

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

©2015 Pearson Education Ltd.



**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:

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

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

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

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

### *Kinematics formulae*

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

$$v = u + at$$

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

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

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all stages in your working.**

- 1** 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?

---

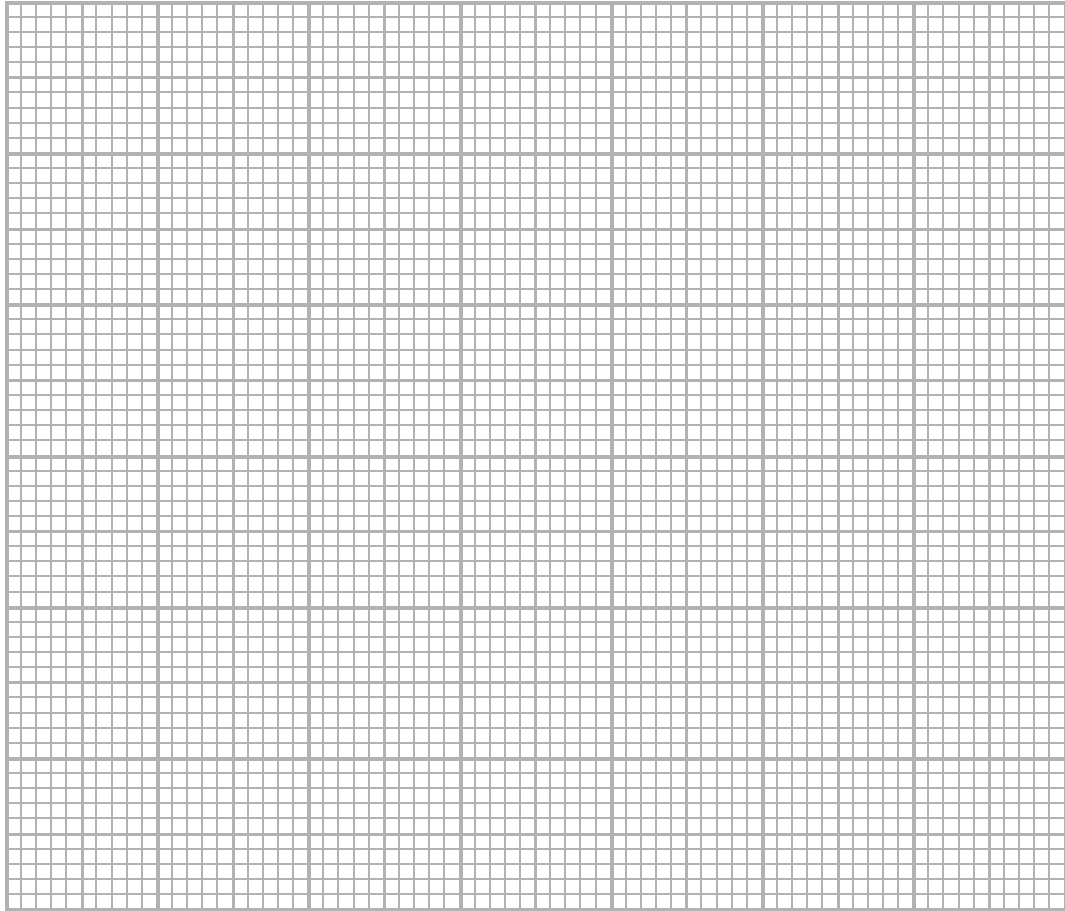
**(Total for Question 1 is 3 marks)**

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

<b>Year of birth</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>Life expectancy (years)</b>	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  $90^\circ$  clockwise about  $C$ .  
The card is then rotated  $90^\circ$  clockwise about  $B$ .  
The card is then rotated  $90^\circ$  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

$$x + 5 > 8 \quad \text{and} \quad 2x - 3 < 7$$

(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  $9.75 \times 10^7$  km from Earth.

Taking the speed of light to be  $3 \times 10^8$  m/s,

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

(3)

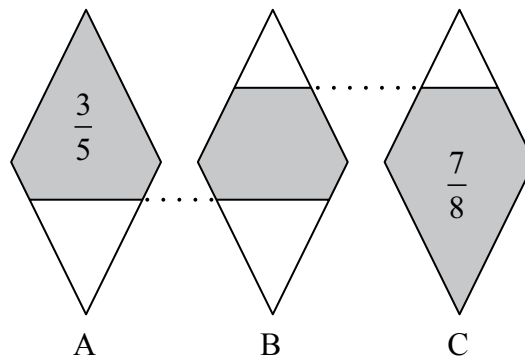
---

**(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.

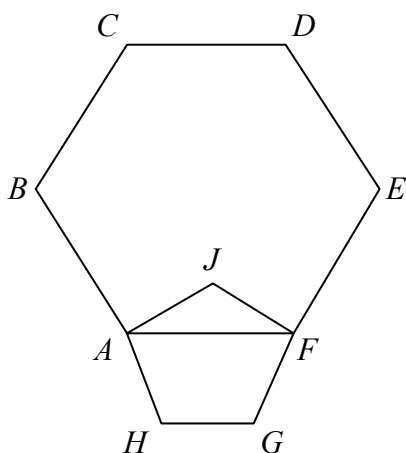
Wheat is grown on  $\frac{5}{8}$  of the land used to grow crops.

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.

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

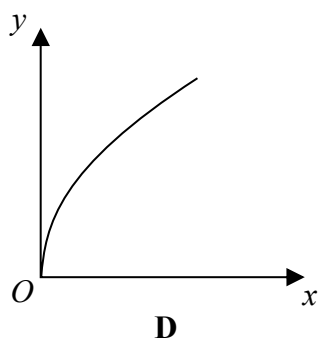
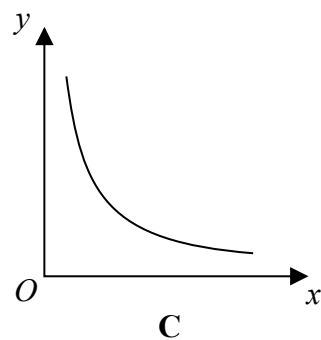
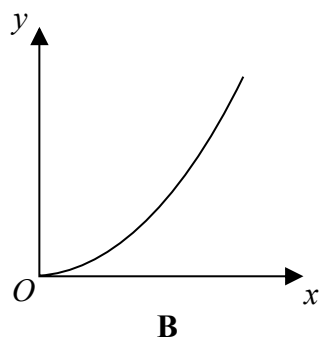
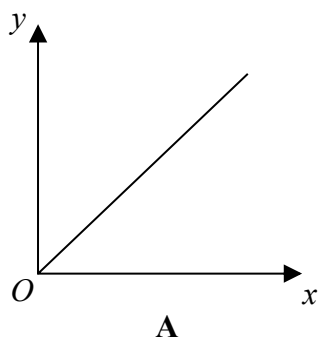
In September, Ishmael's monthly wage was £1850

Work out his sales, in £, for September.

---

**(Total for Question 10 is 4 marks)**

11 Here are four graphs.



(a) 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

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

(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.

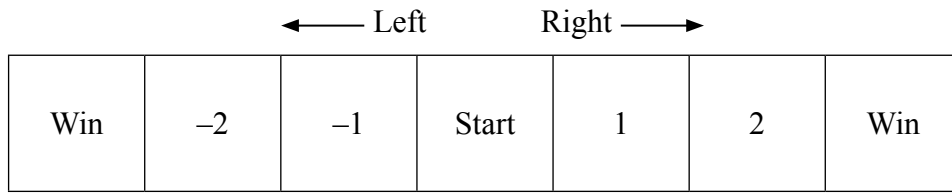
The car then travels at a constant speed of  $2u$  m/s for 10 seconds.

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.”

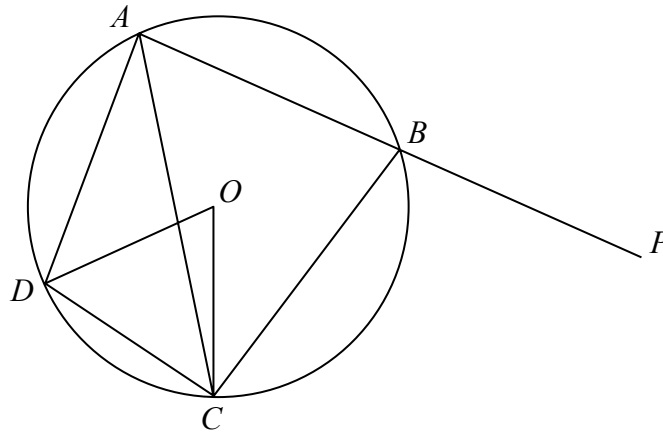
(c) Explain whether or not Jim is correct.

(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  $PBC = 100^\circ$ .

Angle  $DAC = 23^\circ$ .

Show that the size of angle  $OCA = 10^\circ$

You must give a reason for each stage of your working.

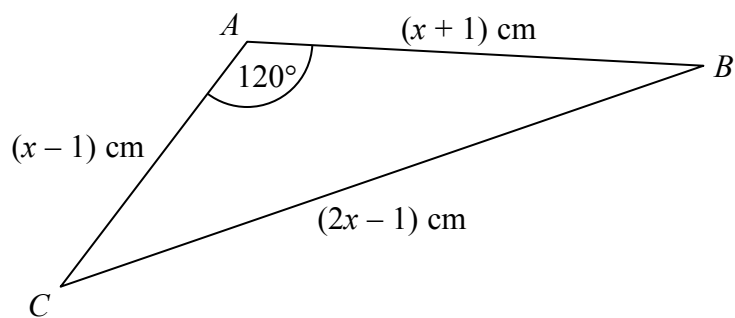
**(Total for Question 15 is 6 marks)**

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  $k\sqrt{3}$   $\text{cm}^2$ .

Find the exact value of  $k$ .

---

(Total for Question 17 is 7 marks)

---

**TOTAL FOR PAPER IS 80 MARKS**

**BLANK PAGE**

**BLANK PAGE**



### Higher tier Paper 1 – Non-calculator

Question	Working	Answer	Mark	AO	Notes
1	$80 \div (7 - 2) (=16)$ '16' $\times 3$	£48	P	3.1d	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' $\times 3$ A1 cao
2		84 to 85	P	2.3a	P1 for interpreting the data and deciding to draw a graph or a table to represent the data
(a)			P	2.3b	P1 for a correct process to label axes or communicate the data connections
			P	3.1d	P1 drawing in an appropriate line of best fit or model the problem as a linear function in time
			A	1.3b	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	3.4b	C1 for a valid comment eg cannot assume a linear relationship
			C	3.4b	C1 for a valid comment eg that one cannot predict accurately with a date so far away from the original data
3		$2^3 \times 3 \times 5$ $2^4 \times 3^3 \times 5^2$	B	1.3a	B1 cao
(i)			B	1.3a	B1 cao
(ii)			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 $A$
4		locus (see diagram at end)	C	2.3b	C1 for understanding it is a continuous process, e.g.

Question	Working	Answer	Mark	AO	Notes
5 (a)	$3x + 5y = 4$ $10x - 5y = 35$ $13x = 39$	$x = 3, y = -1$	C M M A	2.3b 1.3b 1.3b 1.3b	quarter circle with radius $PC$ centre $C$ and radius $PB$ centre $B$ and radius $PA$ centre $A$ C1 for fully correct drawing 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 <sup>2</sup>	M	1.3a	M1 for use of $4\pi r^2$ with either $\pi$ or $r$ rounded to 1 significant figure A1 accept 50 000 000 km <sup>2</sup> C1 for appropriate evaluation of method, e.g. 3 and 2000 both less than true values
6 (a) (ii)			A C	1.3a 3.4a	
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 $\div$ 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	3.1b 3.1b	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 $\frac{7}{8} - \frac{2}{8}$ 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°	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. $JAF = (180 - 108) \div 2$ P1 for a complete process to find angle $BAJ$ A1 cao

Question	Working	Answer	Mark	AO	Notes
10	<p><u>Method 1</u>  <math>2200 - 1700 = 500</math>  <math>30000 - 0000 = 100000</math>  For every £100 increase in wage the increase in sales = £2000  <math>1850 - 1700 = 150</math>  Difference in sales  <math>= 1.5 \times 2000 = 3000</math>  <math>20000 + 3000</math></p> <p><u>Method 2</u>  Use <math>y = mx + c</math>  <math>1700 = 20000m + c</math>  <math>2200 = 30000m + c</math>  <math>m = \frac{2200 - 1700}{30000 - 20000}</math>  <math>= 0.05</math>  <math>c = 2200 - 30000 \times 0.05 = 700</math></p> <p>When <math>y = 1850</math>, <math>x = \frac{1850 - 700}{0.05}</math></p> <p><u>Method 3</u>  Draw a graph</p>	23000	P  P  P  A	2.3a  3.1d  3.1d  1.3b	P1 for process to interpret information, e.g. $2200 - 1700 = 500$ or use $y = mx + c$ or start to draw graph P1 for process to build on initial strategy, e.g. $2200 - 1700 = 500$ and $30000 - 20000 = 10000$ or use proportional increase or process to find $m$ and $c$ P1 for strategy to use found information, e.g. $1000 \div 5$ 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' P1 for full interpretation of results rather than a specific distance, e.g. $\frac{1}{4}$ of original force
(b)(ii)	$40 = \frac{k}{3^2}$ ( $k = 360$ ) $360 \div 10^2$	3.6 N	M	1.3b	M1 for $40 = \frac{k}{3^2}$ M1 for complete method, e.g. $360 \div 10^2$
12 (a)	$g(1 - 5 \times 1) = 1 + 5 \times (-4)$ or $1 + 5f(1) = 1 + 5 \times (-4)$	Shown with working	P P	2.2 2.2	A1 cao P1 for process to begin expansion, e.g. $(1 - 5 \times 1)$ or $1 + 5f(1)$ P1 for full process to stated expression
12 (b)	$f^{-1}(x) = \frac{1-x}{5}$ $f^{-1}(x) + g^{-1}(x) = \frac{1-x}{5} + \frac{x-1}{5}$ $= \frac{1-x+x-1}{5} = 0$	Proof	P	2.4b	P1 for start to proof, e.g. $f^{-1}(x) = \frac{1-x}{5}$ or $g^{-1}(x) = \frac{x-1}{5}$ P1 For continuation of proof, e.g. $g^{-1}(x) = \frac{x-1}{5}$ and P1 for a complete proof with all steps shown

Question	Working	Answer	Mark	AO	Notes
13	$0.5(u + 2u) \times 12 + 2u \times 10$	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	$\angle DOC = 46^\circ$ $\angle OCD = (180^\circ - 46^\circ)/2$ $\angle ADC = 100^\circ$ $\angle DCA = 57^\circ$ $\angle OCA = 67^\circ - 57^\circ$	10°	P P P P C C	2.2 2.2 2.2 2.2 1.1 1.1	<p>P1 <math>\angle DOC = 2 \times 23^\circ</math> ( angle at centre is twice angle at circumference)</p> <p>P1 <math>\angle OCD = (180^\circ - 46^\circ)/2</math> (base angles of isosceles triangle <math>OCD</math> ) and <math>\angle ABC = 180^\circ - 100^\circ</math> (angles on a straight line sum to <math>180^\circ</math>)</p> <p>P1 <math>\angle ADC = 100^\circ</math> (opposite angles of a cyclic quadrilateral sum to <math>180^\circ</math>)</p> <p>P1 <math>\angle DCA = 180^\circ - 100^\circ - 23^\circ</math> (angle sum of a triangle is <math>180^\circ</math>)</p> <p>C1 for complete chain of reasoning to find angle <math>OCA</math> seen with <math>10^\circ</math> and at least 1 circle theorem quoted</p> <p>C1 dependent on all previous marks for full reasons at each stage</p>

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 A1 for $(x - 2.5)^2 + 3.75$ or parabola with minimum marked at (2.5, 3.75) C1 for parabola drawn with minimum in 1st quadrant or y intercept at (0, 10) 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 $(x + 2)^2 - 5(x + 2) + 10 - 3 = 0$ ( $x^2 - x + 1 = 0$ ) 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	$(2x - 1)^2 = (x + 1)^2 + (x - 1)^2 - 2(x + 1)(x - 1) \cos 120^\circ$ $4x^2 - 4x + 1 = x^2 + 2x + 1 + x^2 - 2x + 1 - 2(x^2 - 1) \times (-0.5)$ $x^2 - 4x = 0$ $x = 4$ Area = $0.5 \times 3 \times 5 \times \sin 120^\circ$	$\frac{15}{4}$	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 $\cos 120^\circ$ or value of $\sin 120^\circ$  P1 for strategy to start to solve problem, e.g. $(2x - 1)^2 = (x + 1)^2 + (x - 1)^2 - 2(x + 1)(x - 1)\cos 120^\circ$  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

