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GCSE (9-1) Mathematics

Sample Assessment Materials

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics (1MA1)

First teaching from September 2015

First certification from June 2017 | Issue 1

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Sample Assessment Materials

First certification 2017

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Contents

Introduction

The Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics is designed for use in schools and colleges. It is part of a suite of GCSE qualifications offered by Pearson. These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked **unless** the candidate has replaced it with an alternative response.

Guidance on the use of codes within this mark scheme:

- **B mark** is one mark for accuracy in AO1 (e.g. for recall of a formula) in Strands 1, 2, 3.
- **A mark** is always an AO1 mark awarded for accuracy.
- **M mark** is a method mark, and can be awarded across all Assessment Objectives
- **C mark** is a mark that involves descriptive comment at the end which may or may not contain a numerical solution to the problem.
- **P mark** is a mark that can be awarded to a proof, a process (correct process with the correct result), or a numerical solution to a problem (where the method is shown), or for evaluation of AO3 (Strands 4 and 5). Where there is evidence of a decision that starts the problem-solving process, this is exemplified in words, followed by an example of working out (where the example given is not exhaustive). This means that alternative and valid solutions should also be rewarded.

- **oe** – or equivalent
- **cao** – correct answer only
- **ft** – follow through
- **sc** – special case
- **awrt** – answers which round to

Each mark is allocated to an Assessment Objective strand and element within the mark scheme. Please see page 22 in the specification for the breakdown of the Assessment Objectives into strands and elements.

Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 1 (Non-Calculator)

Foundation Tier

Sample Assessment Materials for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
1MA1/1F

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 not be used.**
- 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 ▶

S47348A

S 4 7 3 4 8 A 0 1 2 4

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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:

Curved surface area of a cone = πrl

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

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

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 (a) Work out $16 - 6 \times 2$

(1)

(b) Write 0.7 as a percentage.

(1)

(c) Write $\frac{3}{5}$ as a decimal.

(1)

(d) Find 15% of 120

(2)

(Total for Question 1 is 5 marks)

---

2 (a) Solve $4x = 20$

(1)

(b) Solve $y - 9 = 17$

(1)

(Total for Question 2 is 2 marks)

---

3 Dan buys 24 packets of nuts.
Each packet of nuts weighs 225 g.

(a) Work out the total weight of all the packets of nuts that Dan buys.

(2)

Susan is going to have a party.
There will be 50 people at the party.

Susan wants to buy enough sausages so that each person at the party can have 2 sausages.

There are 8 sausages in each pack.
Susan buys 12 packs of sausages.

(b) Has she bought enough sausages?

(3)

(Total for Question 3 is 5 marks)

4 (a) Write down the 20th odd number.

(1)

The sum of two consecutive odd numbers is 48

(b) Find the smaller of these two odd numbers.

(2)

Here are the first five terms of an arithmetic sequence.

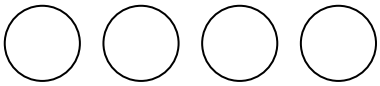
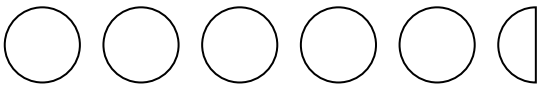
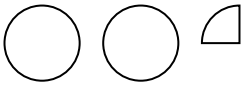
5 8 11 14 17

(c) Is 42 a term of this sequence?
Show how you get your answer.

(2)

(Total for Question 4 is 5 marks)

5 Ajay owns a cafe.
The pictogram shows information about the number of each type of fruit he has in the cafe.

Apples	
Oranges	
Bananas	

Key

represents 4 pieces of fruit

It takes 7 oranges to make 500 m*l* of orange juice.

Ajay has to make $1\frac{1}{2}$ litres of orange juice.

Has Ajay enough oranges?
You must show all your working.

(Total for Question 5 is 3 marks)

6 Shazia buys 10 boxes of drinks.

The cost of each box of drinks is £5
Each box holds 12 cans of drink.

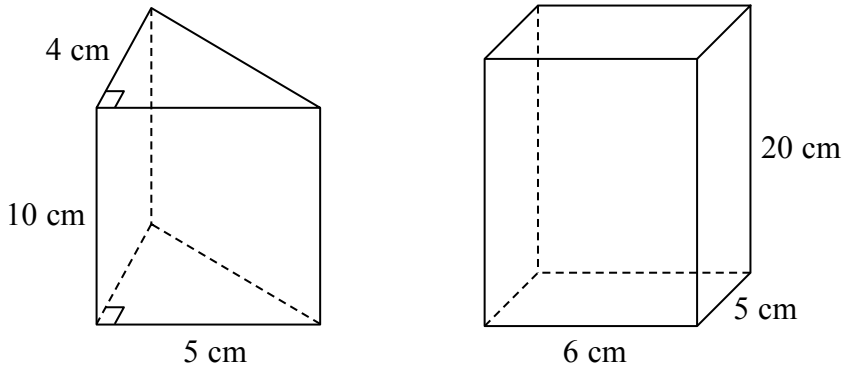
Shazia sells $\frac{2}{3}$ of the total number of cans for 60p each.

She then sells all the remaining cans for 30p each.

Work out the total profit that Shazia makes.

(Total for Question 6 is 5 marks)

7 The diagram shows a right-angled triangular prism **A** and a cuboid **B**.



A **B**

Show that the volume of **B** is 6 times the volume of **A**.

(Total for Question 7 is 3 marks)

8 Carpet tiles are going to be used to cover a floor.

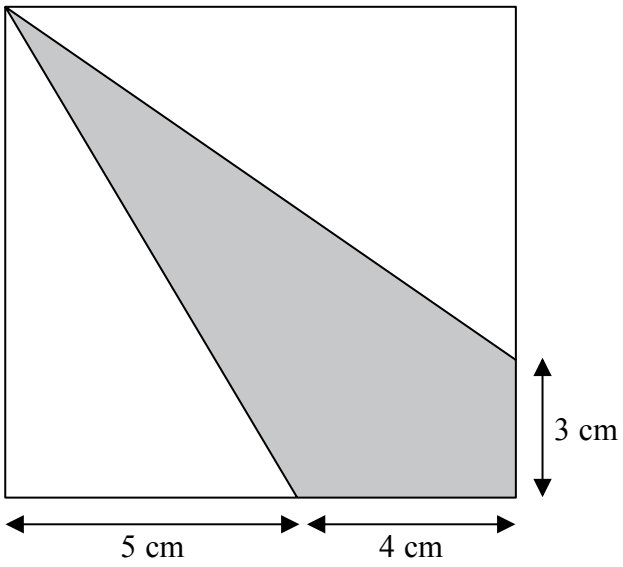
The floor is a 1200 mm by 1000 mm rectangle.
Each carpet tile is a 40 cm by 30 cm rectangle.

Exactly 10 carpet tiles can be used to cover the floor completely.

Show in a labelled sketch how this can be done.

(Total for Question 8 is 3 marks)

9 The diagram shows a shaded quadrilateral inside a square.



Work out the area of the shaded quadrilateral.

(Total for Question 9 is 4 marks)

10 There are 3 red beads and 1 blue bead in a jar.
A bead is taken at random from the jar.

(a) What is the probability that the bead is blue?

(1)

There are 4 yellow counters and 3 green counters in a bag.

Sharon puts some more green counters into the bag.
The ratio of the number of yellow counters to the number of green counters is now 2 : 5

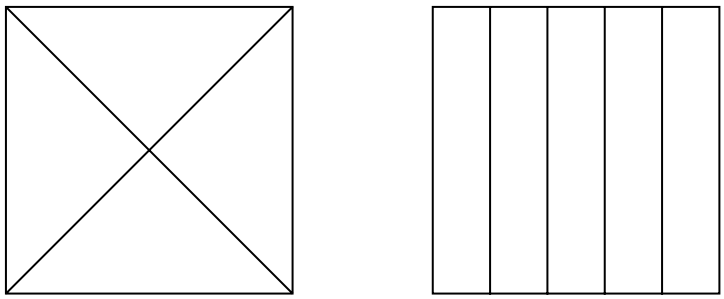
(b) How many green counters did Sharon put into the bag?

(2)

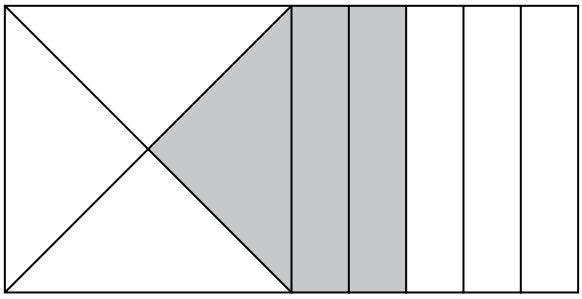
(Total for Question 10 is 3 marks)

11 Here are two identical squares.

The first square is divided into four equal parts.
The second square is divided into five equal parts.



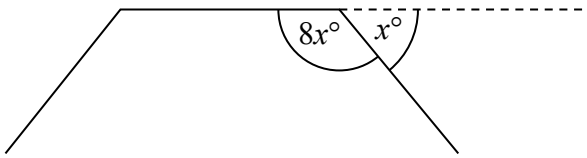
The two squares are joined together as shown to make a rectangle.



What fraction of the rectangle is shaded?

(Total for Question 11 is 3 marks)

12 The diagram shows three sides of a regular polygon.



The size of each exterior angle of the regular polygon is $x°$.
The size of each interior angle of the regular polygon is $8x°$.

Work out the number of sides the regular polygon has.

(Total for Question 12 is 3 marks)

13 Liam, Sarah and Emily shared some money in the ratio 2 : 3 : 7
Emily got £80 more than Liam.

How much money did Sarah get?

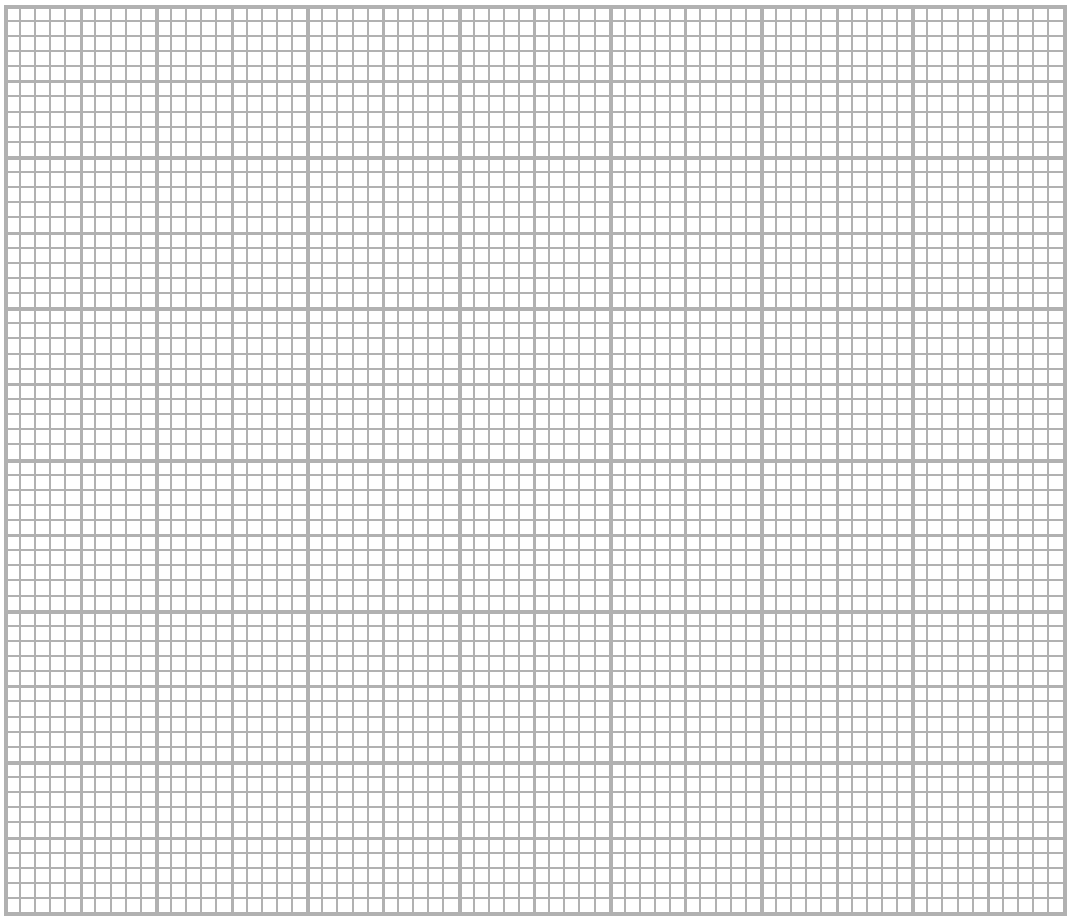
(Total for Question 13 is 3 marks)

14 The table shows the life expectancy (in years) for males born in the UK from 2000 to 2012.

Year of birth	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Life expectancy (years)	75.4	75.7	75.8	76.1	76.6	76.9	77.2	77.4	77.6	78.1	78.4	78.8	79.0

(Data from statistics.gov.uk)

(a) Use this information to predict the life expectancy of a male born in 2030.



(4)

(b) Make two comments explaining why your prediction in part (a) may not be reliable.

(2)

(Total for Question 14 is 6 marks)

15 Given that $A = 2^4 \times 3^3 \times 5$ and $B = 2^3 \times 3 \times 5^2$

write down, as a product of powers of its prime factors,

(i) the highest common factor (HCF) of A and B

(ii) the lowest common multiple (LCM) of A and B.

(Total for Question 15 is 2 marks)

16 A rectangular piece of card *ABCP* is placed on a horizontal straight line.

The card is first rotated 90° clockwise about *C*.
The card is then rotated 90° clockwise about *B*.
The card is then rotated 90° clockwise about *A*.

Draw the locus of the vertex *P*.

(Total for Question 16 is 3 marks)

17 (a) Solve the simultaneous equations $3x + 5y = 4$

$2x - y = 7$

(3)

(b) Find the integer value of x that satisfies both the inequalities

$x + 5 > 8$ and $2x - 3 < 7$

(3)

(Total for Question 17 is 6 marks)

18 Modelling the planet Mercury as a sphere, it has a radius of 2440 km.

(a) (i) Work out an estimate in square kilometres for the surface area of Mercury.

(ii) Without carrying out a further calculation, give evidence to show whether your method gives you an underestimate or an overestimate for the surface area of Mercury.

(3)

In July 2013, the spacecraft Messenger was near Mercury at a distance of 9.75×10^7 km from Earth.

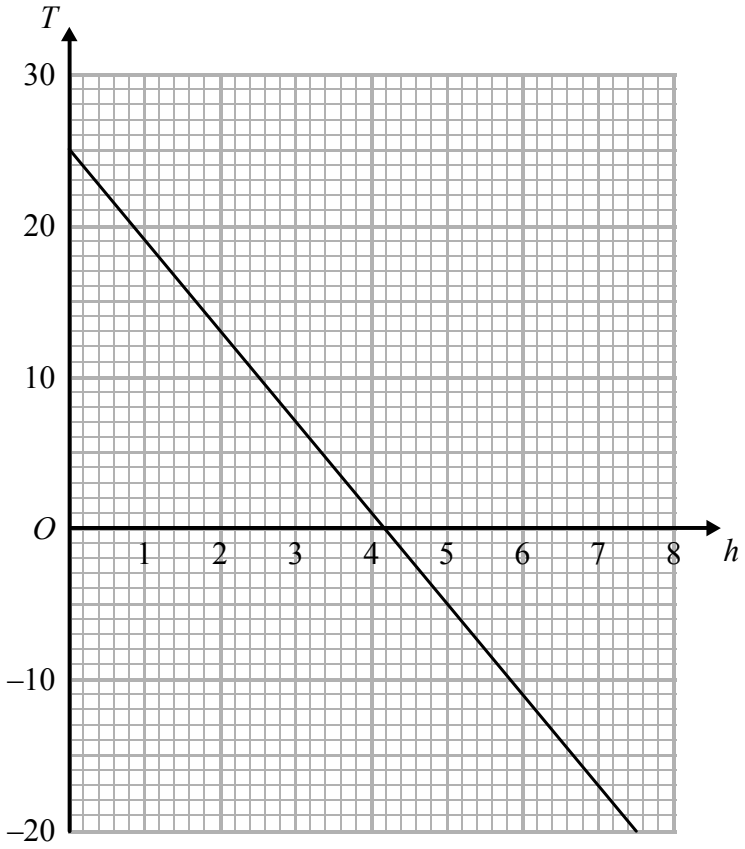
Taking the speed of light to be 3×10^8 m/s,

(b) work out how long it takes light to travel a distance of 9.75×10^7 km.

(3)

(Total for Question 18 is 6 marks)

19 The graph gives information about how the temperature, T °C, of the atmosphere decreases as the height above ground level, h km, increases.



(a) Use the graph to estimate the temperature at a point 2.5 km above ground level.

(1)

A balloon rises up from ground level to a height of 5.5 km.

(b) Use the graph to estimate the decrease in temperature.

(2)

Jean says:

"The temperature falls 6 °C for every kilometre the balloon rises."

(c) What evidence is available from the graph to support this?

(4)

(Total for Question 19 is 7 marks)

20 Michael carried out a survey of the time, in minutes, it takes the 20 people in his office to get to work. This table gives some information about his results.

Time (t minutes)	Frequency
$0 < t \leqslant 10$	8
$10 < t \leqslant 20$	6
$20 < t \leqslant 30$	1
$30 < t \leqslant 40$	4
$40 < t \leqslant 50$	1

Michael used this information to work out the mean of the times taken.
He got an answer of 68 minutes.

(a) Explain why it is impossible for the mean time to be 68 minutes.

(1)

The 20 people in the survey had:
a mean age of 45 years
a median age of 41 years

Michael decides to include his age so that he works out the mean age and median age of 21 people.
Michael is 42 years old.

Here are two statements about the ages of the 21 people.

Statement 1: The mean age of the 21 people is less than 45 years.

Statement 2: The median age of the 21 people is more than 41 years.

(b) (i) Is statement 1 correct?
You must give a reason to support your answer.

(ii) Is statement 2 correct?
You must give a reason to support your answer.

(2)

(Total for Question 20 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS

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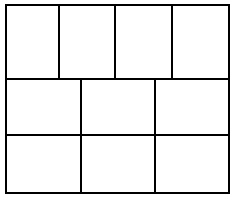
Foundation tier Paper 1 – Non-calculator

Question	Working	Answer	Mark	AO	Notes
1 (a)		4	B	1.3a	B1
1 (b)		70%	B	1.3a	B1
1 (c)		0.6	B	1.3a	B1
1 (d)		18	M A	1.3a 1.3a	M1 for 0.15 × 120 oe A1 cao
2 (a)		5	B	1.3a	B1
2 (b)		26	B	1.3a	B1
3 (a)		5400 g or 5.4 kg	M A	1.3a 1.3a	M1 for a complete correct method for multiplication with no more than one multiplication error A1 cao
3 (b)		Deduction, e.g. No with 100 and 96	P M C	3.1c 1.3a 2.1a	P1 start to solve problem, e.g. 50 × 2 or 8×12 M1 show sufficient calculations that would enable a deduction to be made, e.g. 50 × 2 and 8 × 12 **or** 50 × 2 and 50 × 2 ÷ 8 C1 deduction from accurate figures
4 (a)		39	B	1.3a	B1 cao
4 (b)		23	P A	3.1a 1.3a	P1 for a correct process to start to solve the problem, e.g. 48 ÷ 2 or 23 + 25 A1
4 (c)		No with justification	P C	2.2 2.4a	P1 for a start to the process, e.g. sight of $3n + 2$ or a correct continuation of sequence with an extra 3 terms C1 for 'No' with full justification, e.g. if $3n + 2 = 42$

Question	Working	Answer	Mark	AO	Notes
					then $n = \frac{40}{3}$ which is not an integer value **or** complete sequence up to 41, 44 with statement that 42 is not in the sequence
5	$5 \times 4 + 2$ (= 22) oranges $1.5 \times 1000 \div 500$ (=3) '3' × 7 (=21)	Yes with supporting evidence	P P C	2.3a 3.1b 2.3b	P1 for interpreting the key, e.g. $5 \times 4 + 2$ **or** 22 (oranges) P1 for complete process to find number of oranges needed C1 for 'yes' with 21 and 22
6	Cost price is £50 Total number is 120 $\frac{2}{3} \times 120 = 80$ Income from these is 60p × 80 = £48 Income from the remainder is 30p × 40 = £12 Profit = £48 + £12 – £50	£10	P P P P A	3.1d 3.1d 3.1d 3.1d 1.3b	P1 for a process to find the total cost of 10 boxes of drink and the total number of cans bought, e.g. 10×5 (=50) and 10×12 (=120) P1 for a process to find the number of cans sold for 60p, e.g. $\frac{2}{3} \times$ '120' (= 80) oe P1 for a process to find the cost of cans sold for 60p e.g. '80' × 60p (= £48) oe P1 for a process to find the cost of their remaining cans at 30p each, e.g. (120 – '40') × 30p oe A1 cao

Question	Working	Answer	Mark	AO	Notes
7		Show	M P C	1.1 2.2 2.2	M1 for Use of correct formula for volume for triangular prism or cuboid, e.g. $\frac{1}{2}\times 4\times 10\times 5(=100)$ **or** $6 \times 20 \times 5(= 600)$ P1 for beginning to construct chains of reasoning, e.g. $\frac{1}{2}\times 4\times 10\times 5(=100)$ **and** $6 \times 20 \times 5 (= 600)$ C1 for completion of chains of reasoning, e.g. $600 \div 100 = 6$
8	$1200 \div 300 = 4$ $1200 \div 400 = 3$ $1000 = 400 + 300 + 300$	Correct diagram with correct layout 	M P C	1.1 2.3a 2.3b	M1 for changing to consistent units, e.g. $1000 \div 10$ or 40×10 P1 for interpreting information and a process to fit tiles in floor area, e.g. may be seen on a sketch or may see a calculation C1 for diagram to communicate a correct layout with lengths clearly identified
9	Square $9 \times 9 = 81$ Bottom triangle $\frac{5\times 9}{2} = \frac{45}{2}$ Top triangle $\frac{6\times 9}{2} = \frac{54}{2}$ Shaded area $81 - 22.5 - 27$	31.5 cm^2	P P P	3.1b 3.1b 3.1b	P1 for a process to establish the missing lengths on the perimeter of the shape P1 for a process to begin the problem by finding the area of one relevant shape P1 for complete process to find the shaded area, e.g. $9 \times 9 - (\text{'22.5'} + \text{'27'})$

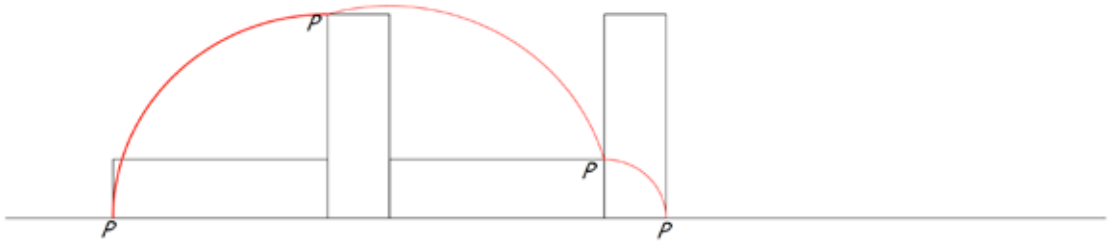
Question	Working	Answer	Mark	AO	Notes
9 cont.	Or $\frac{1}{2}\times 4\times(4+5)+\frac{1}{2}\times 3\times(4+5)$		A	1.3b	A1 cao
10 (a)		$\frac{1}{4}$	B	1.2	B1 for $\frac{1}{4}$ oe
10 (b)		7	P A	3.1c 1.3a	P1 for process to start to solve problem, e.g. 2 : 5 = 4 : 10 A1 cao
11		$\frac{13}{40}$	P P A	2.3a 3.1a 1.3a	P1 for interpreting diagrams eg. writing the area of the triangle section of the square as a quarter or writing the rectangular section as a fraction of the area of the square as two fifths P1 for correct processes needed to solve problem, e.g. $\frac{1}{4}+\frac{2}{5}=\frac{1\times 5+2\times 4}{4\times 5}\left(=\frac{13}{20}\right)$ **and** $\frac{1}{2}\times\text{'}\frac{13}{20}\text{'}$ A1 for $\frac{13}{40}$ oe

Question	Working	Answer	Mark	AO	Notes
12		18	P P A	3.1b 3.1b 1.3b	P1 for a process to start to solve problem, e.g. $8x + x = 180$ or $180 \div 9$ (=20) P1 for a full process to solve problem, e.g. $360 \div$ '20' A1 cao
13	$80 \div (7 - 2)$ (= 16) '16' × 3	£48	P P A	3.1d 3.1d 1.3b	P1 for a strategy to start to solve problem, e.g. $80 \div (7 - 2)$ (=16) P1 for full process to solve problem, e.g. '16' × 3 A1 cao
14 (a)		84 to 85	P P P A	2.3a 2.3b 3.1d 1.3b	P1 for interpreting the data and deciding to draw a graph or a table to represent the data P1 for a correct process to label axes or communicate the data connections P1 drawing in an appropriate line of best fit or model the problem as a linear function in time A1 for correctly reading off the value at 2030 in the range 84 to 85 or using their linear function correctly to give an answer in this range
(b)			C C	3.4b 3.4b	C1 for a valid comment eg cannot assume a linear relationship C1 for a valid comment eg that one cannot predict accurately with a date so far away from the original data
15 (i) (ii)		$2^3 \times 3 \times 5$ $2^4 \times 3^3 \times 5^2$	B B	1.3a 1.3a	B1 cao B1 cao

Question	Working	Answer	Mark	AO	Notes
16		locus (see diagram at the end)	C	2.3b	C1 for method of showing a rotation about one fixed point, e.g. quarter circle with radius *PC* centre *C* or radius *PB* centre *B* or *PA* centre A
			C	2.3b	C1 for understanding it is a continuous process, e.g. quarter circle with radius *PC* centre *C* and radius *PB* centre *B* and radius *PA* centre A
			C	2.3b	C1 for fully correct drawing
17 (a)	$3x + 5y = 4$ $10x - 5y = 35$ $13x = 39$	$x = 3, y = -1$	M M A	1.3b 1.3b 1.3b	M1 for correct method to eliminate one variable M1 for correct method to find second variable A1 for $x = 3$ and $y = -1$
17 (b)	$x + 5 > 8$ $x > 3$ $2x - 3 < 7$ $2x < 10$ $x < 5$	$x = 4$	B B B	1.3b 1.3b 1.3b	B1 for $x > 3$ or for $x < 5$ B1 for $x > 3$ **and** for $x < 5$ B1 for $x = 4$ from $x > 3$ and $x < 5$
18 (a) (i)	$4 \times 3 \times 2000^2$	48 000 000 km^2	M A	1.3a 1.3a	M1 for use of $4\pi r^2$ with either π or r rounded to 1 significant figure A1 accept 50 000 000 km^2
(ii)			C	3.4a	C1 for appropriate evaluation of method, e.g. 3 and 2000 both less than true values
18 (b)	$9.75 \times 10^7 \times 1000 \div (3 \times 10^8)$	325 s	M M A	1.3b 1.3b 1.3b	M1 for use of distance ÷ time M1 for consistent units A1 cao

Question	Working	Answer	Mark	AO	Notes
19 (a)		10°C	B	1.3a	B1 for answer in range 9 – 11
19 (b)	25 – – 8	33°C	P A	2.3a 1.3a	P1 for a process to identify 25 as the temperature when $h = 0$ and when h is 5.5 and show an intention to subtract, e.g. 25 – – 8 A1 for 33°C cao
19 (c)		Explanation with −6	C C M A	2.3a 2.1b 1.3a 1.3a	C1 the graph is a straight line, e.g. the gradient is constant oe C1 falling as the graph has a negative gradient (or gradient is −6) M1 for method to find gradient A1 for −6
20 (a)		Explanation	C	2.5a	C1 for explanation, e.g. 68 is outside the range of the data
(b) (i) (ii)		Yes and reason Don't know and reason	C C	2.4a 2.4a	C1 for Yes and reason, e.g. mean will go down as Michael's age is below the mean of the 20 people C1 for 'don't know' and reason, e.g. cannot tell as do not know other ages

Question 16:



Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 2 (Calculator)

Foundation Tier

Sample Assessment Materials for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
1MA1/2F

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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S 4 7 3 4 9 A 0 1 2 0

PEARSON

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:

Curved surface area of a cone = πrl

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

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

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 Ellen buys items from car boot sales.
She then sells these items on an internet auction site.

The table shows some information about the items Ellen bought and sold one week.
The first row has been completed.

Item	Bought	Sold	Profit or loss
DVD	£5	£7.50	£2.50 profit
Doll	£8	£12	.....
Jigsaw	£2	.....	£1.50 profit
Chair	.....	£20	£5 loss
Train set	£37	£35	.....

(a) Complete the table.

(2)

(b) Work out Ellen's total profit or loss for these five items.

(2)

(Total for Question 1 is 4 marks)

2 (a) Find the value of $\sqrt{1.6 + 0.96}$

(1)

(b) Find the value of 1.2^4

(1)

(c) Write 37.483 correct to 1 significant figure.

(1)

(Total for Question 2 is 3 marks)

3 (a) Simplify $c + c + c + c$

(1)

(b) Simplify $6 \times m \times 5$

(1)

(c) Simplify $2e + 3f + 7e - 5f$

(2)

(d) Expand and simplify $(x + 3)(x + 5)$

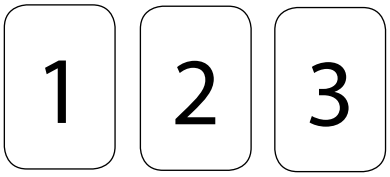
(2)

(Total for Question 3 is 6 marks)

4 (a) Write the ratio 48 : 120 in its simplest form.

(2)

Sally has three tiles.
Each tile has a different number on it.
Sally puts the three tiles down to make a number.
Each number is made with all three tiles.



(b) How many different numbers can Sally make?

(2)

There are 60 animals at a rescue centre.

30% of the animals are cats.
38 of the animals are dogs.

The rest of the animals are horses.

(c) Work out how many horses there are at the rescue centre.

(3)

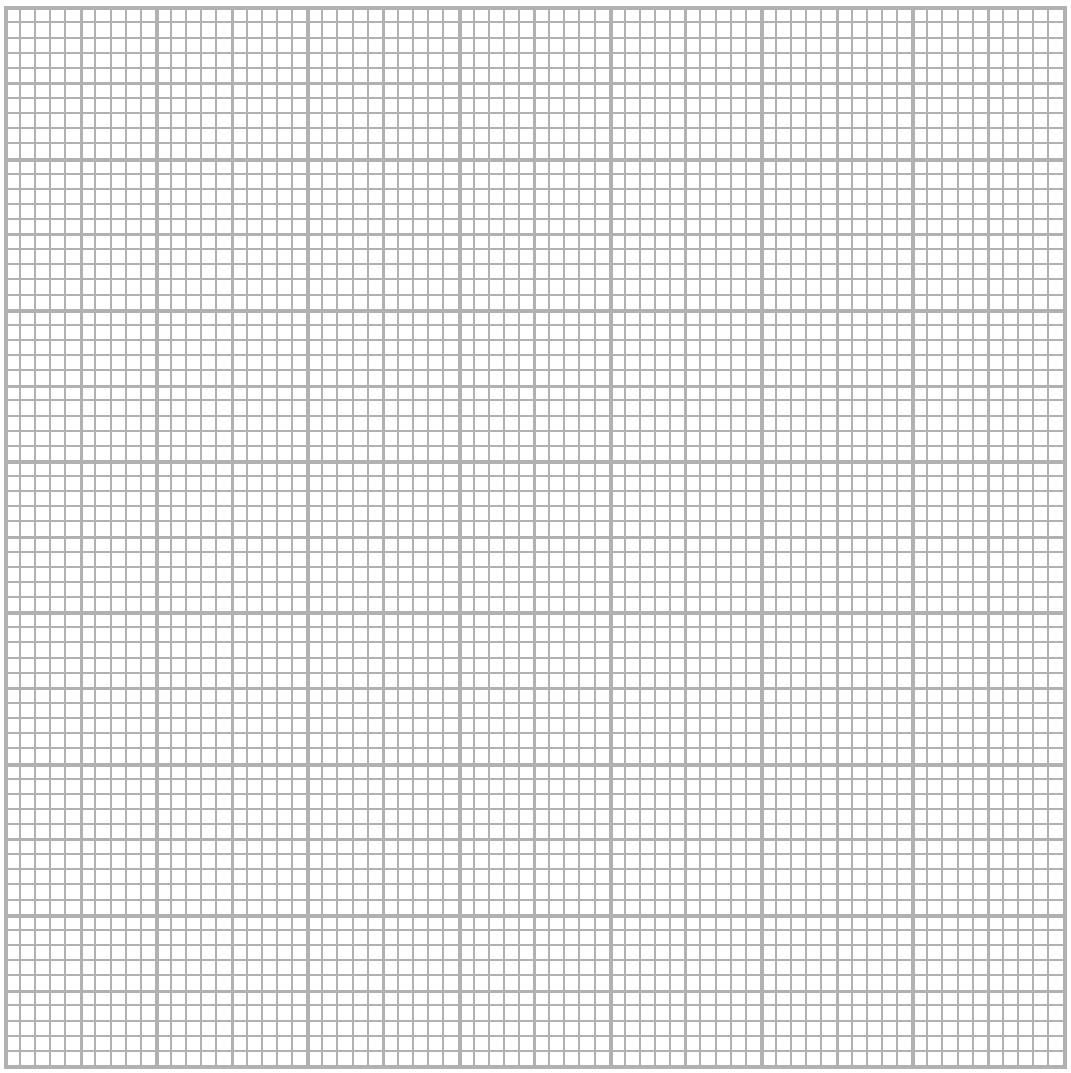
(Total for Question 4 is 7 marks)

5 Ade sells shirts in 4 sizes.
The sizes are small (S), medium (M), large (L) and extra large (XL).

Here are the sizes of the shirts that Ade sold in each of two weeks.

Week 1	S	L	M	L	XL	M	L	S	L	L
	M	XL	S	L	M	M	L	L	M	M
Week 2	M	M	L	L	L	XL	S	S		
	L	XL	S	M	M	L	M	M		

(a) (i) Draw a suitable diagram that Ade could use to compare the sizes of shirts sold in week 1 with the sizes of shirts sold in week 2



(ii) Explain how the diagram you have chosen allows the sizes of the shirts sold in week 1 to be compared with the sizes of the shirts sold in week 2.

(4)

Ade buys 240 more shirts to sell.

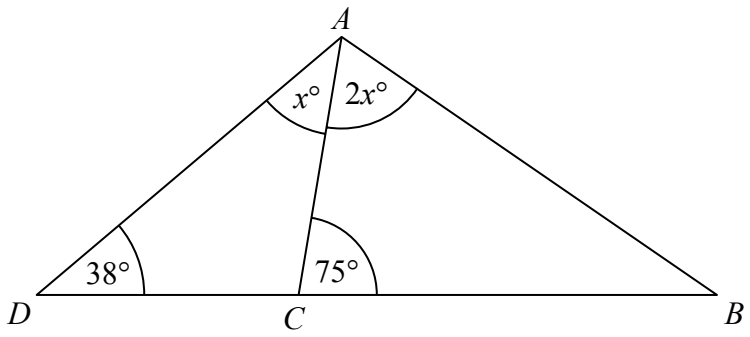
(b) (i) Work out an estimate of the number of size large (L) shirts Ade should buy.

(ii) Explain whether your answer to part (b)(i) gives a reliable estimate of the number of size large (L) shirts Ade should buy.

(3)

(Total for Question 5 is 7 marks)

6



ABD is a triangle.
C is a point on *BD*.

Show that angle *ABD* is 31°.
Give a reason for each stage in your working.

(Total for Question 6 is 4 marks)

7 Noah buys coffee sachets to use in his coffee maker.

There are 16 coffee sachets in a pack.

A pack costs £3.99

Noah uses 5 coffee sachets each day.

Work out the minimum amount that Noah spends on coffee sachets in one year.

(Total for Question 7 is 4 marks)

8 Delia uses this rule to cook some beef.

Cooking time in minutes = 20 × weight in pounds + 30

The weight of the beef is 1.5 kg.
1 kg = 2.2 pounds.

(a) How long will the beef take to cook?

(4)

Kevin has a different piece of beef.
The weight of his beef is 3 kg.

Kevin says

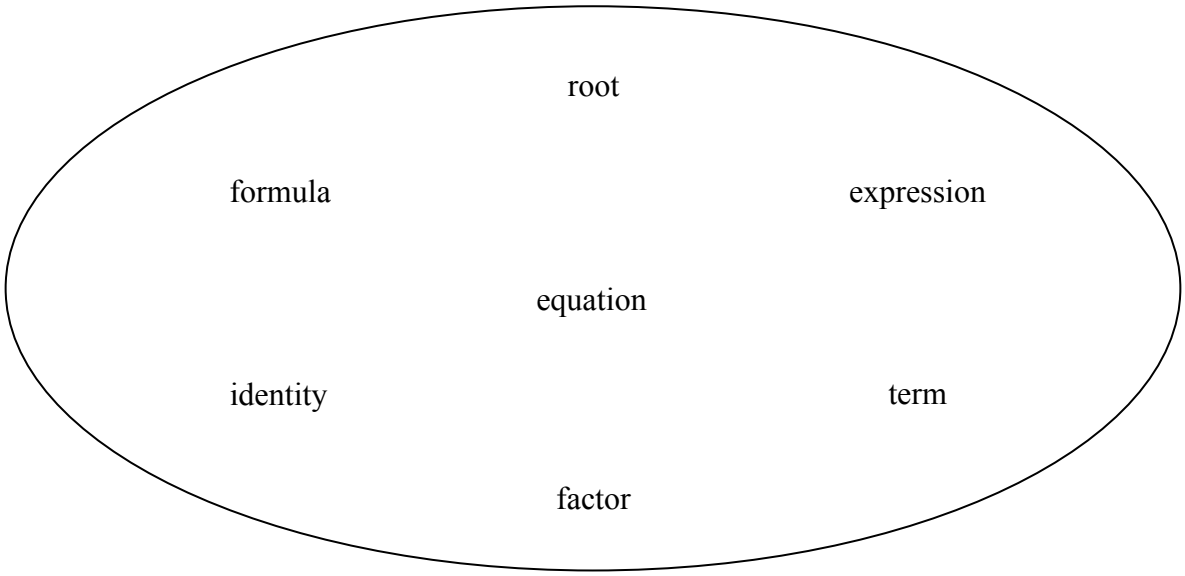
> 'Because the weight of my piece of beef is twice the weight of Delia's piece of beef it will take twice as long to cook as Delia's piece took.'

(b) Is Kevin correct?
Explain your answer.

(1)

(Total for Question 8 is 5 marks)

9



Choose a word from those above that makes this statement correct.

(a) x^2 is a ..... in $x^2 + 4y$

(1)

Choose a word from those above that makes this statement correct.

(b) $(y + 2)$ is a ..... of $3y + 6$

(1)

(Total for Question 9 is 2 marks)

10 Brian, Suha and Kamil pick apples.

Suha picks twice as many apples as Brian.
Kamil picks nine more apples than Suha.

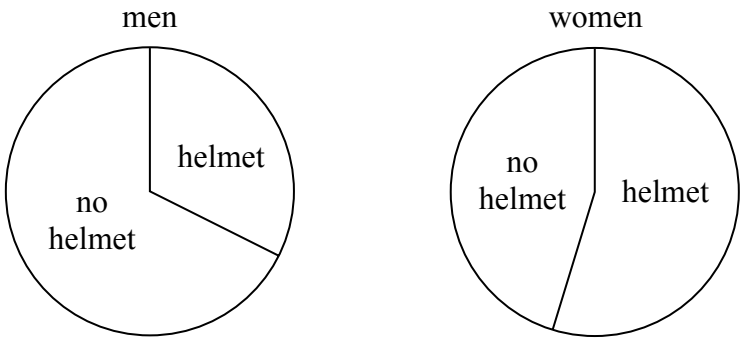
They pick a total of 94 apples.

How many apples does Brian pick?

(Total for Question 10 is 4 marks)

11 Imran carried out a survey on the wearing of cycle helmets by the men and the women living in his village.

He used the information he collected to draw two pie charts.



Mary looks at the two pie charts.

She says:

"The pie charts show that more women wear helmets than men."

(a) Is Mary right?
You must explain your answer.

(1)

Imran chose to draw pie charts to display the results of his survey.

(b) Are pie charts the best way to show this information?
You must explain your answer.

(1)

(Total for Question 11 is 2 marks)

12 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 12 is 3 marks)

13 Given that $3(x - c) = 2x + 5$ where c is an integer,

show that x cannot be a multiple of six.

(Total for Question 13 is 3 marks)

14 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 14 is 9 marks)

15 The diagrams show two identical squares.

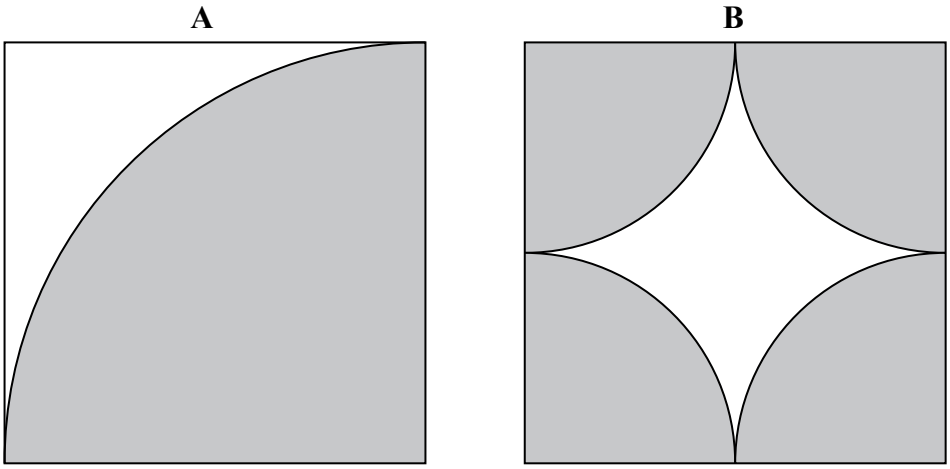


Diagram **A** shows a quarter of a circle shaded inside the square.
Diagram **B** shows four identical quarter circles shaded inside the square.

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 15 is 3 marks)

16 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 16 is 7 marks)

17 A piece of wood has a mass of x kg and a volume of 0.002 m^3.

Show that the density of the wood is $0.5x$ g/cm^3.

(Total for Question 17 is 4 marks)

18 Polly and Fiona play each other at chess and at snooker.

The probability that Polly wins at chess is 0.6
The probability that Polly wins at snooker is 0.7

Work out the probability that Polly does not win both games.

(Total for Question 18 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS

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Foundation tier Paper 2 − Calculator

Question	Working	Answer	Mark type	AO	Notes
1 (a)		Doll: £4 profit Jigsaw: £3.50 Chair: £25 Train set: £2 loss	M A	1.3a 1.3a	M1 for any correct method to find profit or loss and any correct method to find cost or selling prices (this may be given for the sight of at least one correct entry in the **profit or loss** column and one correct entry in **bought** or **sold** columns) A1 for a fully correct table with units and 'profit' or 'loss' quoted as required
1 (b)		£1 profit	M A	1.3a 1.3a	M1 for a fully correct method to find profit or loss A1 for £1 profit
2 (a)		1.6	B	1.3a	B1
2 (b)		2.0736	B	1.3a	B1
2 (c)		40	B	1.3a	B1
3 (a)		$4c$	B	1.3a	B1
3 (b)		$30m$	B	1.3a	B1
3 (c)		$9e - 2f$	M A	1.3a 1.3a	M1 for $9e$ or $-2f$ A1
3 (d)		$x^2 + 8x + 15$	M A	1.3a 1.3a	M1 for at least 3 terms out of 4 correct in expansion A1

Question	Working	Answer	Mark type	AO	Notes
4 (a)		2 : 5	M A	1.3a 1.3a	M1 for any correct ratio equivalent to 48 : 120 A1 cao
4 (b)		6	M A	1.3b 1.3b	M1 for starting to list combinations A1 cao
4 (c)		4	P P A	3.1d 3.1d 1.3b	P1 for a correct process to start to solve problem, e.g. 0.3×60 P1 for all necessary processes A1 cao
5 (a) (i)		A suitable diagram showing all required information	P C C	2.3b 2.3b 2.3b	P1 for selecting a suitable diagram, e.g. dual bar chart, a pair of pie charts C1 for chart(s) showing all fully correct information. C1 for fully-labelled chart(s)
(ii)		one advantage	C	2.5b	C1 For one advantage, e.g. bars for each size next to each other
5 (b) (i)		86 to 87	P P	3.1c 1.3a	P1 for selecting the appropriate proportion of size large and writing as a fraction P1 for an answer in the range 86 to 87 supported by a complete process, e.g. multiplying their fraction by 240
(b) (ii)		decision and explanation	C	3.4b	C1 for a decision of whether or not the estimate is reliable with a valid explanation (needs both a decision and a valid explanation to gain the mark)
6		show	P P P C	2.2 2.2 2.2 1.1	P1 for a correct start to the chain of reasoning, e.g. find angle *CAB* P1 for a correct process to find angle *CAB* P1 for completion of chain of reasoning with at least one appropriate reason C1 for all other reasons

Question	Working	Answer	Mark type	AO	Notes
7		£458.85 or £454.86	P P P A	3.1d 3.1d 3.1d 1.3b	P1 for a correct process to find number of sachets used in a year, e.g. 5 × 365 (= 1825) or 5 × 366 (= 1830) P1 for a correct process to find the number of packs required, e.g. "1825" ÷ 16 (= 114 or 115) or "1830" ÷ 16 (= 114 or 115) P1 for recognising the need to round up or down to ensure a whole number value £3.99 × 115 (or 114) A1 for £458.85 or £454.86
8 (a)		96 minutes	M P P A	1.3a 3.1d 3.1d 1.3b	M1 for 1.5 × 2.2 (= 3.3) P1 for process to start to find cooking time P1 for full process to find cooking time A1 for 96 minutes or 1 hour 36 minutes
(b)		No and comment	C	3.4a	C1 for no with valid comment eg his takes 3×2.2×20 + 30 = 162 which is not double 96 (need both the decision and a comment to gain the mark)
9 (a)		term	B	1.1	B1 for a fully correct statement
9 (b)		factor	B	1.1	B1 for a fully correct statement
10		17	P P P A	3.1d 3.1d 3.1d 1.3b	P1 for strategy to start to solve problem, e.g. x, $2x$, $2x + 9$ P1 for process to form an equation in x P1 for complete process to find number of apples A1 cao
11 (a)		Explanation	C	2.3b	C1, e.g. No because pie charts show proportions not actual numbers **or** could be that there were more men in the survey than women
11 (b)		Explanation	C	2.5b	C1, e.g. Yes pie charts are useful if you want to show proportion in each category **or** No – if you want to show that more women than men wear helmets, then bar chart or vertical line graph would be more appropriate

Question	Working	Answer	Mark type	AO	Notes
12	7 + 28 + 22 = 57	11, 44 and 38	P P A	3.1b 3.1b 1.3b	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 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
13	$3x - 3c = 2x + 5$ $x = 3c + 5$	Shown	P P C	2.2 2.2 2.4a	P1 for a process to start a chain of reasoning P1 for a process to isolate terms in x C1 convincing explanation from $x = 3c + 5$
14 (a)		720	P P A	3.1c 3.3 1.3b	P1 attempt to find the maximum biscuits for one of the ingredients, e.g. 5000 ÷ 150 (= 33.3..) or 2500 ÷ 75 (= 33.3…) or 3000 ÷ 100 (= 30) or 320 ÷ 10 (= 32) P1 for identifying butter as the limiting factor or 30 × 24 (= 720) seen A1 for 720 cao

Question	Working	Answer	Mark type	AO	Notes
14 (b)		116.25%	M	1.3b	M1 for a correct method of finding either 70% (= 504) or 30% (= 216) of 720
			P	3.1b	P1 for a process to find the cost of "216" at 55p for 4 (= £29.70)
			P	3.1b	P1 for a process to find revenue, e.g. "504" × £0.25 + "£29.70" (= £155.70)
			P	3.1b	P1 for a process to find profit, e.g. "£155.70" – £45 – £27 (= £83.70)
			M	1.3b	M1 for $\frac{'83.70'}{72}\times 100$
			A	1.3b	A1 for 116.25%
15		Demonstration	M	1.1	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)
			P	2.4a	P1 for a process to find the area of a quadrant, e.g. $\frac{1}{4}\times\pi x^2$ or $4\times\frac{1}{4}\times\pi\left(\frac{x}{2}\right)^2$ (x may be numerical)
			C	2.4a	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)
16 (a) (i)		Correct drawing	M	1.3a	M1 for a correct bearing drawn or for a correct distance drawn or quoted
			A	1.3a	A1 for a correct position of B
(a) (ii)		230°	B	1.1	B1 for 230° cao

Question	Working	Answer	Mark type	AO	Notes
16 (b)		Correct statement with evidence	P	2.3a	P1 for drawing a correct right-angle triangle showing line East from A and perpendicular from B (can be implied by correct trigonometric ratio)
			M	1.3b	M1 for $\cos 50^o = \frac{d}{36}$ oe
			P	2.2	P1 for $36 \times \cos 50^o$ 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
17	$x \div 0.002$ $(x \times 1000) \div 0.02$ (g/m^3) $(x \times 1000) \div (0.02 \times 100^3)$	show	M M P P	1.1 1.1 2.2 2.2	M1 for use of density = mass ÷ volume M1 for at least one correct unit conversion P1 for process to use density and all unit conversions P1 for complete chain of reasoning
18		0.58	M M A	1.3b 1.3b 1.3b	M1 for probability that Polly wins both games = 0.6×0.7 (= 0.42) M1 for 1 – "0.42" A1 for 0.58 OR M1 for 0.6×0.3 (Polly wins at chess and loses at snooker) or 0.4×0.7 (Polly does not win at chess but wins at snooker) or 0.4×0.3 (Polly does not win either game) M1 for $0.6 \times 0.3 + 0.4 \times 0.7 + 0.4 \times 0.3$ A1 for 0.58

Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 3 (Calculator)

Foundation Tier

Sample Assessment Materials for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
1MA1/3F

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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PEARSON

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:

Curved surface area of a cone = πrl

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

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

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 the stages in your working.

1 (a) Write the following numbers in order.

−3 −8 7 −5 3 0

(1)

(b) Write the following numbers in order.

0.59 0.5 0.09 0.95 0.05

(1)

(c) Write down all the factors of 20

(2)

(Total for Question 1 is 4 marks)

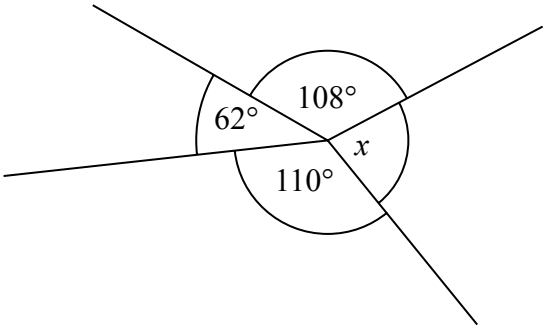
2 (a) Complete the following sentences.

(i) A cuboid has six .....

(ii) A ..... is a straight line from the centre of a circle to its circumference.

(2)

(b)



Explain clearly why angle x cannot be a right angle.

(2)

(Total for Question 2 is 4 marks)

---

3 (a) Here are the first four terms of a sequence.

4 11 18 25

Write down the next two terms of this sequence.

(1)

(b) The nth term of a different sequence is $3n + 1$

Work out the 5th term of this sequence.

(1)

(Total for Question 3 is 2 marks)

4 Amir, Caitlin and Michael work in a warehouse.
The table shows some information about their wages one week.

	Basic wage		**Overtime**		
	Rate of pay per hour	Number of hours worked	Rate of pay per hour	Number of hours worked	**Total wage**
Amir	£8.40	30	£12.60	7	£340.20
Caitlin	£9.30	30	£12.40	4	
Michael	£7.80	35	£15.60		£319.80

(a) Work out Caitlin's total wage for this week.

(2)

(b) Work out how many hours Michael worked.

(3)

(Total for Question 4 is 5 marks)

5 Rob buys p packets of plain crisps and c packets of cheese crisps.

(a) Write down an expression for the total number of packets of crisps Rob buys.

(1)

The formula

$$F = 1.8C + 32$$

can be used to convert between temperatures in degrees Celsius (C) and temperatures in degrees Fahrenheit (F).

(b) Change 28° Celsius into degrees Fahrenheit.

(2)

(c) Solve $4x + 2 = 20$

(2)

(d) Factorise $3x^2 - 2x$

(1)

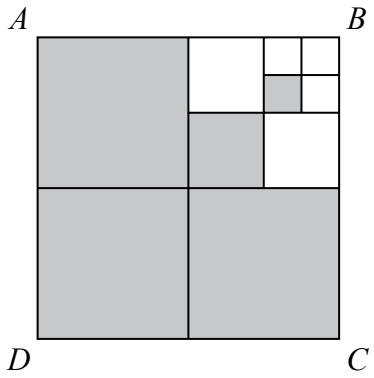
(Total for Question 5 is 6 marks)

6 (a) Work out the value of

$$\frac{1}{4}+\left(\frac{1}{4}\times\frac{1}{4}\right)+\left(\frac{1}{4}\times\frac{1}{4}\times\frac{1}{4}\right)$$

(2)

ABCD is a square.
This diagram is drawn accurately.



(b) What fraction of the square *ABCD* is shaded?

(2)

(Total for Question 6 is 4 marks)

7 The cost of 3 calculators is £26.85

(a) Work out the cost of 5 of these calculators.

(2)

The ratio of the number of boys to the number of girls in a class is 3 : 4

(b) What fraction of the class is boys?

(1)

Shane and Gemma share 35 sweets in the ratio 1 : 4

Gemma eats 10 of her sweets and then gives Shane $\frac{1}{2}$ of the sweets she has left.

(c) How many sweets does Shane have now?

(3)

(Total for Question 7 is 6 marks)

8 (a) Work out $\dfrac{9.76 + 1.031}{5.7 - 0.85}$

Give your answer correct to 2 decimal places.

(2)

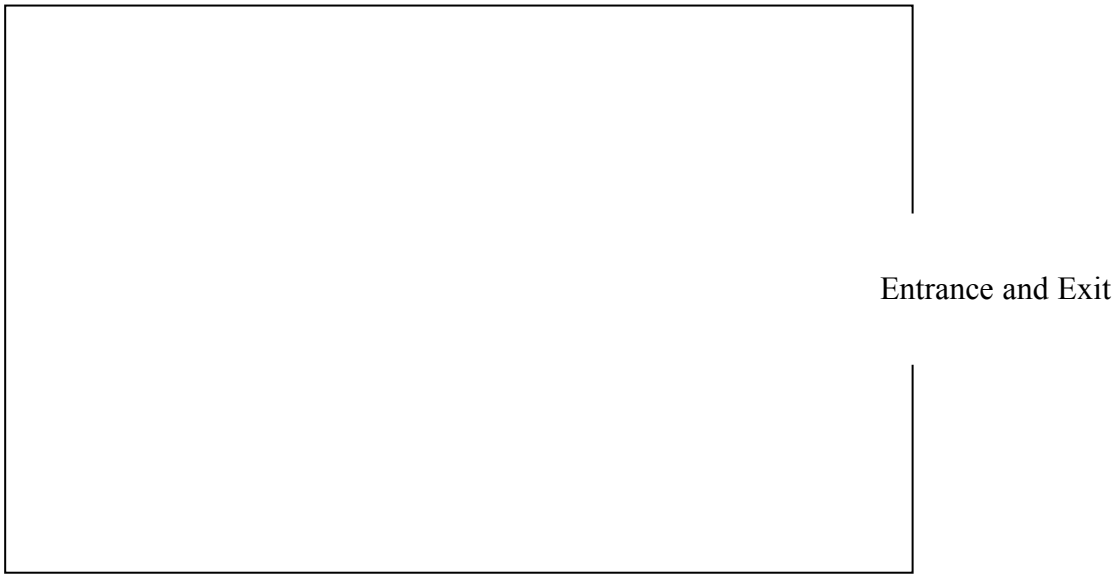
The area of a square is 42.25 m^2.

(b) Find the length, in metres, of one side of the square.

(1)

(Total for Question 8 is 3 marks)

9 Here is a scale drawing of a car park.



Scale: 1 cm represents 2 m

There must be at least 5 m between rows of parking bays to enable cars to go in and out.

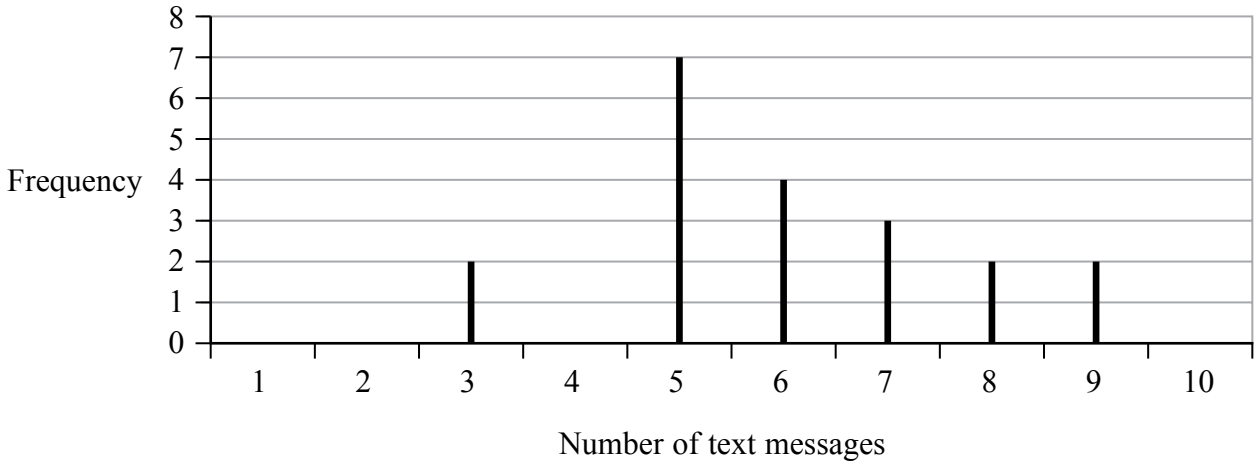
Stuart wants there to be 20 parking bays.

Is this possible?
You must show how you got your answer.

(Total for Question 9 is 3 marks)

10 Mrs Brown carried out a survey about the number of text messages received on one day by the students in her class.

The vertical line graph gives information about the number of text messages received by the boys.



(a) Write down the number of text messages that was the mode for the boys.

(1)

The mean number of text messages received on the same day by the girls was 6.5

(b) Who had the greater mean, the boys or the girls?
You must show how you got your answer.

(3)

(Total for Question 10 is 4 marks)

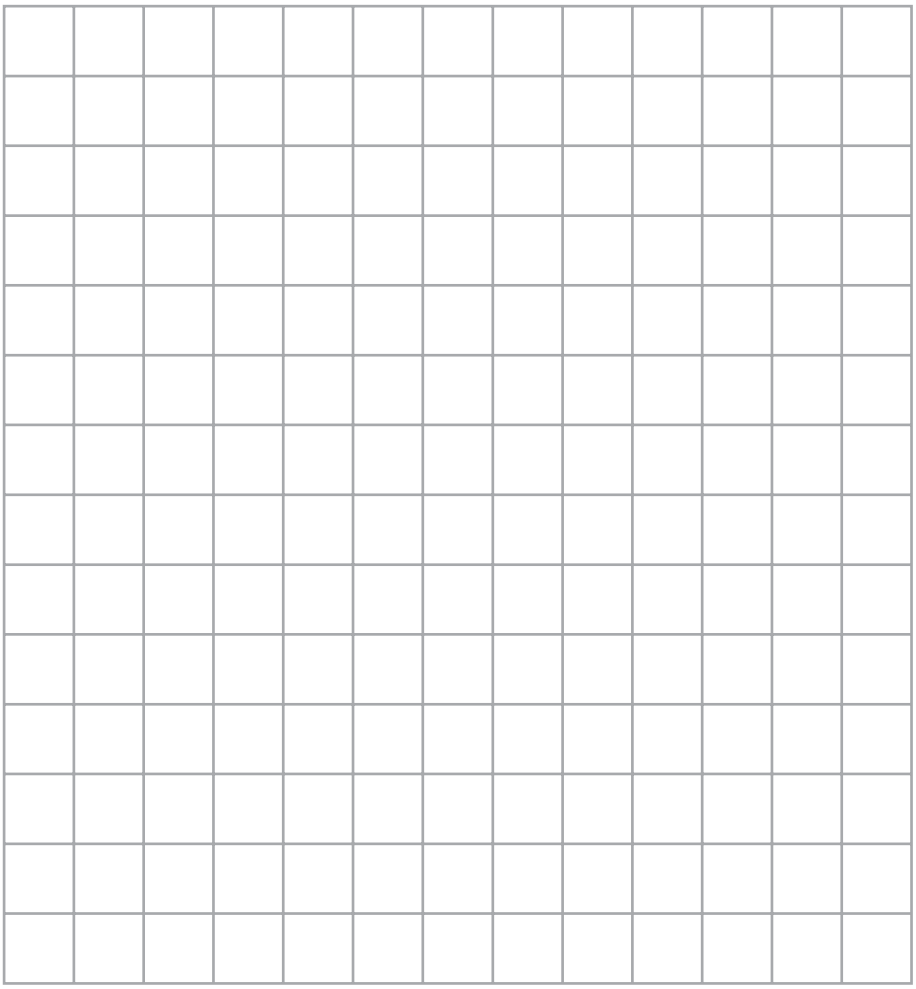
11 A has coordinates (40, 60)
B has coordinates (0, 20)

A straight line passes through the points A and B.

The point P lies on this straight line.

The x-coordinate of P is 0.5.

(a) Find the y-coordinate of P.



(3)

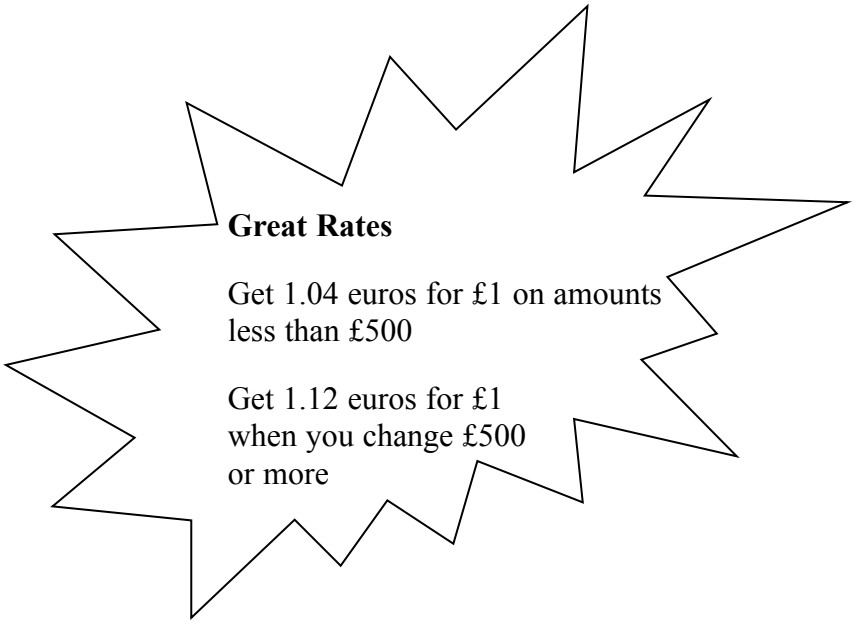
(b) Is your answer to part (a) reliable?
Explain your answer.

(1)

(Total for Question 11 is 4 marks)

12 Mr and Mrs Sharma are going to France.

They each have £300 which they want to change into euros.
They see this deal in a bank.



Mr and Mrs Sharma want the best deal.

They put their money together before changing it into euros.

How much extra money do they get by putting their money together before they change it?

(Total for Question 12 is 3 marks)

13 Stephen throws a fair dice until he gets a six.
Work out the probability that Stephen throws the dice

(i) exactly once

(ii) exactly twice

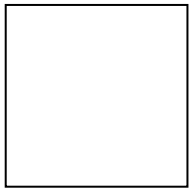
(iii) more than twice.

(Total for Question 13 is 4 marks)

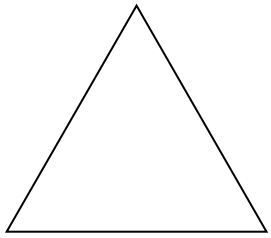
14 Here are a square and an equilateral triangle.

The length of a side of the square is x cm.

The length of a side of the equilateral triangle is 2 cm more than the length of a side of the square.



x cm



The perimeter of the square is equal to the perimeter of the equilateral triangle.

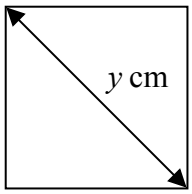
(a) Work out the perimeter of the square.

(3)

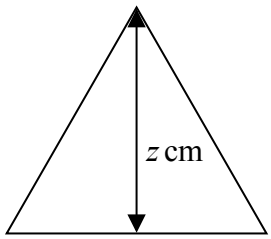
Here are the same square and the same equilateral triangle.

The length of the diagonal of this square is y cm.

The height of this equilateral triangle is z cm.



x cm



(b) Which has the greater value, y or z?

(4)

(Total for Question 14 is 7 marks)

15 Linda keeps chickens.
She sells the eggs that her chickens lay.

She has 140 chickens.
Each chicken lays 6 eggs a week.

Linda gives each chicken 100 g of chicken feed each day.
The chicken feed costs £6.75 for a 25 kg bag.

Work out the cost of the chicken feed for every 12 eggs.

(Total for Question 15 is 5 marks)

16 Bella invests £5000 in an account for two years.
The account pays 3% compound interest per annum.

Bella has to pay 20% tax on the interest earned each year.
This tax is taken from the account at the end of each year.

How much money will Bella have in her account at the end of the two years?

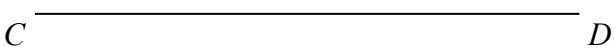
(Total for Question 16 is 4 marks)

17 The diagram shows a rectangle *ABCD*.

In the space below, use a ruler and a pair of compasses to construct a right-angled triangle equal in area to the area of the rectangle *ABCD*.

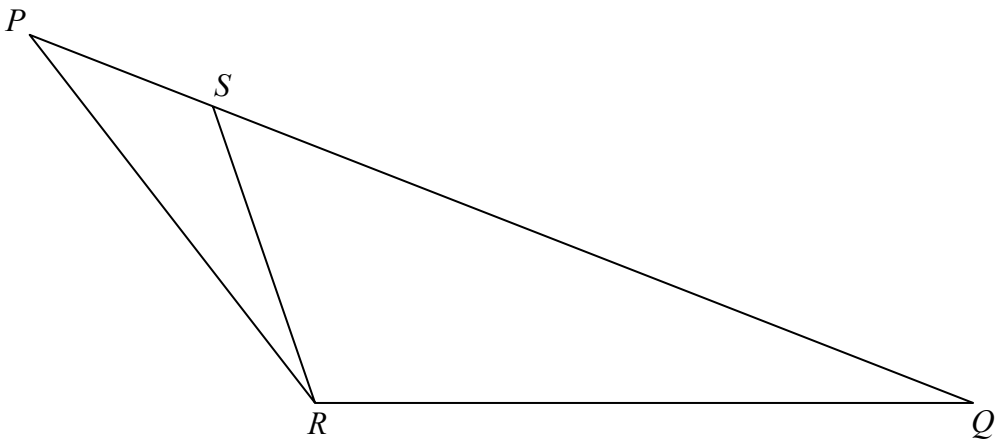
You must show all your construction lines.

The base of the triangle, which is equal in length to the side *CD*, has been drawn for you.



(Total for Question 17 is 3 marks)

18 Triangle PQR is similar to triangle PRS.



PSQ is a straight line

Angle PQR = angle PRS.
PS = 2 cm.
PR = 5 cm.

Work out the length of SQ.

(Total for Question 18 is 3 marks)

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Please turn the page over for question 19

19 Some students watched a film.
James recorded the heart rates, in beats per minute, of the students after they had watched the film.

The back-to-back stem and leaf diagram gives information about his results.

Female		Male
8 5	7	6 7 9
7 5 4 3 0	8	3 5 7 8
9 8 6 1	9	2 3 5 7 8
	10	1 3 7

Key	
5|7 represents 75 beats per minute for female students	7|6 represents 76 beats per minute for male students

(a) Compare the distribution of the heart rates of the female students and the distribution of the heart rates of the male students.

(3)

13 of the 26 students like comedy films.
16 of the 26 students like science fiction films.
5 of the 26 students like both comedy and science fiction films.

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

(3)

(Total for Question 19 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

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Foundation tier Paper 3 − Calculator

Question	Working	Answer	Mark type	AO	Notes
1 (a)		−8, −5, −3, 0, 3, 7	B	1.3a	B1 accept in reverse order
1 (b)		0.05, 0.09, 0.5, 0.59, 0.95	B	1.3a	B1 accept in reverse order
1 (c)		1, 2, 4, 5, 10, 20	M A	1.3a 1.3a	M1 for at least 3 factors A1 for all factors with no additions
2 (a) (i)		faces	B	1.1a	B1
(ii)		radius	B	1.1a	B1
(b)			P C	2.2 2.2	P1 for adding given angles or subtracting given angles from 360 ° C1 for conclusion, e.g. comparing total with 360 ° or showing that x is 80° and not 90°
3 (a)		32, 39	B	1.3a	B1
3 (b)		16	B	1.3a	B1
4 (a)		£328.60	M A	1.3b 1.3b	M1 for 9.30 × 30 + 12.40 × 4 A1 for £328.60 (must be in correct monetary notation)
4 (b)		38 hours	P P A	3.1d 3.1d 1.3b	P1 for starting to solve the problem, e.g. £319.80 – £7.80 × 35 (= £46.80) P1 for a complete process to solve the problem, e.g. "£46.80" ÷ £15.60 (= 3) A1 cao

Question	Working	Answer	Mark type	AO	Notes
5 (a)		$p + c$	B	1.3a	B1
5 (b)		82.4°F	M A	1.3a 1.3a	M1 for correct substitution A1 cao
5 (c)		4.5	M A	1.3a 1.3a	M1 for subtracting 20 from both sides or dividing all terms by 4 A1 for 4.5 oe
5 (d)		$x(3x - 2)$	B	1.3a	B1
6 (a)		$\frac{21}{64}$	M A	1.3a 1.3a	M1 for a fully complete and correct method A1 cao
6 (b)		$\frac{53}{64}$	P A	2.3a 1.3a	P1for interpreting information, e.g. recognising that the shaded area $= \frac{3}{4} + (\frac{1}{4} \times \frac{1}{4}) + (\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4})$ or adding in lines to diagram to show 64ths A1 for $\frac{53}{64}$ or ft $\frac{1}{2}$ + their answer to (a)
7 (a)		£44.75	M A	1.3b 1.3b	M1 for 26.85 ÷ 3 A1
7 (b)		$\frac{3}{7}$	B	1.3a	B1
7 (c)		16	P P A	3.1d 3.1d 1.3b	P1 for starting to solve problem, e.g. 35 ÷ 5 (=7) P1 for complete process to solve problem, e.g. 7 + (28 – 10) ÷ 2 A1 cao
8 (a)	$\frac{10.791}{4.85}$	2.22	M A	1.3a 1.3a	M1 for a correct order of operation equivalent to dividing 10.791 by 4.85 (= 2.22...) A1 cao

Question	Working	Answer	Mark type	AO	Notes
8 (b)		6.5 (m)	B	1.3a	B1
9		Yes with explanation of the position of the bays	P P C	2.3a 2.1a 2.3b	P1 for interpreting the information, e.g. using the scale with the dimensions of the car park as 24 m by 15 m or the dimensions of a bay as 2.4 cm by 1.2 cm P1 for a correct process to deduce the number of bays/row from, e.g. 24 ÷ 2.4 (= 10) or 12 ÷ 1.2 (= 10) or an attempt to position the bays correctly in a different orientation C1 for "Yes" with a row of 10 bays on either side of the entrance/exit; could be shown on the diagram
10 (a)		5	C	2.3a	C1 for correct interpretation from diagram
10 (b)		Girls with correct figures (boys have mean of 6)	P M P	2.3a 1.3b 2.3b	P1 for an interpretation of the diagram, e.g. 2, 7, 4, 3, 2 or 2 + 7 + 4 + 3 + 2 + 2 (=20) M1 for a correct process to find the mean of the boys, e.g. (3×'2' + 5×'7' + 6×'4' + 7×'3' + 8×'2' + 9×'2') ÷ '20' P1 for an answer of 'girls' with mean of 6 for boys

Question	Working	Answer	Mark type	AO	Notes
11 (a)		20.5	P	3.1b	P1 for a correct start to a correct process to identify the required straight line, e.g. a sketch showing points (40, 60) and (0, 20) joined with a line segment or a correct process to find the gradient of a line between the two points, e.g. $\frac{60-20}{40-0}$ (=1)
			P	3.1b	P1 for a correct process using scale factors, e.g. showing two similar triangles with the line crossing the x-axis or for a correct process using $y = mx + c$ to find the value of c (= 20) or $y = x + 20$
			A	1.3b	A1 for 20.5
11 (b)		decision and explanation	C	3.4b	C1 for a decision on the reliability of their answer to part (a) with valid explanation eg no I have drawn a line on he grid and my line may not be accurate(need both the decision and an explanation to gain the mark)
12		€48 or £42.86	P	3.1c	P1 for a correct process, using the lower rate, to find the amount by changing their money separately, e.g. 300 × 1.04 × 2 (= 624)
			P	3.1c	P1 for a correct process, using the higher rate, to find the amount by changing their money together, e.g. 300 × 2 × 1.12 (= 672) resulting in two values to compare
			A	1.3a	A1 for 48 euros or £42.85 or £42.86 if converted to sterling, units must be clear

Question	Working	Answer	Mark type	AO	Notes
13 (i)		$\frac{1}{6}$	B	1.2	B1 oe
(ii)		$\frac{5}{36}$	B	1.3a	B1 oe
(iii)		$\frac{25}{36}$	M	1.3b	M1 for $1-\frac{1}{6}-\frac{5}{36}$ or $\left(1-\frac{1}{6}\right)\times\left(1-\frac{1}{6}\right)$
			A	1.3b	A1 oe OR M1 for 1 – "(i)" – "(ii)" A1 ft provided answer is less than 1
14 (a)	$4x = 3x + 6$ $x = 6$ 4×6	24 (cm)	P	3.1b	P1 for translating the problem into an algebraic equation, e.g. $x + x + x + x = x + 2 + x + 2 + x + 2$ oe
			P	3.2	P1 for collecting terms and solving for x oe
			A	1.3b	A1 24 cao
14 (b)	$y^2 = 6^2 + 6^2$ $y = \sqrt{72}$ $z^2 = 8^2 - 4^2$ $z = \sqrt{48}$	$y > z$ with reason	P	2.3a	P1 for interpreting information, e.g. numerical values for sides on square and triangle
			M	1.3b	M1 for a correct method to find y or z
			M	1.3b	M1 for a correct method to find y and z
			C	2.1a	C1 conclusion based on at least P1 consistent with candidate's figures for y and z or y^2 and z^2

Question	Working	Answer	Mark type	AO	Notes
15		38p	P	3.1d	P1for a correct first step, e.g. 140 × 6 (= 840 eggs per week)
			P	3.1d	P1 for a correct process to find the weight of feed per week, e.g. 100 × 140 × 7 (= 98000g or 98 kg)
			P	3.1d	P1 for a correct method to find the weekly cost, e.g. 6.75 ÷ 25 × "98" (= £26.46)
			P	3.1d	P1 for completing the process to find the cost of feed required for 12 eggs, e.g. (2646 ÷ 840) × 12 = 37.8p
			A	1.3b	A1 for 37.8p or 38p oe
16		£5242.88	P	3.1d	P1 for a correct first step in the process, e.g. 5000 × 0.03 (= 150) or 3× 0.8 = 2.4%
			P	3.1d	P1 for a correct process in finding the effect of the 20% tax on interest (ie "150"), e.g "150" × 0.8 (= 120) or 5000 × 1.024
			P	3.1d	P1 (dependent on previous P marks) for a fully complete and correct process to find balance after 2 years, e.g. (5000 + "120") + (5000 + "120")× 0.03 × 0.8 or $5000 \times (1.024)^2$
			A	1.3b	A1 cao

Question	Working	Answer	Mark type	AO	Notes
17		A correct right-angled triangle constructed	P	2.3a	P1 for a construction of a right angle at C or D (construction arcs must be seen)
			P	2.3b	P1 (indep) for the correct height of the triangle drawn or shown
			P	2.3b	P1 for a fully correct constructed triangle
18		10.5 cm	P	3.1b	P1 for comparing correct corresponding sides, e.g. developing a scale factor of 2.5 (= 5 ÷ 2)
			P	3.1b	P1 for a fully correct and complete process to find the length of *PQ*, e.g. "2.5" × 5 (= 12.5)
			A	1.3b	A1 for a correct answer of 10.5 (= 12.5 – 2) cm
19 (a)	| | F | M | | Lv | 75 | 76 | | Lq | 80 | 83 | | Median | 85 | 92 | | Uq | 96 | 98 | | Hv | 99 | 107 | | Range | 24 | 31 |	Comparisons	C	2.3a	C1 for a correct interpretation of diagram, e.g. correct median, LQ or UQ
			C	2.3b	C1 for a correct comparison of a measure of central tendency (must be in context of the data)
			C	2.3b	C1 for a correct comparison of a measure of spread (must be in context of the data)
19 (b)		Correct Venn diagram	P	2.3a	P1 for two overlapping circles with 5 in the overlap
			P	2.3a	P1 for 8 in ‘comedy’ or 11 in ‘science fiction’
			C	2.3b	C1 for a fully correct Venn diagram with labels

Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 1 (Non-Calculator)

Higher Tier

Sample Assessment Materials for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
1MA1/1H

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 not be used.**
- 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 ▶

S47351A

S 4 7 3 5 1 A 0 1 2 4

PEARSON

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:

Curved surface area of a cone = πrl

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

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

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 Liam, Sarah and Emily shared some money in the ratio 2 : 3 : 7
Emily got £80 more than Liam.

How much money did Sarah get?

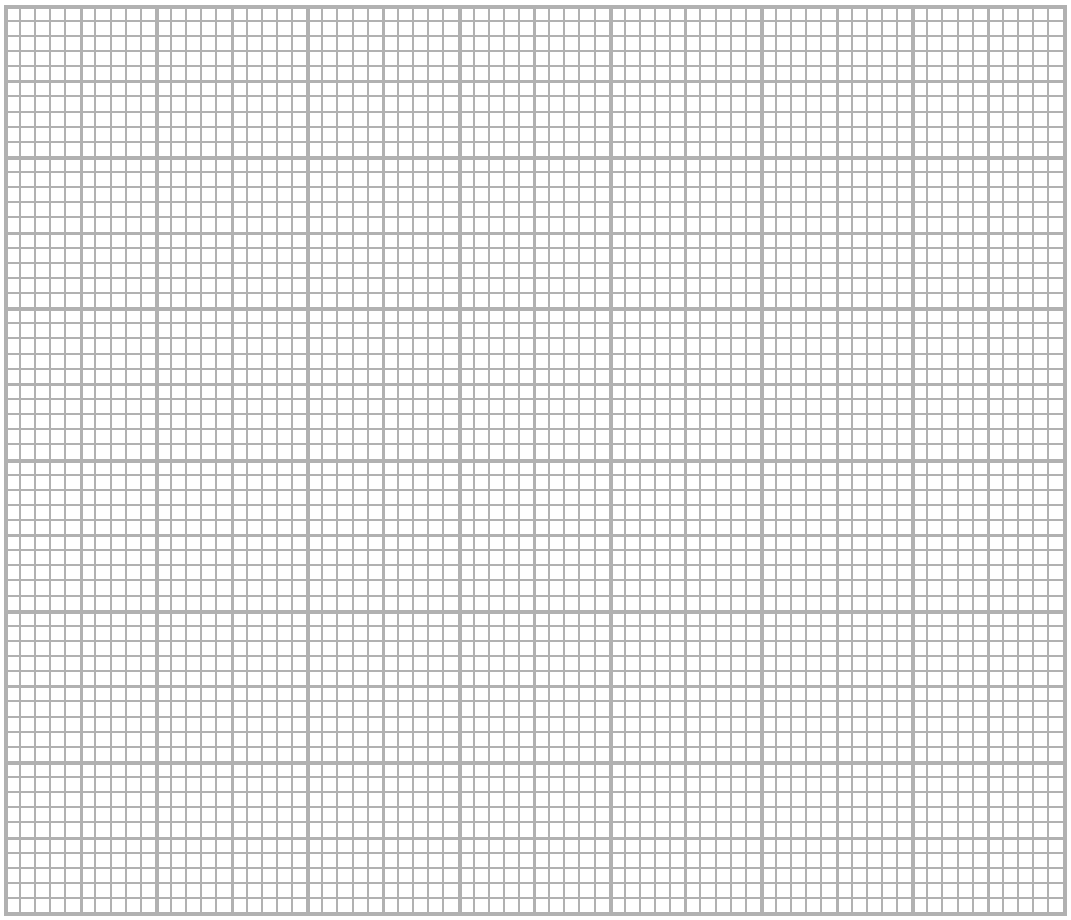
(Total for Question 1 is 3 marks)

2 The table shows the life expectancy (in years) for males born in the UK from 2000 to 2012.

Year of birth	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Life expectancy (years)	75.4	75.7	75.8	76.1	76.6	76.9	77.2	77.4	77.6	78.1	78.4	78.8	79.0

(Data from statistics.gov.uk)

(a) Use this information to predict the life expectancy of a male born in 2030.



(4)

(b) Make two comments explaining why your prediction in part (a) may not be reliable.

(2)

(Total for Question 2 is 6 marks)

3 Given that $A = 2^4 \times 3^3 \times 5$ and $B = 2^3 \times 3 \times 5^2$

write down, as a product of powers of its prime factors,

(i) the highest common factor (HCF) of A and B

(ii) the lowest common multiple (LCM) of A and B.

(Total for Question 3 is 2 marks)

4 A rectangular piece of card *ABCP* is placed on a horizontal straight line.

The card is first rotated 90° clockwise about *C*.
The card is then rotated 90° clockwise about *B*.
The card is then rotated 90° clockwise about *A*.

Draw the locus of the vertex *P*.

(Total for Question 4 is 3 marks)

5 (a) Solve the simultaneous equations $3x + 5y = 4$

$2x - y = 7$

(3)

(b) Find the integer value of x that satisfies both the inequalities

$x + 5 > 8$ and $2x - 3 < 7$

(3)

(Total for Question 5 is 6 marks)

6 Modelling the planet Mercury as a sphere, it has a radius of 2440 km.

(a) (i) Work out an estimate in square kilometres for the surface area of Mercury.

(ii) Without carrying out a further calculation, give evidence to show whether your method gives you an underestimate or an overestimate for the surface area of Mercury.

(3)

In July 2013, the spacecraft Messenger was near Mercury at a distance of 9.75×10^7 km from Earth.

Taking the speed of light to be 3×10^8 m/s,

(b) work out how long it takes light to travel a distance of 9.75×10^7 km.

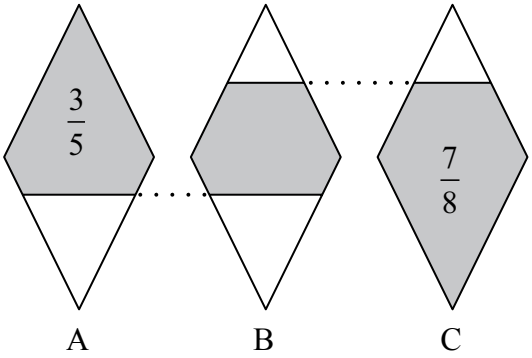
(3)

(Total for Question 6 is 6 marks)

7 The diagram shows three identical shapes A, B and C.

$\frac{3}{5}$ of shape A is shaded.

$\frac{7}{8}$ of shape C is shaded.



What fraction of shape B is shaded?

(Total for Question 7 is 3 marks)

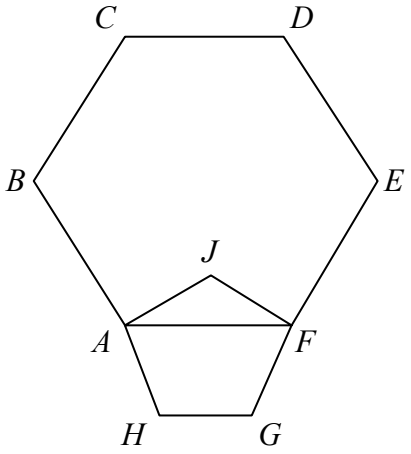
8 On a farm, $4\frac{1}{2}$ out of every 15 acres of the land are used to grow crops.

Wheat is grown on $\frac{5}{8}$ of the land used to grow crops.

What percentage of the total area of the land on the farm is used to grow wheat?

(Total for Question 8 is 3 marks)

9 *ABCDEF* is a regular hexagon.
AJFGH is a regular pentagon.



Work out the size of angle *BAJ*.

(Total for Question 9 is 4 marks)

10 Ishmael is a salesperson for a company.

His monthly wage is made up of his fixed basic wage plus commission.
His commission for a month is a fixed percentage of the sales he makes that month.

The table gives some information about his monthly wages.

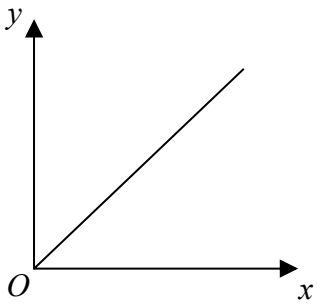
Month	Monthly wage (£)	Sales (£)
June	1700	20 000
July	2200	30 000
August	2050	27 000

In September, Ishmael's monthly wage was £1850

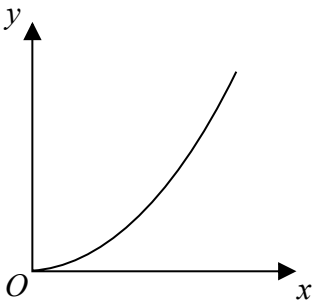
Work out his sales, in £, for September.

(Total for Question 10 is 4 marks)

11 Here are four graphs.



A



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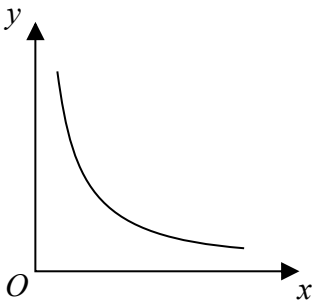
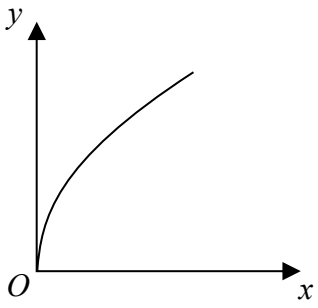


C



D

(a) Write down the letter of the graph that could represent

y is proportional to x^2

(1)

(b) The force of attraction, F newtons, between two magnets varies inversely as the square of the distance, d cm, between the two magnets.

(i) What happens to the force of attraction between the magnets when the distance between the magnets is doubled?

When the magnets are 3 cm apart the force of attraction between them is 40 newtons.

(ii) What is the force of attraction between the magnets when they are 10 cm apart?

(5)

(Total for Question 11 is 6 marks)

12 The functions f and g are such that

$$f(x) = 1 - 5x \qquad \text{and} \qquad g(x) = 1 + 5x$$

(a) Show that $gf(1) = -19$

(2)

(b) Prove that $f^{-1}(x) + g^{-1}(x) = 0$ for all values of x.

(3)

(Total for Question 12 is 5 marks)

13 A car has an initial speed of u m/s.

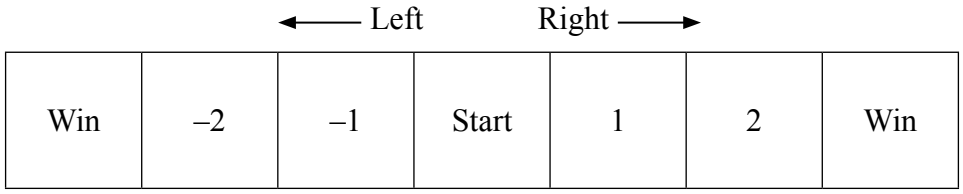
The car accelerates to a speed of $2u$ m/s in 12 seconds.

The car then travels at a constant speed of $2u$ m/s for 10 seconds.

Assuming that the acceleration is constant, show that the total distance, in metres, travelled by the car is $38u$.

(Total for Question 13 is 4 marks)

14 Here is a board for a game.



Jim begins with a counter on **Start**.
He rolls a fair dice.

He moves his counter one square to the right when the dice lands on 1 or on 2 or on 3 or on 4

Otherwise he moves his counter one square to the left.

Jim rolls the dice twice and moves his counter twice.

(a) Work out the probability that his counter will then be on the square with 2 on it.

(2)

Jim puts the counter back on the **Start** square.

He rolls the dice 3 times and moves his counter three times.

(b) Work out the probability that his counter will then be on the square with –1 on it.

(3)

Jim wins the game when his counter lands on a square with **Win** on it.

Jim says:

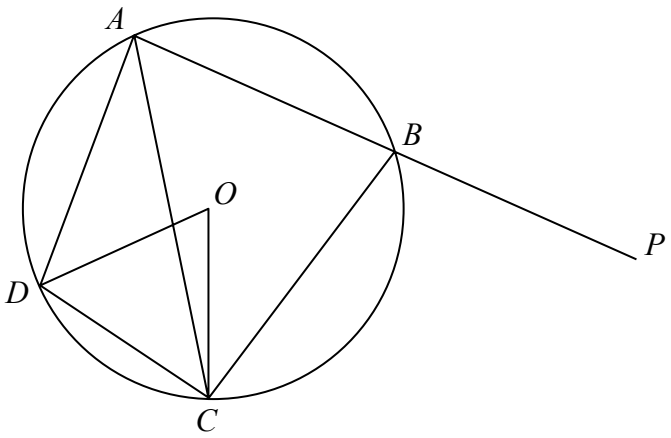
"I cannot win in an even number of throws of the dice."

(c) Explain whether or not Jim is correct.

(1)

(Total for Question 14 is 6 marks)

15



A, *B*, *C* and *D* are four points on a circle, centre *O*.

PBA is a straight line.
Angle *PBC* = 100°.
Angle *DAC* = 23°.

Show that the size of angle *OCA* = 10°
You must give a reason for each stage of your working.

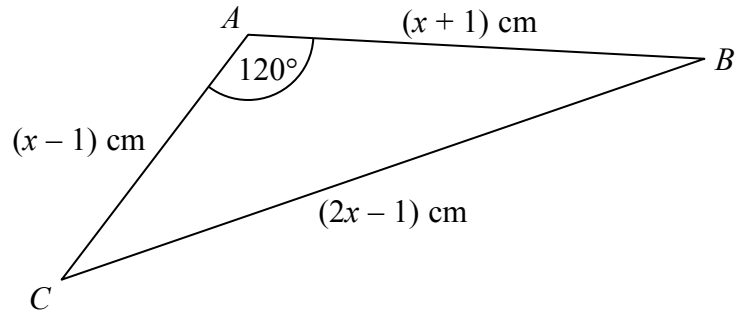
(Total for Question 15 is 6 marks)

16 (i) Sketch the graph of $f(x) = x^2 - 5x + 10$, showing the coordinates of the turning point and the coordinates of any intercepts with the coordinate axes.

(ii) Hence, or otherwise, determine whether $f(x + 2) - 3 = 0$ has any real roots. Give reasons for your answer.

(Total for Question 16 is 6 marks)

17 The diagram shows triangle ABC.



The area of triangle ABC is $k\sqrt{3}$ cm^2.

Find the exact value of k.

(Total for Question 17 is 7 marks)

TOTAL FOR PAPER IS 80 MARKS

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Higher tier Paper 1 – Non-calculator

Question	Working	Answer	Mark	AO	Notes
1	80 ÷ (7 – 2) (=16) '16' × 3	£48	P P A	3.1d 3.1d 1.3b	P1 for a strategy to start to solve problem, e.g. 80 ÷ (7 – 2) (=16) P1 for full process to solve problem, e.g. '16' × 3 A1 cao
2 (a)		84 to 85	P P P A	2.3a 2.3b 3.1d 1.3b	P1 for interpreting the data and deciding to draw a graph or a table to represent the data P1 for a correct process to label axes or communicate the data connections P1 drawing in an appropriate line of best fit or model the problem as a linear function in time A1 for correctly reading off the value at 2030 in the range 84 to 85 or using their linear function correctly to give an answer in this range
(b)			C C	3.4b 3.4b	C1 for a valid comment eg cannot assume a linear relationship C1 for a valid comment eg that one cannot predict accurately with a date so far away from the original data
3 (i) (ii)		$2^3 \times 3 \times 5$ $2^4 \times 3^3 \times 5^2$	B B	1.3a 1.3a	B1 cao B1 cao
4		locus (see diagram at end)	C C	2.3b 2.3b	C1 for method of showing a rotation about one fixed point, e.g. quarter circle with radius *PC* centre *C* or radius *PB* centre B or *PA* centre A C1 for understanding it is a continuous process, e.g.

Question	Working	Answer	Mark	AO	Notes
			C	2.3b	quarter circle with radius *PC* centre *C* and radius *PB* centre B and radius *PA* centre A C1 for fully correct drawing
5 (a)	$3x + 5y = 4$ $10x - 5y = 35$ $13x = 39$	$x = 3, y = -1$	M M A	1.3b 1.3b 1.3b	M1 for correct method to eliminate one variable M1 for correct method to find second variable A1 for $x = 3$ and $y = -1$
5 (b)	$x + 5 > 8$ $x > 3$ $2x - 3 < 7$ $2x < 10$ $x < 5$	$x = 4$	B B B	1.3b 1.3b 1.3b	B1 for $x > 3$ or for $x < 5$ B1 for $x > 3$ **and** for $x < 5$ B1 for $x = 4$ from $x > 3$ and $x < 5$
6 (a) (i)	$4 \times 3 \times 2000^2$	48 000 000 km^2	M	1.3a	M1 for use of $4\pi r^2$ with either π or r rounded to 1 significant figure
(ii)			A C	1.3a 3.4a	A1 accept 50 000 000 km^2 C1 for appropriate evaluation of method, e.g. 3 and 2000 both less than true values
6 (b)	$9.75 \times 10^7 \times 1000 \div (3 \times 10^8)$	325 s	M M A	1.3b 1.3b 1.3b	M1 for use of distance ÷ time M1 for consistent units A1 cao
7	Shaded area in B $= 1 - \frac{2}{5} - \frac{1}{8}$ **or** $\frac{3}{5} - \frac{1}{8}$	$\frac{19}{40}$	P P A	3.1b 3.1b 1.3b	P1 for strategy to start to solve problem, e.g. $1 - \frac{3}{5}$ **or** $1 - \frac{7}{8}$ **or** correct equation, e.g. $x + \frac{1}{8} = \frac{3}{5}$ P1 for setting up a calculation that will lead to the correct answer, e.g. $1 - \frac{2}{5} - \frac{1}{8}$ **or** $\frac{3}{5} - \frac{1}{8}$ **or** $\frac{7}{8} - \frac{2}{5}$ A1 cao

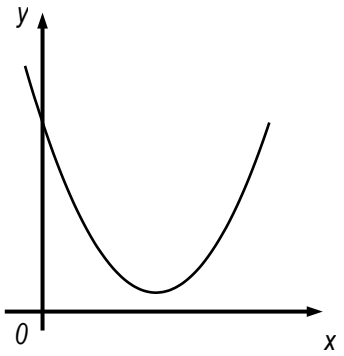
Question	Working	Answer	Mark	AO	Notes
8	$\frac{4.5}{15} \times \frac{5}{8} = \frac{22.5}{120}$ $\frac{22.5}{120} \times 100$	18.75 (%)	P P A	3.1d 3.1d 1.3b	P1 for process to find amount of amount of land for wheat, e.g. $\frac{4.5}{15} \times \frac{5}{8}$ P1 for complete process, e.g. $\frac{22.5}{120} \times 100$ A1 18.75 oe
9		84^{o}	P P P A	3.1b 3.1b 3.1b 1.3b	P1 for process to find size of interior angle of hexagon or pentagon P1 for establishing a correct process to find angle *JAF*, e.g. *JAF* = (180 − 108) ÷ 2 P1 for a complete process to find angle *BAJ* A1 cao

Question	Working	Answer	Mark	AO	Notes
10	Method 1 2200 − 1700 = 500 30000 − 0000 = 10000 For every £100 increase in wage the increase in sales = £2000 1850 − 1700 = 150 Difference in sales = 1.5×2000 = 3000 20000 + 3000 Method 2 Use $y = mx + c$ $1700 = 20000m + c$ $2200 = 30000m + c$ $m = \frac{2200 - 1700}{30000 - 20000}$ = 0.05 $c = 2200 - 30000 \times 0.05 = 700$ When $y = 1850$, $x = \frac{1850 - 700}{0.05}$ Method 3 Draw a graph	23000	P P P A	2.3a 3.1d 3.1d 1.3b	P1 for process to interpret information, e.g. 2200 – 1700 = 500 oe or use $y = mx + c$ or start to draw graph P1 for process to build on initial strategy, e.g. 2200 − 1700 = 500 and 30000 − 20000 = 10000 oe use proportional increase or process to find m and c P1 for strategy to use found information, e.g. 1000 ÷ 5 or use values of m and c or use straight line graph A1 cao

Question	Working	Answer	Mark	AO	Notes
11 (a)		B	B	1.1	B1 cao
11 (b)(i)		$\frac{1}{4}$ of original force	P	3.1c	P1 for $F = \frac{k}{d^2}$ and $F = \frac{k}{(2d)^2}$ (d may be numerical) or 'Force gets smaller'
			P	3.3	P1 for full interpretation of results rather than a specific distance, e.g. $\frac{1}{4}$ of original force
(b)(ii)	$40 = \frac{k}{3^2}$ ($k = 360$)	3.6 N	M	1.3b	M1 for $40 = \frac{k}{3^2}$
	$360 \div 10^2$		M	1.3b	M1 for complete method, e.g. $360 \div 10^2$
			A	1.3b	A1 cao
12 (a)	$g(1 - 5\times1) = 1 + 5\times(-4)$ or $1 + 5f(1) = 1 + 5\times(-4)$	Shown with working	P P	2.2 2.2	P1 for process to begin expansion, e.g. $(1 - 5\times1)$ or $1 + 5f(1)$ P1 for full process to stated expression
12 (b)	$f^{-1}(x) = \frac{1-x}{5}$	Proof	P	2.4b	P1 for start to proof, e.g $f^{-1}(x) = \frac{1-x}{5}$ or $g^{-1}(x) = \frac{x-1}{5}$
	$f^{-1}(x) + g^{-1}(x) = \frac{1-x}{5} + \frac{x-1}{5}$ $= \frac{1-x+x-1}{5} = 0$		P	2.4b	P1 For continuation of proof, e.g. $g\,f^{-1}(x) = \frac{1-x}{5}$ and $g^{-1}(x) = \frac{x-1}{5}$
			P	2.4b	P1 for a complete proof with all steps shown

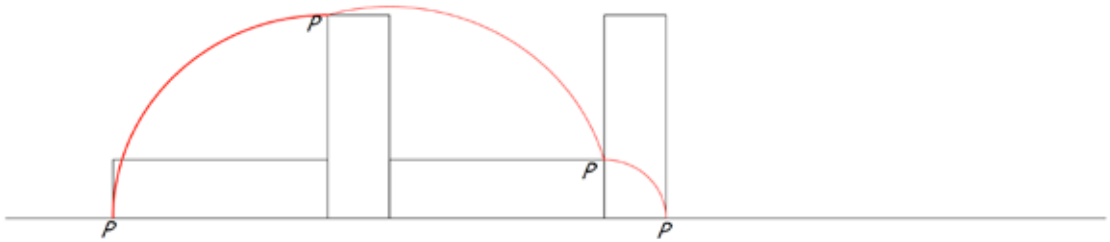
Question	Working	Answer	Mark	AO	Notes
13	$0.5(u + 2u)\times12 + 2u \times 10$	Show	P P P P	2.3a 2.2 2.2 2.2	P1 for process to interpret information, e.g. draw graph P1 for process to identify a strategy, e.g. statement that distance is area under graph or one correct area P1 for process to find complete area, e.g. $0.5(u + 2u) \times 12 + 2u \times 10$ P1 for all steps given leading to result $38u$
14 (a)	$\frac{4}{6}\times\frac{4}{6}$	$\frac{16}{36}$	P A	3.1c 1.3a	P1 for process to calculate probability of RR, e.g. $\frac{4}{6}\times\frac{4}{6}$ or sample space with all elements correctly identified A1 oe
14 (b)	$3\times\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$	$\frac{48}{216}$	P P A	3.1d 3.1d 1.3b	P1 for process to calculate probability of RRL in any one order, e.g $\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$ P1 for process to calculate correct probability, e.g. $3\times\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$ A1 oe
14 (c)		Yes + reason	C	2.4a	C1 Yes because an even number of +1s and –1s cannot give the answers +3 or – 3

Question	Working	Answer	Mark	AO	Notes
15	$\angle DOC = 46^o$ $\angle OCD = (180^o - 46^o)/2$ $\angle ADC = 100^o$ $\angle DCA = 57^o$ $\angle OCA = 67^o - 57^o$	10^o	P P P P C C	2.2 2.2 2.2 2.2 1.1 1.1	P1 $\angle DOC = 2 \times 23^o$ (angle at centre is twice angle at circumference) P1 $\angle OCD = (180^o - '46'^o)/2$ (base angles of isosceles triangle OCD) and $\angle ABC = 180^o - 100^o$ (angles on a straight line sum to 180^o) P1 $\angle ADC = 100^o$ (opposite angles of a cyclic quadrilateral sum to 180^o) P1 $\angle DCA = 180^o - '100'^o - 23^o$ (angle sum of a triangle is 180^o) C1 for complete chain of reasoning to find angle OCA seen with 10^o and at least 1 circle theorem quoted C1 dependent on all previous marks for full reasons at each stage

Question	Working	Answer	Mark	AO	Notes
16 (i)			M	1.3b	M1 for $(x – 2.5)^2 – (2.5)^2 + 10$ **or** attempt to find points to plot – must have at least 3 correct points evaluated
			A	1.3b	A1 for $(x – 2.5)^2 + 3.75$ or parabola with minimum marked at (2.5, 3.75)
			C	2.3b	C1 for parabola drawn with minimum in 1st quadrant **or** y intercept at (0, 10)
			C	2.3b	C1 for parabola drawn with minimum in 1st quadrant at (2.5, 3.75) **and** y intercept at (0, 10)
(ii)		Explanation	C	2.4a	C1 for a start to explanation, e.g. f$(x + 2) – 3$ is a translation of $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$ or attempt to draw graph of f(x + 2) – 3 or Graph of $y = f(x + 2)$ and $y = 3$ drawn or $(x + 2)^2 – 5(x + 2) + 10 – 3 = 0$ $(x^2 – x + 1 = 0)$
			C	2.4a	C1 for a convincing explanation, e.g. new minimum at (0.5, 0.75) so graph will not cross x axis **or** no interception between y = f$(x + 2)$ and $y = 3$ or demonstration that $x^2 – x + 1 = 0$ has no real roots

Question	Working	Answer	Mark	AO	Notes
17	$(2x-1)^2 = (x+1)^2 + (x-1)^2 - 2(x+1)(x-1)\cos 120^o$ $4x^2 - 4x + 1 = x^2 + 2x + 1 + x^2 - 2x + 1 - 2(x^2-1) \times (-0.5)$ $x^2 - 4x = 0$ $x = 4$ Area $= 0.5 \times 3 \times 5 \times \sin 120^o$	$\frac{15}{4}$	B P P M P P A	1.1 3.2 3.2 1.3b 3.2 3.2 1.3b	B1 for correct statement of cosine rule or $\frac{1}{2}ab\sin C$ or value of cos 120° or value of sin120° P1 for strategy to start to solve problem, e.g. $(2x-1)^2 = (x+1)^2 + (x-1)^2 - 2(x+1)(x-1)\cos 120^o$ P1 for strategy to reduce to a quadratic equation, e.g. $x^2 - 4x = 0$ M1 for method to solve quadratic equation P1 for attempt to use $0.5ab\sin C$ with numeric or algebraic values substituted P1 for process to equate to $k\sqrt{3}$ A1 for $k = \frac{15}{4}$ oe

Question 4



Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

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 ▶

S47352A

S 4 7 3 5 2 A 0 1 2 0

PEARSON

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:

Curved surface area of a cone = πrl

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

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

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.

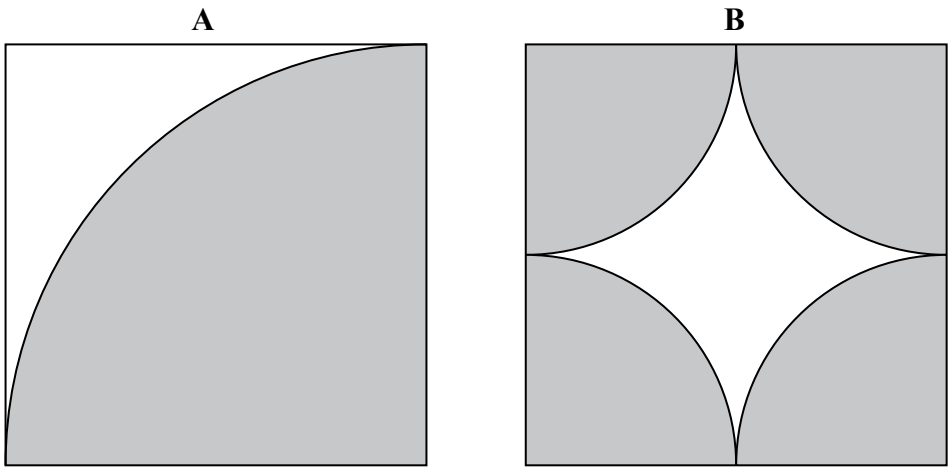


Diagram **A** shows a quarter of a circle shaded inside the square.
Diagram **B** shows four identical quarter circles shaded inside the square.

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 nth 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 nth 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

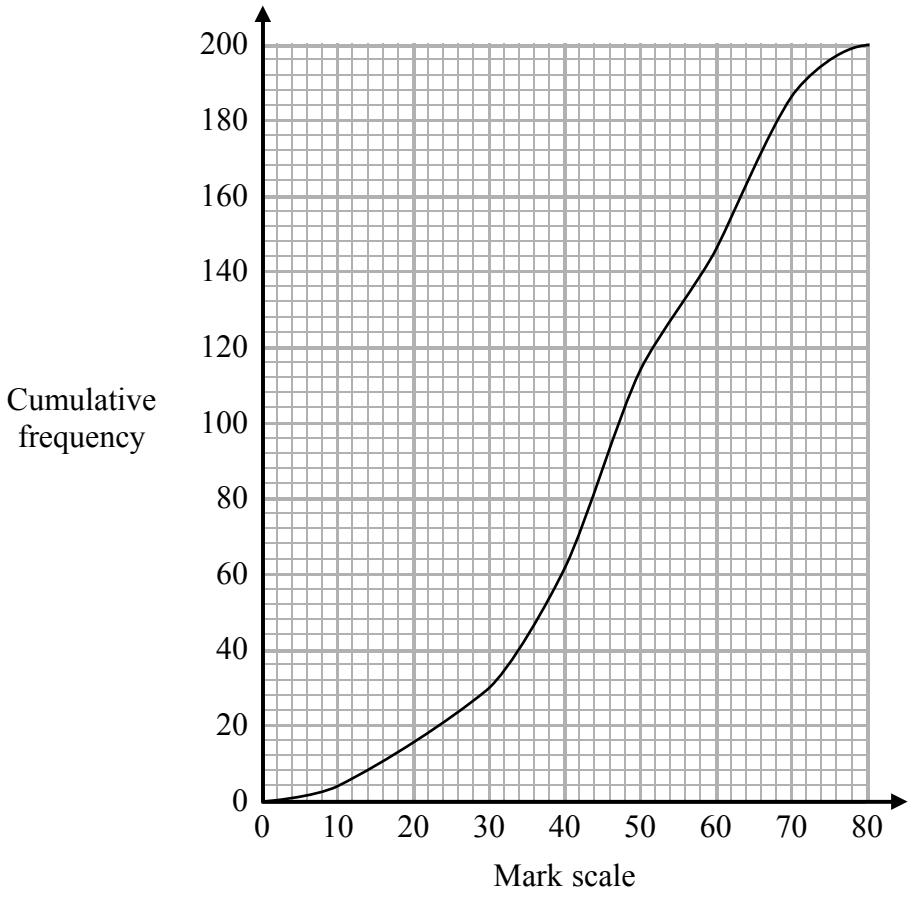
(c) Find the smaller of these two terms.

(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)

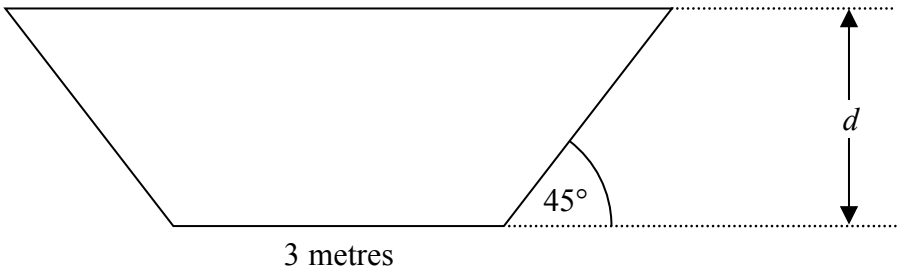
$2^{61} - 1$ is a prime number.

(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 m^2.

(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)

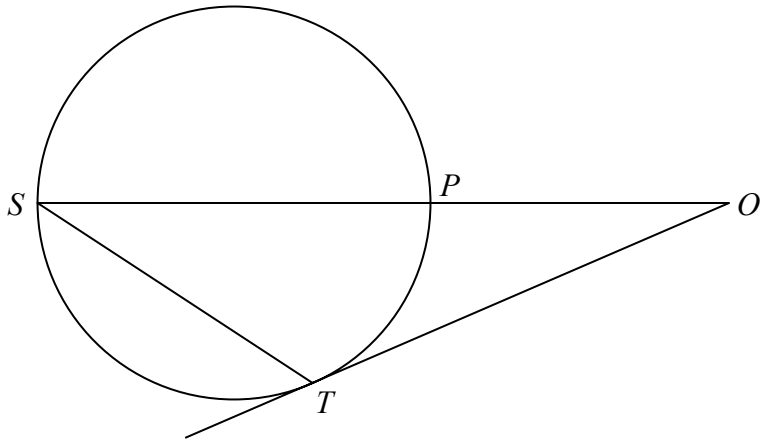
The water flows along the drainage channel at a rate of 486 000 litres per minute.
The depth of the water is constant.

(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,

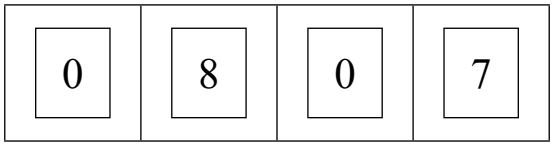
(c) find the probability that this student also speaks French.

(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 $y = x^2 - 4x + 4$

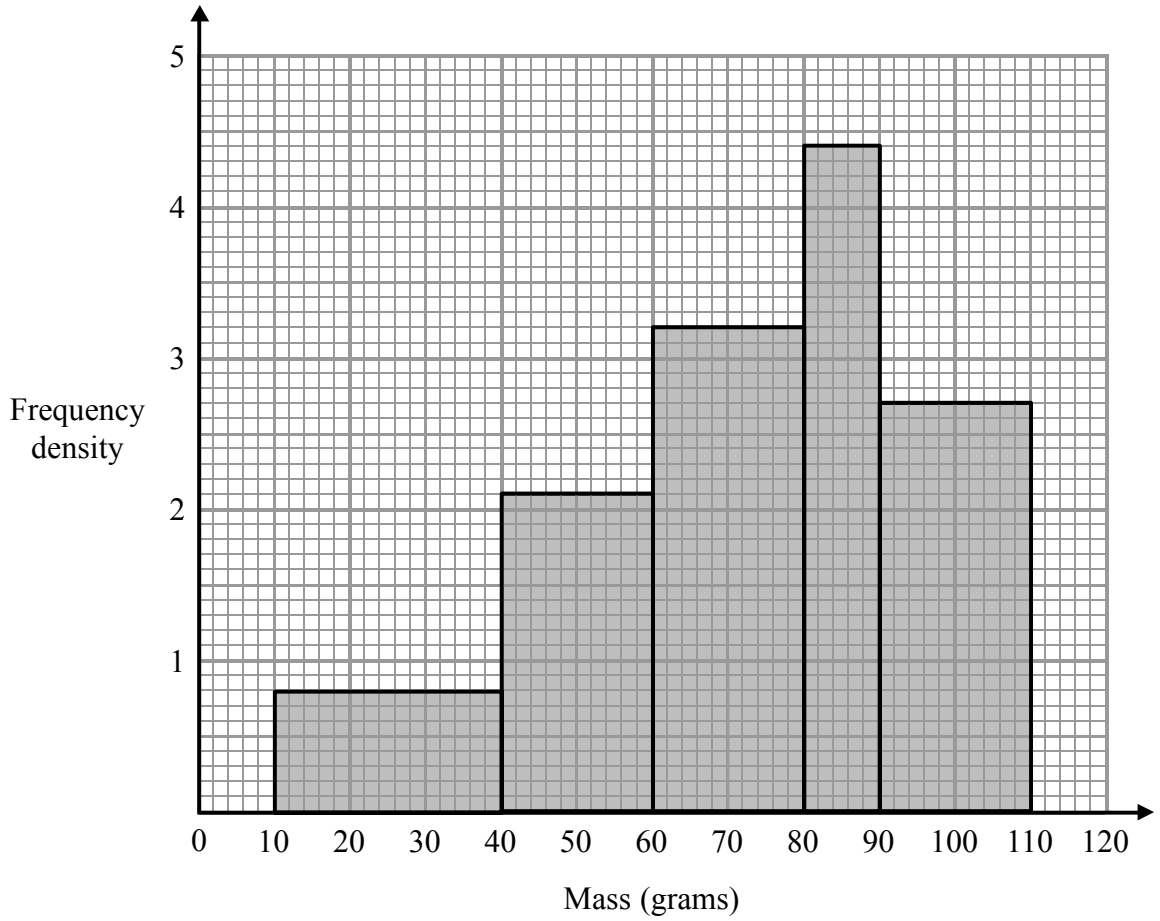
L is the straight line with equation $y = 2x - 4$

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)

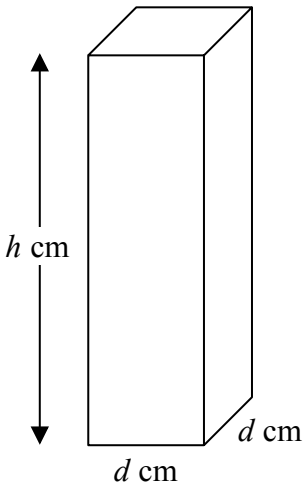
(Total for Question 14 is 6 marks)

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 P A	3.1b 3.1b 1.3b	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 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
2	$3x – 3c = 2x + 5$ $x = 3c + 5$	Shown	P P C	2.2 2.2 2.4a	P1 for a process to start a chain of reasoning P1 for a process to isolate terms in x C1 convincing explanation from $x = 3c + 5$
3 (a)		720	P P A	3.1c 3.3 1.3b	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 30×24 (= 720) seen A1 for 720 cao

Question	Working	Answer	Mark	AO	Notes
3 (b)		116.25%	M	1.3b	M1 for a correct method of finding either 70% (= 504) or 30% (= 216) of 720
			P	3.1b	P1 for a process to find the cost of "216" at 55p for 4 (= £29.70)
			P	3.1b	P1 for a process to find revenue, e.g. "504" × £0.25 + "£29.70" (= £155.70)
			P	3.1b	P1 for a process to find profit, e.g. "£155.70" – £45 – £27 (= £83.70)
			M	1.3b	M1 for $\frac{'83.70'}{72} \times 100$
			A	1.3b	A1 for 116.25%
4		Demonstration	M	1.1	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)
			P	2.4a	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)
			C	2.4a	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
			A	1.3a	A1 for a correct position of *B*
(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 *A* and perpendicular from *B*
			M	1.3b	(can be implied by correct trigonometric ratio)
			P	2.2	M1 for $\cos 50^\circ = \frac{d}{36}$ oe
			C	2.1a	P1 for $36 \times \cos 50^\circ$ oe
					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 *n* 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

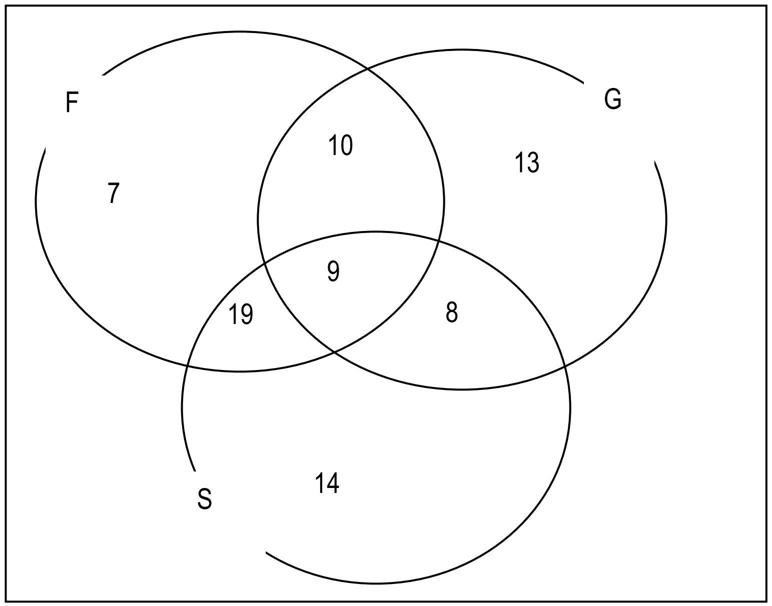
Question	Working	Answer	Mark	AO	Notes
7 (i)	$\frac{72}{100}\times 80$	60	P	3.1c	P1 for a correct process to find the number of students with a score of at least 72% e.g. $\frac{72}{100}\times 80$
			P	3.2	P1 for process to use graph to find number who exceeded 57.6
			A	1.3a	A1 56 - 64
(ii)		Assumption and how it affects answer	C	3.5	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	1.3a	M1 for $x(x^2-1)$ or $(x^2+x)(x-1)$ oe
			A	1.3a	A1 cao
8 (b)		Shown	P	2.4b	P1 for explanation to show that n^3-n is the product of three consecutive positive integers, e.g. $n^3-n=(n-1)n(n+1)$
			C	2.4b	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	2.4a	P1 for recognising that $2^{61}-1, 2^{61}$ and $2^{61}+1$ are three consecutive positive integers
			C	2.4a	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	3.1b	P1 for correct process to find width of surface
			P	3.1b	P1 for correct process to find cross-sectional area, e.g. $\frac{d}{2}(d+d+3+3)$
			A	1.3b	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
			A	1.3a	A1 for 6.75
9 (c)	486000 ÷ 60 = 8100 8100 L = 8.1 m^3 8.1 ÷ 6.75	1.2 m/s	P	3.1d	P1 for a correct process to convert rate to per second, e.g. 486 000 ÷ 60 (=8100)
			P	3.1d	P1 for process to convert to m^3, e.g." 8100" ÷ 1000
			P	3.1d	P1 for process to convert litres/min to m/s, e.g. "8.1" ÷ ".75"
			A	1.3b	A1 cao
10		Proof	P	2.4b	P1 for recognising that angle *O* is common
			C	2.4b	P1 for angle *OTP* = 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
			P	2.3a	P1 to extend interpretation of given information, e.g. 3 overlapping labelled ovals with at least 5 regions correct
			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 $\frac{19}{40}$ oe
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	$2x - 4 = x^2 - 4x + 4$ $x^2 - 6x + 8 = 0$ $(x - 4)(x - 2) = 0$ $x = 4, \quad x = 2$ When $x = 4$, $y = 4$ When $x = 2$, $y = 0$ $4 - 2 = 2$ $4 - 0 = 4$ $2^2 + 4^2$	√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 √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
					the calculated value of the mean, e.g. the evidence supports the hypothesis as the mean in 2013 is lower
14 (b)		No + reason	C	2.5b	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 P P P A	1.1 3.1c 3.1c 2.4a 1.3a	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 $M = 13.915$ P1 for correct process to find upper bound of D (= 2.4(48... or 0.0024(48...)) oe P1 for correct process to find lower bound of D (= 2.3 (60... or 0.0023(6...)) oe P1 for an explanation or a correct process to find D to an appropriate degree of accuracy A1 2.4 g /cm^3

Question 11(a)



Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 3 (Calculator)

Higher Tier

Sample Assessment Materials for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
1MA1/3H

You do not need any further materials.

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 ▶

S47353A

S 4 7 3 5 3 A 0 1 2 4

PEARSON

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:

Curved surface area of a cone = πrl

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

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

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:

$$v = u + at$$

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

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

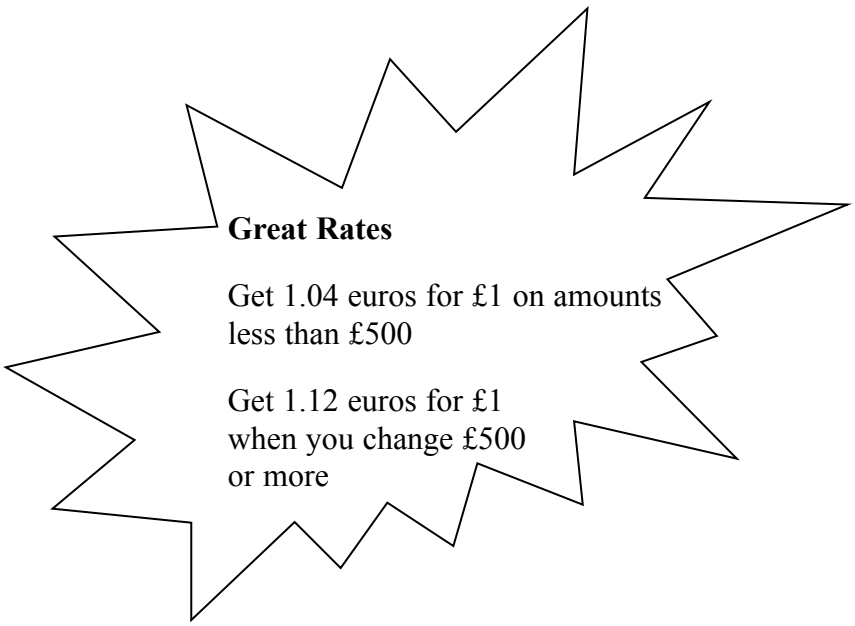
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Mr and Mrs Sharma are going to France.

They each have £300 which they want to change into euros.
They see this deal in a bank.



Mr and Mrs Sharma want the best deal.

They put their money together before changing it into euros.

How much extra money do they get by putting their money together before they change it?

(Total for Question 1 is 3 marks)

2 Stephen throws a fair dice until he gets a six.
Work out the probability that Stephen throws the dice

(i) exactly once

(ii) exactly twice

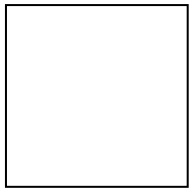
(iii) more than twice.

(Total for Question 2 is 4 marks)

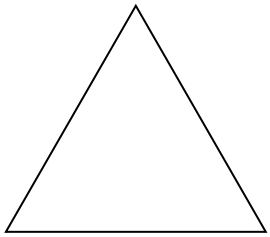
3 Here are a square and an equilateral triangle.

The length of a side of the square is x cm.

The length of a side of the equilateral triangle is 2 cm more than the length of a side of the square.



x cm



The perimeter of the square is equal to the perimeter of the equilateral triangle.

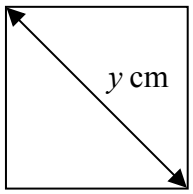
(a) Work out the perimeter of the square.

(3)

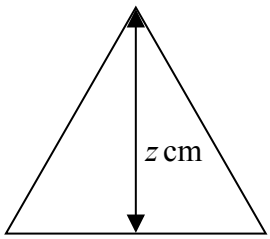
Here are the same square and the same equilateral triangle.

The length of the diagonal of this square is y cm.

The height of this equilateral triangle is z cm.



x cm



(b) Which has the greater value, y or z?

(4)

(Total for Question 3 is 7 marks)

4 Linda keeps chickens.
She sells the eggs that her chickens lay.

She has 140 chickens.
Each chicken lays 6 eggs a week.

Linda gives each chicken 100 g of chicken feed each day.
The chicken feed costs £6.75 for a 25 kg bag.

Work out the cost of the chicken feed for every 12 eggs.

(Total for Question 4 is 5 marks)

5 Bella invests £5000 in an account for two years.
The account pays 3% compound interest per annum.

Bella has to pay 20% tax on the interest earned each year.
This tax is taken from the account at the end of each year.

How much money will Bella have in her account at the end of the two years?

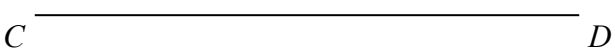
(Total for Question 5 is 4 marks)

6 The diagram shows a rectangle *ABCD*.

In the space below, use a ruler and a pair of compasses to construct a right-angled triangle equal in area to the area of the rectangle *ABCD*.

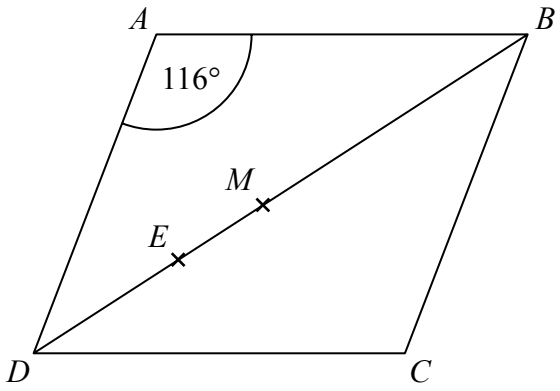
You must show all your construction lines.

The base of the triangle, which is equal in length to the side *CD*, has been drawn for you.



(Total for Question 6 is 3 marks)

7



ABCD is a rhombus.
M is the midpoint of *BD*.
E is the point on *BD* such that *DE* = *CE*.

Calculate the size of angle *MCE*.

(Total for Question 7 is 3 marks)

8 A school has a biathlon competition.
Each athlete has to throw a javelin and run 200 metres.

(a) The points scored for throwing a javelin are worked out using the formula

$$P_1 = 16(D - 3.8)$$

where P_1 is the number of points scored when the javelin is thrown a distance D metres.

(i) Lottie throws the javelin a distance of 42 metres.
How many points does Lottie score?

(ii) Ingrid scores 584 points for throwing the javelin.
Work out the distance that the javelin was thrown by Ingrid.

(4)

The points scored for running 200 metres are worked out using the formula

$$P_2 = 5(42.5 - T)^2$$

where P_2 is the number of points scored when the time taken to run 200 metres is T seconds.

Suha scores 1280 points in the 200 metres.

(b) (i) Work out the time, in seconds, it took Suha to run 200 metres.

The formula for the number of points scored in the 200 metres should not be used for $T > n$.

(ii) State the value of n.
Give a reason for your answer.

(4)

(Total for Question 8 is 8 marks)

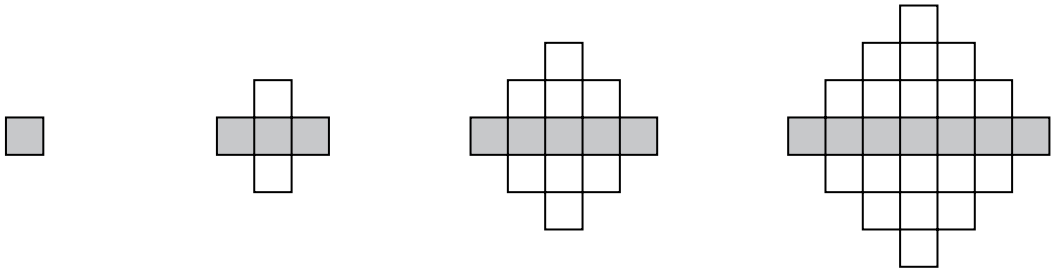
9 Triangle ABC has a right angle at C.

Angle $BAC = 48°$.
$AB = 9.3$ cm.

Calculate the length of BC.

(Total for Question 9 is 3 marks)

10 The diagrams show a sequence of patterns made from grey tiles and white tiles.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

The number of grey tiles in each pattern forms an arithmetic sequence.

(a) Find an expression, in terms of n, for the number of grey tiles in Pattern n.

(2)

The **total** number of grey tiles and white tiles in each pattern is always the sum of the squares of two consecutive whole numbers.

(b) Find an expression, in terms of n, for the **total** number of grey tiles and white tiles in Pattern n.
Give your answer in its simplest form.

(3)

(c) Is there a pattern for which the total number of grey tiles and white tiles is 231?
Give a reason for your answer.

(2)

The total number of grey tiles and white tiles in any pattern of this sequence is always an odd number.

(d) Explain why.

(2)

(Total for Question 10 is 9 marks)

11 Alfred studies animal populations on an island.

The size of an animal population at the start of 2014 was 2500.

The size of this animal population increases exponentially.

Alfred assumes that the rate of increase is 20% per year.

(a) Using his assumption, work out the size of this animal population at the start of 2009.

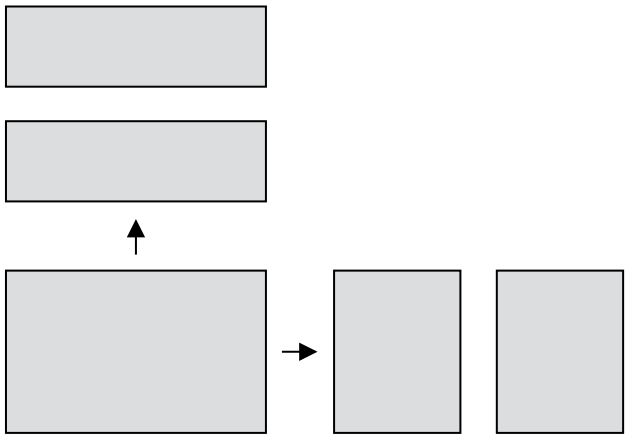
(3)

(b) Alfred's assumption is too high. Explain how your answer to part (a) is affected.

(1)

(Total for Question 11 is 4 marks)

12 A rectangular sheet of paper can be cut into two identical rectangular pieces in two different ways.



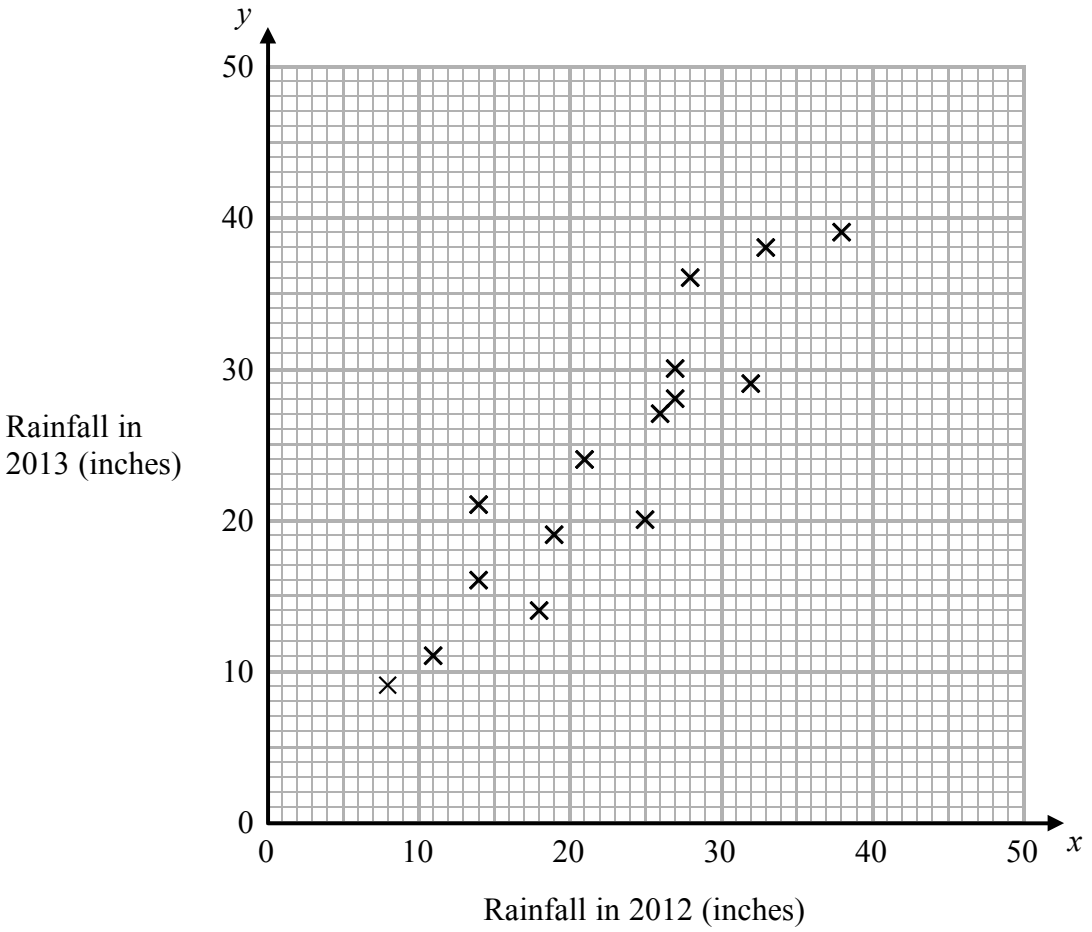
When the original sheet of paper is cut one way, the perimeter of each of the two pieces is 50 cm.

When the original sheet of paper is cut the other way, the perimeter of each of the two pieces is 64 cm.

What is the perimeter of the original sheet of paper?

(Total for Question 12 is 5 marks)

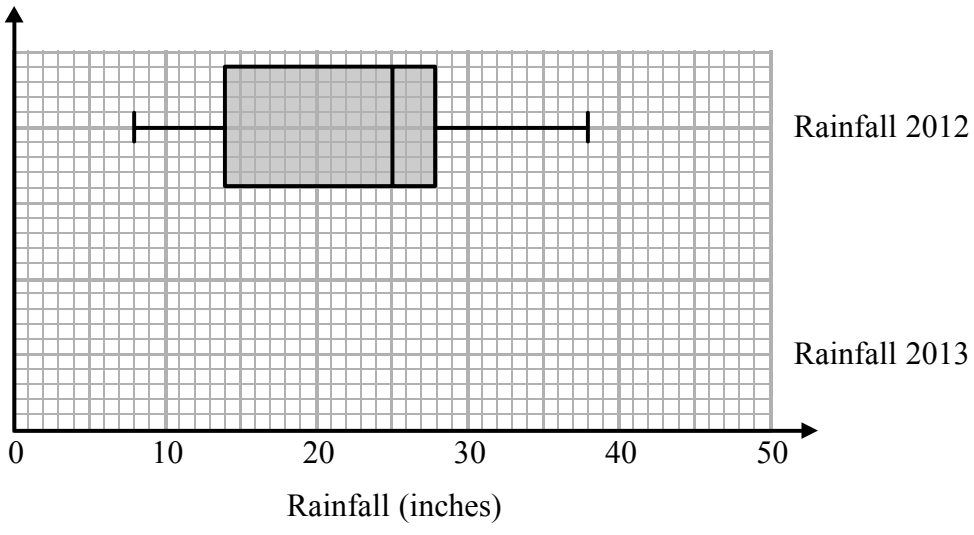
13 The scatter graph gives information about the rainfall, in inches, in 2012 and the rainfall, in inches, in 2013 for each of 15 countries.



(Source: data.worldbank.org)

The box plot for the rainfall in 2012 for the 15 countries is drawn on the grid below.

(a) On the same grid, draw the box plot for the rainfall in 2013 for the 15 countries.



(3)

(b) Compare the distributions of the rainfall in the 2 years.

(2)

(Total for Question 13 is 5 marks)

14 The quantity of heat, H calories, delivered by an electric current, I amps, acting for t seconds to heat an amount of water is given by the formula

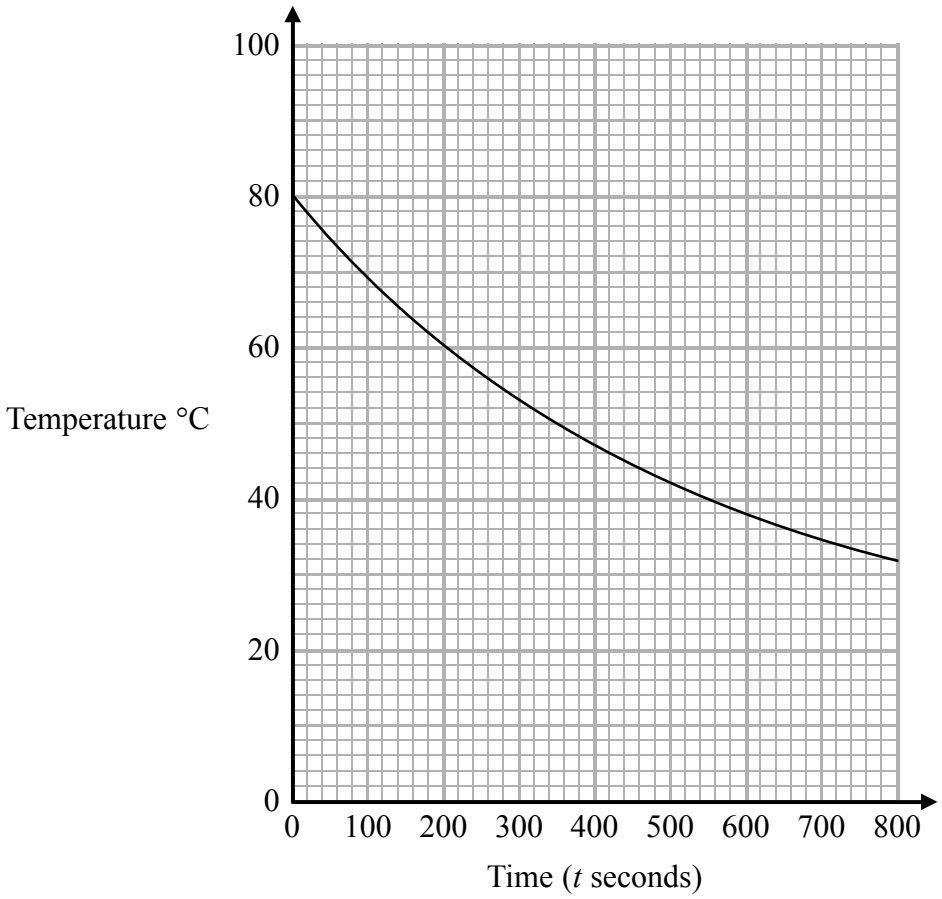
$$H = atI^2 - b$$

where a and b are constants.

(a) Rearrange the formula to make I the subject.

(2)

The graph gives information about the variation in the temperature, in °C, of an amount of water that is allowed to cool from 80 °C.



(b) (i) Work out the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.

The instantaneous rate of decrease of the temperature of the water at time T seconds is equal to the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.

(ii) Find an estimate for the value of T.
You must show how you got your answer.

(4)

(Total for Question 14 is 6 marks)

15 (a) Prove that the recurring decimal $0.\dot{1}\dot{5}$ has the value $\frac{5}{33}$

(2)

(b) $x = \frac{1}{2^{183} \times 5^{180}}$

Show that, when x is written as a terminating decimal, there are 180 zeros after the decimal point.

(2)

The reciprocal of any prime number p (where p is neither 2 nor 5) when written as a decimal, is always a recurring decimal.

A theorem in mathematics states

The period of a recurring decimal is the least value of n for which p is a factor of $10^n - 1$

Hugo tests this theorem.

He uses his calculator to show that 37 is a factor of $10^3 - 1$

Hugo then makes this statement,

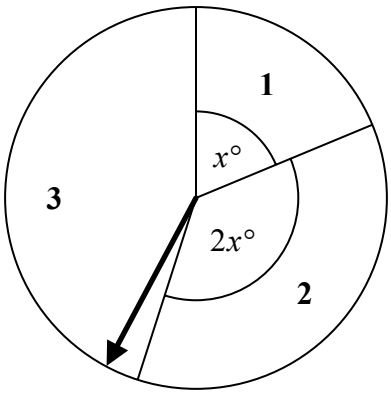
"The period of the recurring decimal equal to the reciprocal of 37 is 3 because 37 is a factor of $10^3 - 1$. This shows the theorem to be true in this case."

(c) Explain why Hugo's statement is incomplete.

(2)

(Total for Question 15 is 6 marks)

16



Here is a spinner.
When the arrow is spun once, a 1 or a 2 or a 3 can be scored.

Bill is going to spin the arrow twice.
He will work out his total score by adding the two scores he gets on the two spins.

The probability that he will get a total score of 4 is $\frac{16}{81}$

Assuming that the thickness of the three lines between the sectors may be ignored,

Work out the value of x.

(Total for Question 16 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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Higher Tier Paper 3 – Calculator

Question	Working	Answer	Mark	AO	Notes
1		€48 or £42.86	P P A	3.1c 3.1c 1.3a	P1 for a correct process, using the lower rate, to find the amount by changing their money separately, e.g. 300 × 1.04 × 2 (= 624) P1 for a correct process, using the higher rate, to find the amount by changing their money together, e.g. 300 × 2 × 1.12 (= 672) resulting in two values to compare A1 for 48 euros or £42.85 or £42.86 if converted to sterling, units must be clear
2 (i) (ii) (iii)		$\frac{1}{6}$ $\frac{5}{36}$ $\frac{25}{36}$	B B M A	1.2 1.3a 1.3b 1.3b	B1 oe B1 oe M1 for $1-\frac{1}{6}-\frac{5}{36}$ or $\left(1-\frac{1}{6}\right)\times\left(1-\frac{1}{6}\right)$ A1 oe OR M1 for 1 – "(i)" – "(ii)" A1 ft provided answer is less than 1

Question	Working	Answer	Mark	AO	Notes
3 (a)	$4x = 3x + 6$ $x = 6$ 4×6	24 (cm)	P P A	3.1b 3.2 1.3b	P1 for translating the problem into an algebraic equation, e.g. $x + x + x + x = x + 2 + x + 2 + x + 2$ oe P1 for collecting terms and solving for x oe A1 24 cao
3 (b)	$y^2 = 6^2 + 6^2$ $y = \sqrt{72}$ $z^2 = 8^2 - 4^2$ $z = \sqrt{48}$	$y > z$ with reason	P M M C	2.3a 1.3b 1.3b 2.1a	P1 for interpreting information, e.g. numerical values for sides on square and triangle M1 for a correct method to find y or z M1 for a correct method to find y and z C1 conclusion based on at least P1 consistent with candidate's figures for y and z or y^2 and z^2
4		38p	P P P P A	3.1d 3.1d 3.1d 3.1d 1.3b	P1 for a correct first step, e.g. 140 × 6 (= 840 eggs per week) P1 for a correct process to find the weight of feed per week, e.g. 100 × 140 × 7 (= 98000g or 98 kg) P1 for a correct method to find the weekly cost, e.g. 6.75 ÷ 25 × "98" (= £26.46) P1 for completing the process to find the cost of feed required for 12 eggs, e.g. (2646 ÷ 840) × 12 = 37.8p A1 for 37.8p or 38p oe

Question	Working	Answer	Mark	AO	Notes
5		£5242.88	P	3.1d	P1 for a correct first step in the process, e.g. 5000 × 0.03 (= 150) or 3 × 0.8 = 2.4%
			P	3.1d	P1 for a correct process in finding the effect of the 20% tax on interest (i.e. "150"), e.g. "150" × 0.8 (= 120) or 5000 × 1.024
			P	3.1d	P1 (dependent on previous P marks) for a fully complete and correct process to find balance after 2 years, e.g. (5000 + "120") + (5000 + "120") × 0.03 × 0.8 or $5000 \times (1.024)^2$
			A	1.3b	A1 cao
6		A correct right-angled triangle constructed	P	2.3a	P1 for a construction of a right angle at C or D (construction arcs must be seen)
			P	2.3b	P1 (indep) for the correct height of the triangle drawn or shown
			P	2.3b	P1 for a fully correct constructed triangle

Question	Working	Answer	Mark	AO	Notes
7		26^o	P P A	3.1b 3.1b 1.3b	P1 for a correct process that leads to angle *EDC*, e.g. $(180^o - 116^o) \div 2$ P1 for a correct process that leads to angle *MCE*, e.g. $(58^o - 32^o)$ A1 cao
8 (a) (i)		611.2	M A	1.3a 1.3a	M1 for $16 \times (42 - 3.8)$ A1 for 611 (accept 611.2)
(ii)		40.3 m	M A	1.3b 1.3b	M1 for a fully correct method to find distance by applying the correct inverse operations in the correct order A1 for 40.3 m
8 (b) (i)		26.5	M A	1.3b 1.3b	M1 for a fully correct method to find Time by applying the correct inverse operations in the correct order A1 for 26.5
(ii)		42.5 seconds with correct reason	P C	3.1c 2.4a	P1 for a recognition that $42.5 - T \geq 0$ C1 for 42.5 and a statement that this will lead to an increasing number of points the slower you get oe

Question	Working	Answer	Mark	AO	Notes
9	$9.3 \times \sin 48^o$	6.911 cm	P M A	2.3a 1.3a 1.3a	P1 for process to decide which trig function to use from description M1 $9.3 \times \sin 48^o$ A1 awrt 6.91cm
10 (a)		$2n - 1$	P A	2.1a 1.3a	P1 for process to deduce nth term from information given, e.g. $2n + k$ oe A1 for $k = -1$
10 (b)		$2n^2 - 2n + 1$	P P A	2.3a 2.2 1.3b	P1 starts process for at least first 3 pattern numbers by looking for sums of squares, e.g. 1st: $1 = 0 + 1$, 2nd: $5 = 4 + 1$ 3rd: $13 = 9 + 4$ or begins to make a difference table at least as far as second differences P1 for process that leads to identification of n^2 and $(n-1)^2$ or to identification of $2n^2$ from a difference table A1 $2n^2 - 2n + 1$
10 (c)		No with a clear correct reason given	P C	2.4a 2.4a	P1 for an attempt to solve the equation $2n^2 - 2n - 230 = 0$ or evaluating $2n^2 - 2n + 1$ when $n = 11$ and 12 C1 for No and evidence, e.g. 11.2... or 221 and 265

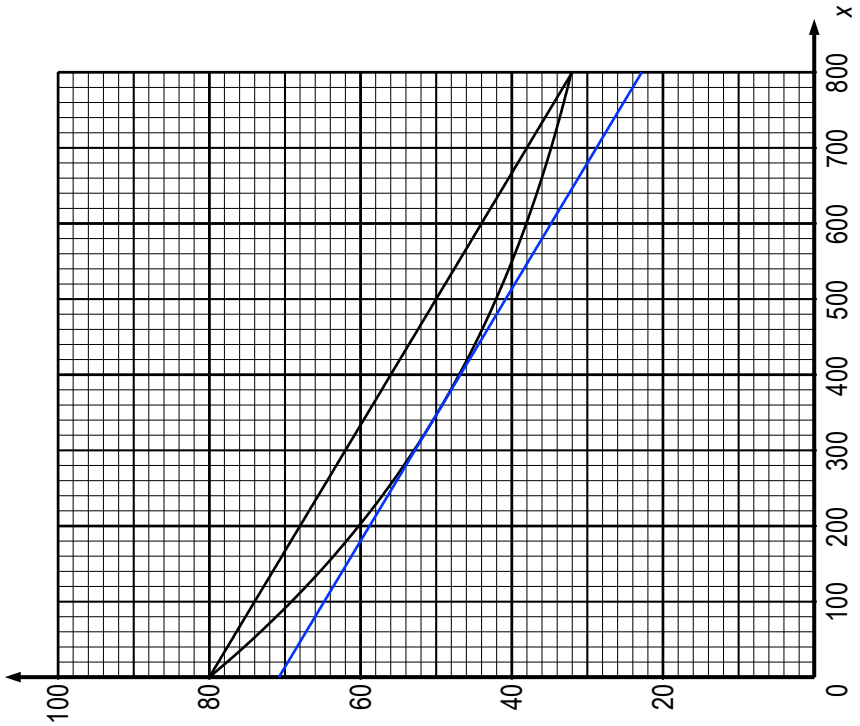
Question	Working	Answer	Mark	AO	Notes
10 (d)		Complete explanation	P C	2.4a 2.4a	P1 for an argument in words or using symbols, e.g. in any two consecutive numbers one is even and one is odd and the square of an even number is even and the square of an odd number is odd The sum of an odd and an even number is odd C1 conclusion with a correct complete argument
11 (a)	$2500 = P \times 1.20^5$ $P = 2500 \div 1.20^5 = 1004.69$	1005	P M A	3.1c 1.3a 1.3a	P1 for process to translate problem into algebraic form, e.g. $2500 = P \times 1.20^5$ M1 $P = 2500 \div 1.20^5$ A1 1005
11 (b)		Correct explanation	C	3.5	C1 for an explanation eg the original population size will be greater
12	Let h and w be the dimensions of the original rectangle $h + 2w = 50$ $2h + w = 64$ $w = 12,\ h = 26$ Perimeter = $2 \times 12 + 2 \times 26$	76 cm	P P P P A	3.2 3.1d 3.1d 3.1d 1.3b	P1 for correct process to set up equations, e.g. $\frac{h}{2} + \frac{h}{2} + w + w = 50$ and $\frac{w}{2} + \frac{w}{2} + h + h = 64$ P1 for correct process to find value of one variable P1 for correct process to find value of other variable P1 for correct process to find numerical value of perimeter, e.g. 2 × ('12' + '26') A1 cao

Question	Working	Answer	Mark	AO	Notes
13 (a)	Lv 9 Lq 16 M 24 Uq 30 Uv 39 2013		P P C	2.3a 2.3a 2.3b	P1 for process to interpret diagram, e.g. identify any quartile P1 for further interpretation in order to draw box plot with at least three correct from Lv, Lq, M, Uq, Uv C1 for fully correct box plot
13 (b)		Correct comparisons	C C	2.3b 2.3b	C1 ft for a correct comparison in context of central tendency C1 ft for a correct comparison in context of any measure of spread
14 (a)	$H = atI^2 - b$ $\frac{H+b}{at} = I^2$	$I = \sqrt{\frac{H+b}{at}}$	M A	1.3b 1.3b	M1 $\frac{H+b}{at} = I^2$ A1 cao (accept ±)
(b)(i)	$\frac{80-32}{800}$	0.06 °C/second	P	3.1a	P1 for process to use graph to find gradient, e.g. $\frac{80-32}{0-800}$
(ii)	Draw a tangent to the curve with a gradient of –0.06 (see diagram at the end)	350 seconds	A P A	1.3a 2.3a 1.3a	A1 accept –0.06 °C/second P1 for process to interpret parallel lines on diagram A1 340 – 360

Question	Working	Answer	Mark	AO	Notes
15 (a)	$x = 0.\dot{1}5\dot{}$ $100x = 15.\dot{1}5\dot{} \quad \therefore 99x = 15$ $\therefore x = \frac{15}{99} = \frac{5}{33}$	Shown	M A	1.3b 1.3b	M1 for a complete method A1 fully correct working
15 (b)	$\frac{1}{2^{183} \times 5^{180}} = \frac{1}{8} \times \frac{1}{10^{180}}$ $= 0.125 \times 10^{-180}$	Shown	P P	2.2 2.2	P1 for a correct process to find that 180 comes from 2^{180} and 5^{180} P1 for complete process with correct working to show that the number of zeros is 180
15 (c)		Reasons	P P	2.5a 2.5a	C1 He has not shown that the period is 3 C1 He has omitted to show that 37 is neither a factor of $10^2 - 1$ nor of $10^1 - 1$
16		40	P P	3.1d 3.1d	P1 for identifying probabilites, e.g. prob of '1' = $\frac{x}{360}$, prob of '2' = $\frac{2x}{360}$, prob '3' = $1 - \frac{3x}{360}$ P1 for a correct process to set up a quadratic equation, e.g. $2 \times \frac{x}{360} \times \left(1 - \frac{3x}{360}\right) + \left(\frac{2x}{360}\right)^2 = \frac{16}{81}$

Question	Working	Answer	Mark	AO	Notes
			P M P	3.1d 1.3b 3.3	P1 for a correct process that leads to a 3-term quadratic, e.g. $2x^2 - 720x + 25600 = 0$ M1for a correct method to solve the quadratic equation, e.g. $(2x - 80)(x - 320)$ (=0) P1 selection of $x = 40$ (from solutions $x = 40$ or $x = 320$)

Question 14 (b)(ii)



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