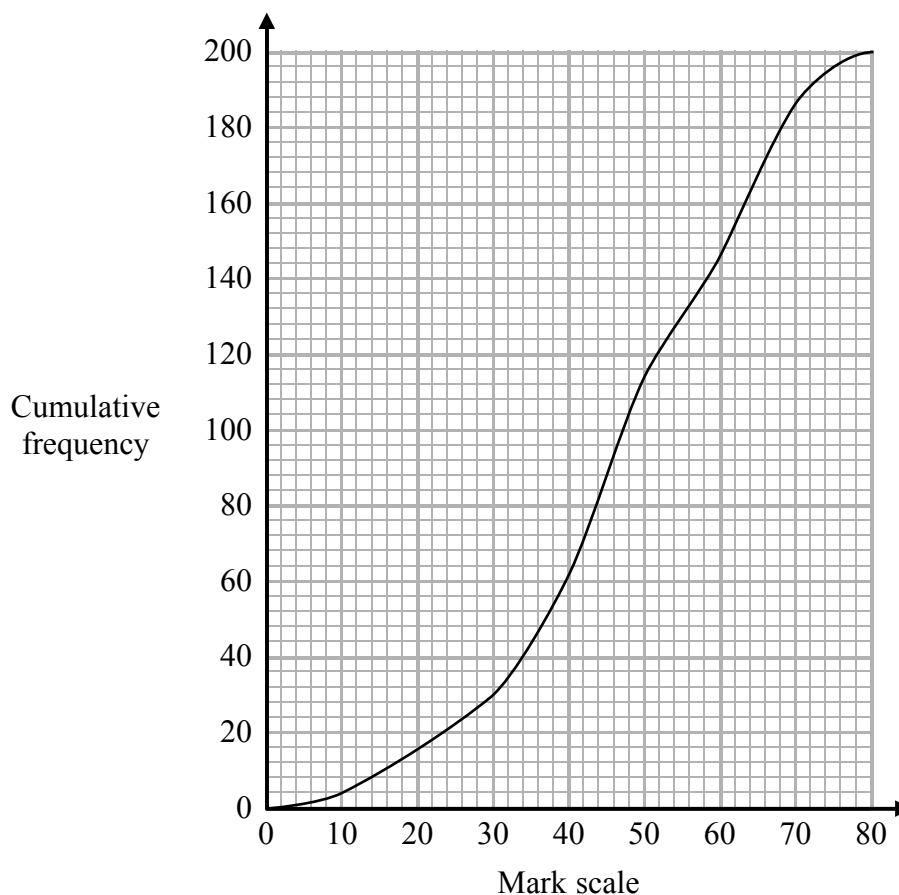
(c) Find the smaller of these two terms.

(2)

(Total for Question 6 is 6 marks)

7 A teacher recorded the marks that 200 students got in an exam.

He produced a grouped frequency table with class intervals of width 10 marks.
He then drew this cumulative frequency graph.



The maximum possible mark for the exam was 80
Any student with more than 72% of the marks got a grade A.

(i) Calculate an estimate of the number of students who got a grade A.

(ii) Explain one assumption you have made that could affect your answer to part (i).

(Total for Question 7 is 4 marks)

8 (a) Expand and simplify $x(x + 1)(x - 1)$

(2)

In a list of three consecutive positive integers at least one of the numbers is even and one of the numbers is a multiple of 3

n is a positive integer greater than 1

(b) Prove that $n^3 - n$ is a multiple of 6 for all possible values of n .

(2)

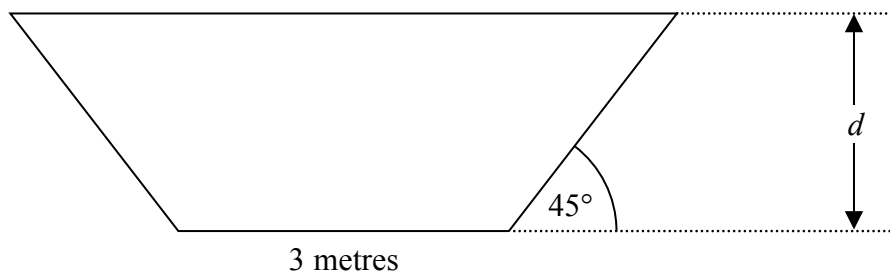
$2^{61} - 1$ is a prime number.

(c) Explain why $2^{61} + 1$ is a multiple of 3

(2)

(Total for Question 8 is 6 marks)

- 9 The diagram shows the cross-section of the water in a drainage channel.



The cross-section is in the shape of a trapezium with one line of symmetry.

The base of the drainage channel is horizontal.

The two equal sides of the trapezium are each inclined at 45° to the horizontal.

The length of the base of the trapezium is 3 metres.

The depth of the water is d metres.

The area of the cross-section is A m².

- (a) Write a formula for A in terms of d .
Give your answer in its simplest form.

(3)

The depth of the water in the drainage channel is 1.5 metres.

- (b) Find the area of the cross-section of the water.

(2)

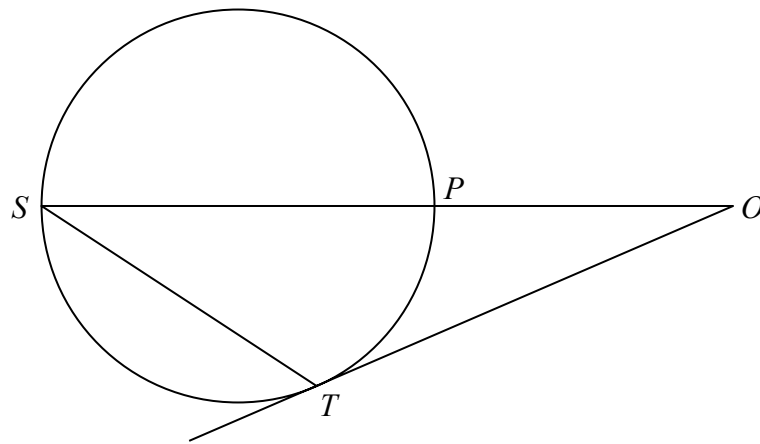
The water flows along the drainage channel at a rate of 486 000 litres per minute.
The depth of the water is constant.

- (c) Work out the speed of the water.
Give your answer in metres per second.

(4)

(Total for Question 9 is 9 marks)

10



In the diagram, P , S and T are points on the circumference of a circle.

O is the point such that

OPS is a straight line.

OT is a tangent to the circle.

Prove that triangle OPT is similar to triangle OTS .

(Total for Question 10 is 3 marks)

11 There are 80 students at a language school.

All 80 students speak at least one language from French, German and Spanish.

9 of the students speak French, German and Spanish.

19 of the students speak French and German.

28 of the students speak French and Spanish.

17 of the students speak Spanish and German.

45 students speak French.

50 students speak Spanish.

(a) Draw a Venn diagram to show this information.

(3)

One of the 80 students is selected at random.

(b) Find the probability that this student speaks German but not Spanish.

(1)

Given that the student speaks German,

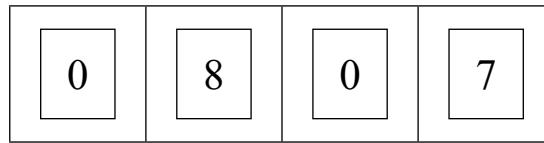
(c) find the probability that this student also speaks French.

(2)

(Total for Question 11 is 6 marks)

12 Pavel has a combination lock.

Pavel has to set each part of the lock to a digit between 0 and 9 inclusive.
One possible way to do this is shown in the diagram.



(a) How many different ways can Pavel do this?

(2)

Pavel decides that the 1st and 3rd digits will be odd numbers and that the 2nd and 4th digits will be even numbers greater than 0.

(b) How many different ways are possible now?

(2)

(Total for Question 12 is 4 marks)

13 **C** is the curve with equation $y = x^2 - 4x + 4$

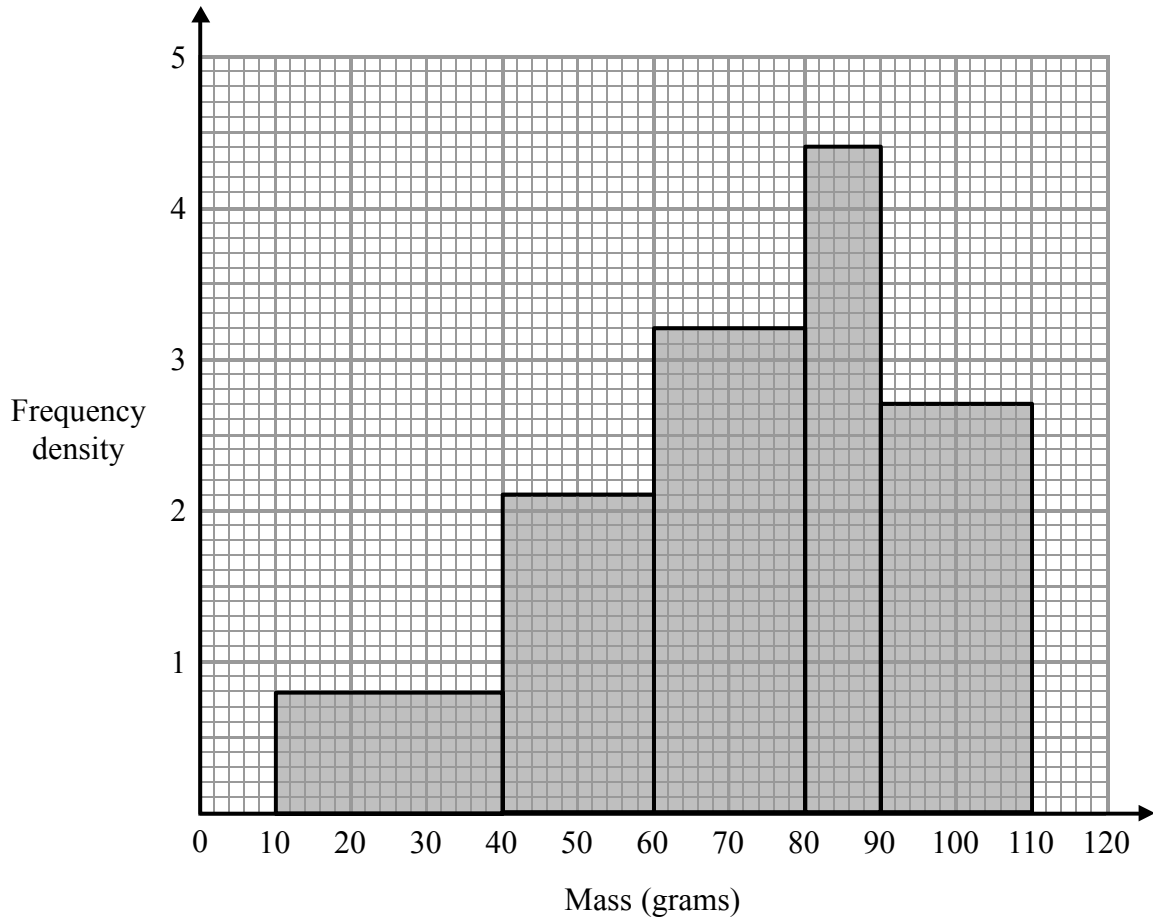
L is the straight line with equation $y = 2x - 4$

L intersects **C** at two points, *A* and *B*.

Calculate the exact length of *AB*.

(Total for Question 13 is 6 marks)

- 14 A biologist is studying the effects of global warming on animal size. The histogram gives information about the masses of a species of snail in a sample he took in 2013 from a large lake.



The mean mass of the same species of snail taken from the lake in 2003 was 75 grams.

- (a) Is there any evidence to support the hypothesis that the mass of this species of snail has decreased?

(5)

- (b) Explain whether it is possible to state what the mode is from this histogram.

(1)

(Total for Question 14 is 6 marks)

15 Here is a solid bar made of metal.

The bar is in the shape of a cuboid.

The height of the bar is h cm.

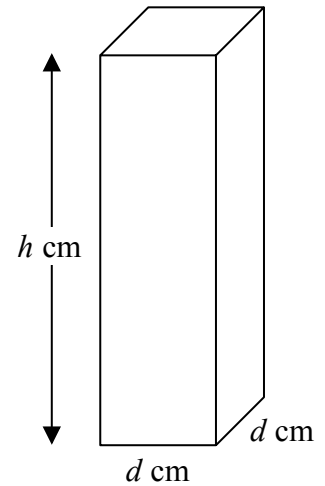
The base of the bar is a square of side d cm.

The mass of the bar is M kg.

$d = 8.3$ correct to 1 decimal place.

$M = 13.91$ correct to 2 decimal places.

$h = 84$ correct to the nearest whole number.



Find the value of the density of the metal to an appropriate degree of accuracy.

Give your answer in g/cm^3 .

You must explain why your answer is to an appropriate degree of accuracy.

(Total for Question 15 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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Higher tier Paper 2 – Calculator

Question	Working	Answer	Mark	AO	Notes
1	$7 + 28 + 22 = 57$	11, 44 and 38	P	3.1b	P1 for a correct process to develop algebraic expressions for each number and set up an inequality, e.g. $x + 4x + 4x - 6 > 57$ or for a correct trial with a prime number
2	$3x - 3c = 2x + 5$ $x = 3c + 5$	Shown	P P C	1.3b 2.2 2.2 2.4a	P1 for a correct process to solve the inequality, e.g. $x > (57 + 6) \div 9 (= 7)$ or for a correct trial with the prime number as 7 resulting in a sum of 57 A1 cao
3 (a)		720	P P A	3.1c 3.3 1.3b	P1 for a process to start a chain of reasoning P1 for a process to isolate terms in x C1 convincing explanation from $x = 3c + 5$ P1 attempt to find the maximum biscuits for one of the ingredients, e.g. $5000 \div 150 (= 33.3...)$ or $2500 \div 75 (= 33.3...)$ or $3000 \div 100 (= 30)$ or $320 \div 10 (= 32)$ P1 for identifying butter as the limiting factor or $30 \times 24 (= 720)$ seen A1 for 720 cao

Question	Working	Answer	Mark	AO	Notes
3 (b)		116.25%	M P P P M A	1.3b 3.1b 3.1b 3.1b 1.3b 1.3b	M1 for a correct method of finding either 70% (= 504) or 30% (= 216) of 720 P1 for a process to find the cost of "216" at 55p for 4 (= £29.70) P1 for a process to find revenue, e.g. "504" × £0.25 + "£29.70" (= £155.70) P1 for a process to find profit, e.g. "£155.70" – £45 – £27 (= £83.70) M1 for $\frac{83.70}{72} \times 100$ A1 for 116.25%
4		Demonstration	M P C	1.1 2.4a 2.4a	M1 for using a radius and a half of the radius in the substitution into $A = \pi r^2$ (or choosing 10 and 5 for the respective radii oe) P1 for a process to find the area of a quadrant, e.g. $\frac{1}{4} \times \pi x^2$ and $4 \times \frac{1}{4} \times \pi \left(\frac{x}{2}\right)^2$ (x may be numerical) C1 for concluding the argument by showing that both areas equate to $\frac{\pi x^2}{4}$ (x may be numerical in which case both areas must be shown to be the same multiple of π)

Question	Working	Answer	Mark	AO	Notes
5 (a)(i)		Correct drawing	M	1.3a	M1 for a correct bearing drawn or for a correct distance drawn or quoted A1 for a correct position of <i>B</i>
(a)(ii)		230°	B	1.1	B1 for 230° cao
5 (b)		Correct statement with evidence	P	2.3a	P1 for drawing a correct right-angle triangle showing line East from <i>A</i> and perpendicular from <i>B</i> (can be implied by correct trigonometric ratio)
			M	1.3b	M1 for $\cos 50^\circ = \frac{d}{36}$ oe
			P	2.2	P1 for $36 \times \cos 50^\circ$ oe
			C	2.1a	C1 for deduction 23.14 km plus a statement saying that the ship is always more than 23 km from the lighthouse
6 (a)		No + written evidence	P	2.2	P1 for a start to the process that leads to a decision, e.g. $n = \frac{93 - 2}{3}$ oe
			C	2.4a	C1 for a convincing argument for 'No' (e.g. because <i>n</i> is not a whole number)
6 (b)	$3n + 2 + 3n + 2 + 3$	$6n + 7$	M	1.3a	M1 for $3n + 2 + 3n + 2 + 3$ oe
			A	1.3a	A1 cao
6 (c)	$3n + 2 + 3n + 2 + 3 = 91$ $n = 14$ $3 \times 14 + 2$	44	P	3.1a	P1 for a process that translates the problem into a suitable form that would lead to a solution, e.g. ' $6n + 7 = 91$ Or $t + t + 3 = 91$ or $(91 - 3) \div 2$
			A	1.3a	A1 cao

Question	Working	Answer	Mark	AO	Notes
7 (i)	$\frac{72}{100} \times 80$	60	P	3.1c	P1 for a correct process to find the number of students with a score of at least 72% e.g. $\frac{72}{100} \times 80$
(ii)		Assumption and how it affects answer	P A C	3.2 1.3a 3.5	P1 for process to use graph to find number who exceeded 57.6 A1 56 - 64 C1 for assumption stated and how it affects answer to (i), e.g. the marks are so distributed within the interval such that numbers can be found by reading directly from graph (need both the assumption and how it affects the answer to gain the mark)
8 (a)		Shown	M A	1.3a 1.3a	M1 for $x(x^2 - 1)$ or $(x^2 + x)(x - 1)$ oe A1 cao
8 (b)		Shown	P C	2.4b 2.4b	P1 for explanation to show that $n^3 - n$ is the product of three consecutive positive integers, e.g. $n^3 - n = (n - 1)n(n + 1)$ C1 for a correct conclusion to the proof, e.g. at least one of these is even and one is a multiple of 3 so the product is a multiple of 6
8 (c)	$2^{61} - 1$ is prime so not a multiple of 3 2^{61} is not a multiple of 3 Hence $2^{61} + 1$ must be a multiple of 3	Shown	P C	2.4a 2.4a	P1 for recognising that $2^{61} - 1$, 2^{61} and $2^{61} + 1$ are three consecutive positive integers C1 for a convincing argument
9 (a)	Width of surface = $d + d + 3$ Area of cross-section = $\frac{d}{2}(d + d + 3 + 3)$	$A = d(d + 3)$	P P A	3.1b 3.1b 1.3b	P1 for correct process to find width of surface P1 for correct process to find cross-sectional area, e.g. $\frac{d}{2}(d + d + 3 + 3)$ A1 for $A = d(d + 3)$ or $A = d^2 + 3d$

Question	Working	Answer	Mark	AO	Notes
9 (b)	$A = 1.5(1.5 + 3)$	6.75 m ²	M	1.3a	M1 for substitution of 1.5 in formula or a complete method starting again A1 for 6.75
9 (c)	$486000 \div 60 = 8100$ $8100 \text{ L} = 8.1 \text{ m}^3$ $8.1 \div 6.75$	1.2 m/s	P	3.1d	P1 for a correct process to convert rate to per second, e.g. $486\,000 \div 60 (=8100)$ P1 for process to convert to m ³ , e.g. " $8100" \div 1000$
10		Proof	A	1.3b	P1 for process to convert litres/min to m/s, e.g. " $8.1" \div ".75"$ A1 cao
			P	2.4b	P1 for recognising that angle O is common
			C	2.4b	P1 for angle $OTP = \text{angle } TSO$ with 'alternate segment theorem'
			C	2.4b	C1 for completion of proof, e.g. third angles are equal, so triangles are equiangular
11 (a)	Venn diagram	Correct diagram (See diagram at end)	P	2.3a	P1 to begin to interpret given information, e.g. 3 overlapping labelled ovals with central region correct P1 to extend interpretation of given information, e.g. 3 overlapping labelled ovals with at least 5 regions correct
			P	2.3a	
			C	2.3b	C1 for correct process to communicate given information, e.g. 3 overlapping labelled ovals with all regions correct, including outside
11 (b)		$\frac{23}{80}$	B	1.3a	B1 ft diagram

Question	Working	Answer	Mark	AO	Notes
11 (c)		$\frac{19}{40}$	M A	1.3a 1.3a	M1 for probability with denominator 40 A1 $\frac{19}{40}$ A1 cao
12 (a)	$10 \times 10 \times 10 \times 10$	10000	M A	1.3a 1.3a	M1 $10 \times 10 \times 10 \times 10$ A1 cao
12 (b)	$5 \times 4 \times 5 \times 4$	400	M A	1.3a 1.3a	M1 $5 \times 4 \times 5 \times 4$ A1 cao
13	$2x - 4 = x^2 - 4x + 4$ $x^2 - 6x + 8 = 0$ $(x - 4)(x - 2) = 0$ $x = 4, x = 2$ When $x = 4, y = 4$ When $x = 2, y = 0$ $4 - 2 = 2$ $4 - 0 = 4$ $2^2 + 4^2$	$\sqrt{20}$	P P P A P A	3.1b 3.1b 3.1b 1.3b 3.1a 1.3a	P1 for a process to eliminate y , e.g. $2x - 4 = x^2 - 4x + 4$ followed by reduction to 3 term quadratic P1 for factorisation or formula for a 3 term quadratic = 0 P1 for a process to find the values of y A1 all 4 values ($x = 4, y = 4$, and $x = 2, y = 0$) P1 for a correct process to find the distance ² or distance between the 2 points, e.g. $(4' - 2')^2 + (4' - 0')^2$ A1 $\sqrt{20}$
14 (a)	$(\sum fx =) 24 \times 25 + 42 \times 50 + 64 \times 70 + 44 \times 85 + 54 \times 100 = 16\,320$ $(\sum f =) 24 + 42 + 64 + 44 + 54 = 228$ Mean = $16\,320 \div 228 = 71.6$	Conclusion + support	P P M A C	2.3a 3.1b 1.3b 1.3b 2.1b	P1 for process to interpret histogram to find frequencies, e.g. $(40 - 10) \times 0.8$ P1 for process to use frequencies and midpoints M1 for $(\sum fx) \div (\sum f)$ A1 for a value $71 - 72$ C1 (dependent on P1) for an inference based on

Question	Working	Answer	Mark	AO	Notes
14 (b)		No + reason	C	2.5b	the calculated value of the mean, e.g. the evidence supports the hypothesis as the mean in 2013 is lower C1 No, because the histogram does not show individual values
15	$\frac{1000 \times 13.915}{8.25^2 \times 83.5} = 2.448$ $\frac{1000 \times 13.905}{8.35^2 \times 84.5} = 2.360$	2.4 g/cm ³	B	1.1	B1 for $83.5 \leq h < 84.5$ or $8.25 \leq d < 8.35$ (or correct bounds) or $13.905 \leq M < 13.915$ (or correct bounds). Accept $h = 84.5$ or $d = 8.35$ or $M = 13.915$
			P	3.1c	P1 for correct process to find upper bound of D (= 2.4(48... or 0.0024(48...)) oe
			P	3.1c	P1 for correct process to find lower bound of D (= 2.3 (60... or 0.0023(6...)) oe
			P	2.4a	P1 for an explanation or a correct process to find D to an appropriate degree of accuracy
			A	1.3a	A1 2.4 g/cm ³

Question 11(a)

