Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

Mathematics A

Paper 3HR

Higher Tier

Monday 11 January 2016 – Morning
Time: 2 hours

Paper Reference
4MA0/3HR

You must have:
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page. Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over ▶

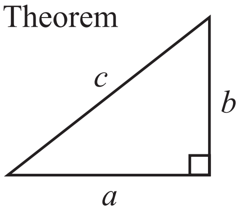
1/1/1/1/1/

P 4 6 9 1 6 A 0 1 2 4

PEARSON

International GCSE MATHEMATICS
FORMULAE SHEET – HIGHER TIER

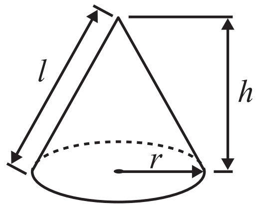
Pythagoras' Theorem



$a^2 + b^2 = c^2$

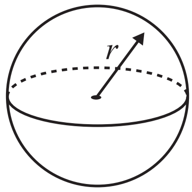
Volume of cone $= \frac{1}{3}\pi r^2 h$

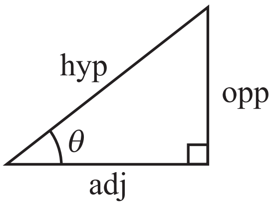
Curved surface area of cone $= \pi r l$



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

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





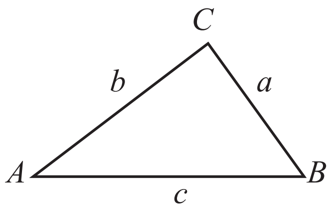
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

or $\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$

$\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$

$\tan\theta = \dfrac{\text{opp}}{\text{adj}}$

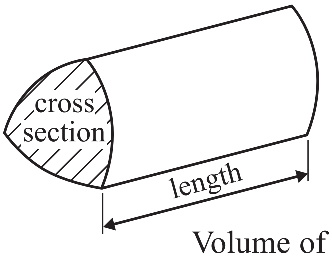
In any triangle ABC



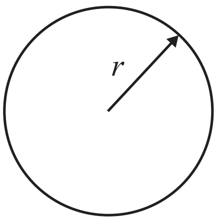
Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$



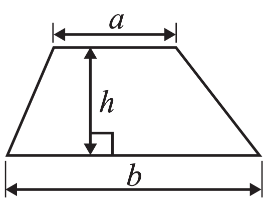
Volume of prism = area of cross section × length

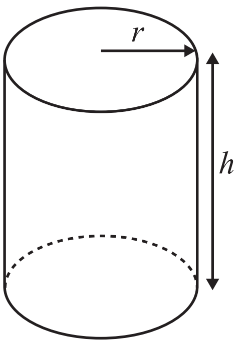


Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$

Area of a trapezium $= \frac{1}{2}(a + b)h$





Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi r h$

The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Answer ALL NINETEEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out the value of $\dfrac{21.89 - 7.75}{0.65 + 2.85}$

....

(Total for Question 1 is 2 marks)

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2 (a) Factorise fully $18c - 27$

....

(2)

(b) Expand and simplify $(t - 4)(t + 5)$

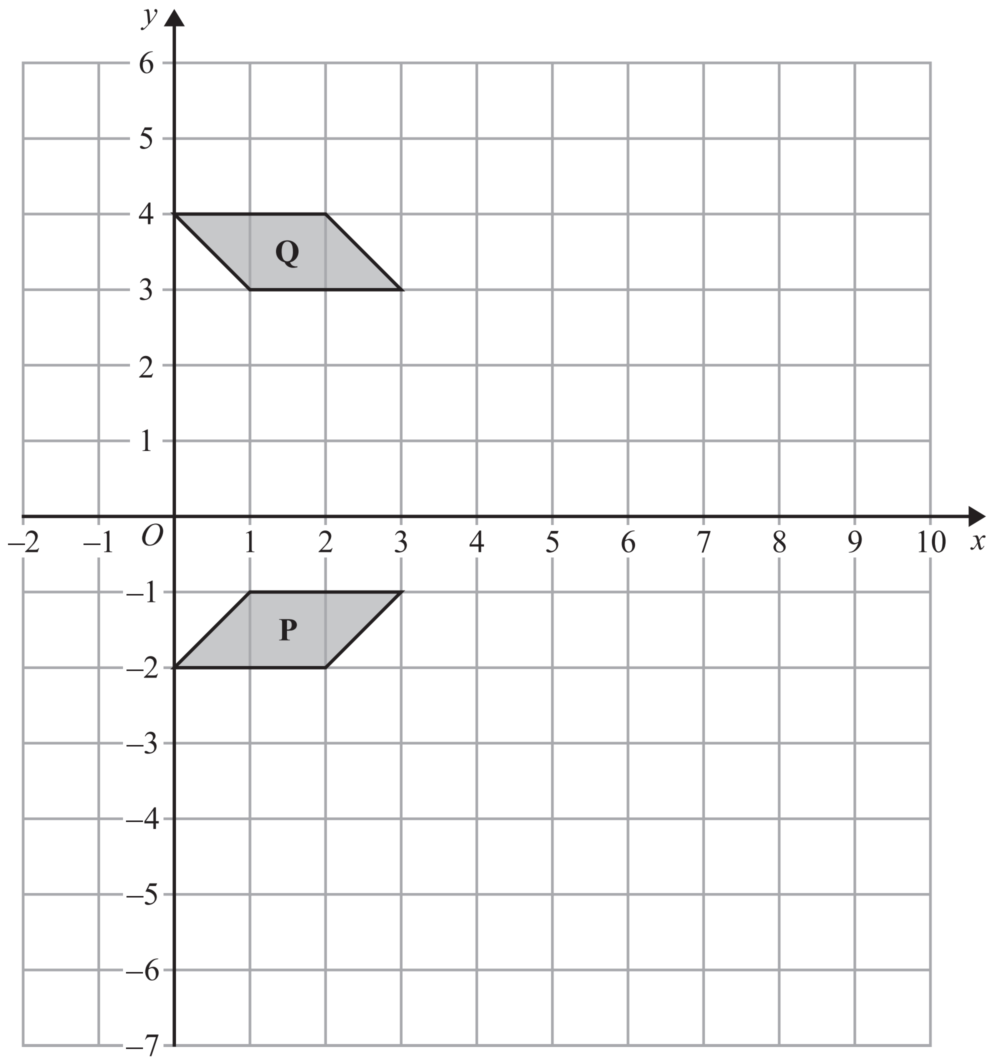
....

(2)

(Total for Question 2 is 4 marks)

P 4 6 9 1 6 A 0 3 2 4

3



(a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

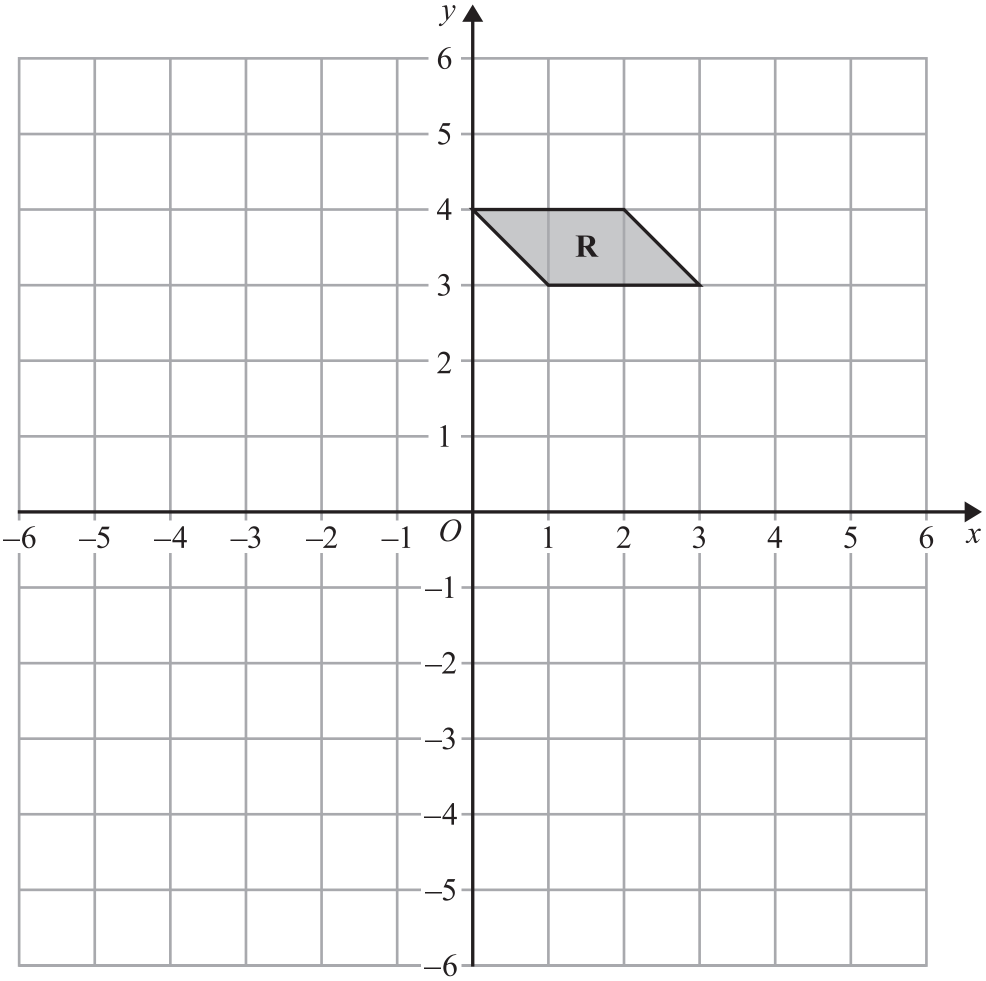
....

....

(2)

(b) On the grid above, enlarge shape **P** with scale factor 3 and centre *O*.

(2)



(c) On the grid above, rotate shape **R** 90° anticlockwise with centre (0, 1)

(2)

(Total for Question 3 is 6 marks)

4 Maisie plays a game.
Each time she plays, she can win a prize of \$1 or \$5 or \$10
When she does not win one of these prizes, she loses.
The table gives the probability of winning each of the prizes.

Prize	Probability
\$1	0.50
\$5	0.15
\$10	0.05

Maisie plays the game once.

(a) Work out the probability that Maisie loses.

....
(2)

(b) Maisie plays the game 40 times.

(i) Work out an estimate for the number of \$5 prizes she wins.

....
(2)

(ii) Work out an estimate for the total value of the prizes she wins.

\$..
(3)

(Total for Question 4 is 7 marks)

5 The diagram shows a circle with centre O and radius 6.5 cm

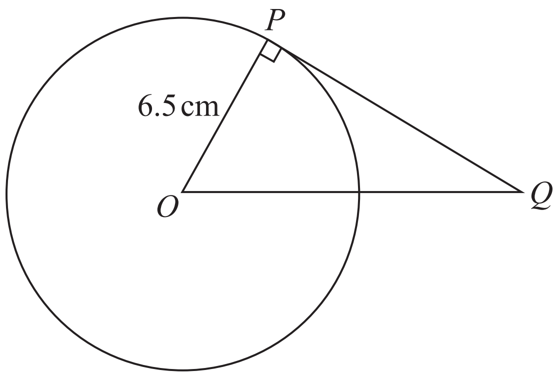


Diagram **NOT** accurately drawn

(a) Work out the area of the circle.
Give your answer correct to 3 significant figures.

.... cm^2

(2)

PQ is the tangent to the circle at P
OQ = 10.5 cm

(b) Work out the length of PQ
Give your answer correct to 3 significant figures.

.... cm

(3)

(Total for Question 5 is 5 marks)

6 (a) Express 600 as a product of powers of its prime factors.
Show your working clearly.

....

(3)

(b) Simplify $\frac{5^{12}}{5^2 \times 5}$

Give your answer as a power of 5

....

(2)

(Total for Question 6 is 5 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

7 (a) Solve the inequality $e - 2 < 0$

....

(1)

(b) Solve the inequality $5 - 3e < 4$

....

(2)

(c) Write down the integer value of e that satisfies both of the inequalities

$e - 2 < 0$ and $5 - 3e < 4$

....

(1)

(Total for Question 7 is 4 marks)

8 In 1981, the population of India was 683 million.
Between 1981 and 1991, the population of India increased by 163 million.

(a) Express 163 million as a percentage of 683 million.
Give your answer correct to 3 significant figures.

....%
(2)

In 2001, the population of India was 1028 million.
Between 2001 and 2011, the population of India increased by 17.6%

(b) Increase 1028 million by 17.6%
Give your answer to the nearest million.

.... million
(3)

In 2001, the population of India was 1028 million.
Between 1971 and 2001, the population of India increased by 87.6%

(c) Work out the population of India in 1971.
Give your answer correct to the nearest million.

.... million
(3)

(Total for Question 8 is 8 marks)

9 The point A has coordinates (0, 2)
The point B has coordinates (–4, –1)

(a) Find the coordinates of the midpoint of AB.

....
(2)

(b) Work out the gradient of the line AB.

....
(2)

(c) Find an equation of the line AB.

....
(2)

(Total for Question 9 is 6 marks)

10 The diagram shows a circle with centre *O*.
The points *A*, *B* and *C* lie on the circle.

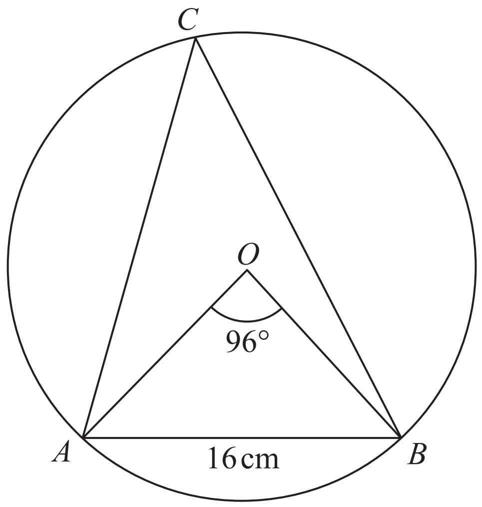


Diagram **NOT** accurately drawn

Angle *AOB* = 96°

(a) Work out the size of angle *ACB*.

.... °

(1)

AB = 16 cm

(b) Work out the radius of the circle.
Give your answer correct to 3 significant figures.

.... cm

(4)

(Total for Question 10 is 5 marks)

11 Solve the simultaneous equations

$$c + 5d = -13$$
$$4c - 5d = 48$$

Show clear algebraic working.

c = ...

d = ...

(Total for Question 11 is 3 marks)

---

12 A stone is thrown vertically upwards from a point O.

The height above O of the stone t seconds after it was thrown from O is h metres, where $h = 17t - 5t^2$

Work out the values of t when the height of the stone above O is 12 metres.
Show your working clearly.

....

(Total for Question 12 is 3 marks)

13 (a) Simplify $\left(4h^{\frac{2}{3}}\right)^3$

....
(2)

$$\frac{a\sqrt{a}}{\sqrt[3]{a^2}} = a^k$$

(b) Work out the value of k.

$k =$ ....
(3)

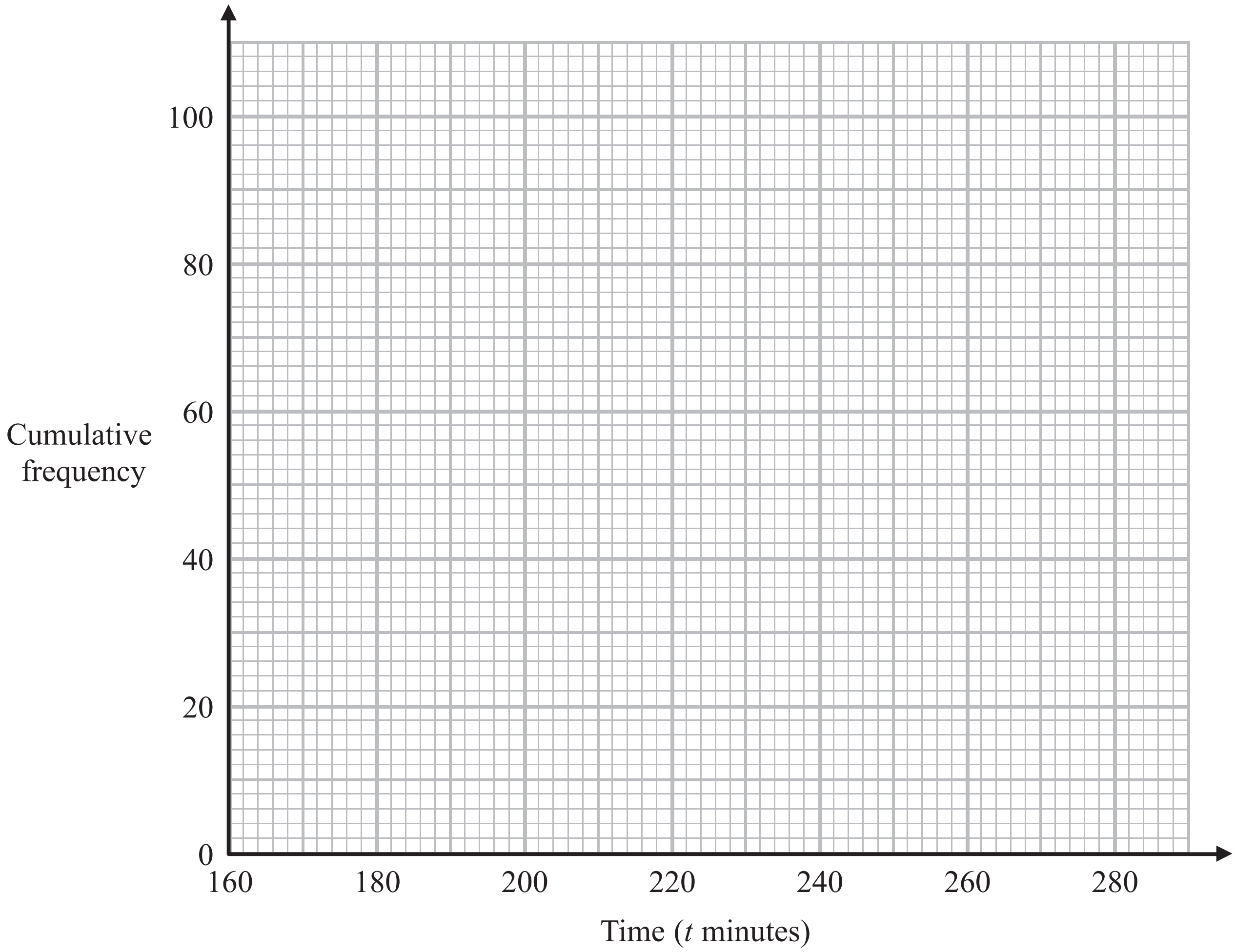
(Total for Question 13 is 5 marks)

---

14 The cumulative frequency table shows information about the times taken by 92 runners to complete a marathon.

Time (*t* minutes)	**Cumulative frequency**
$160 < t \leqslant 180$	9
$160 < t \leqslant 200$	35
$160 < t \leqslant 220$	68
$160 < t \leqslant 240$	80
$160 < t \leqslant 260$	89
$160 < t \leqslant 280$	92

(a) On the grid, draw a cumulative frequency graph for the information in the table.



(2)

(b) Use the graph to find an estimate for the number of runners who took more than 230 minutes to complete the marathon.

....

(2)

(Total for Question 14 is 4 marks)

15 The diagram shows a cylinder inside a cone on a horizontal base.
The cone and the cylinder have the same vertical axis.
The base of the cylinder lies on the base of the cone.
The circumference of the top face of the cylinder touches the curved surface of the cone.

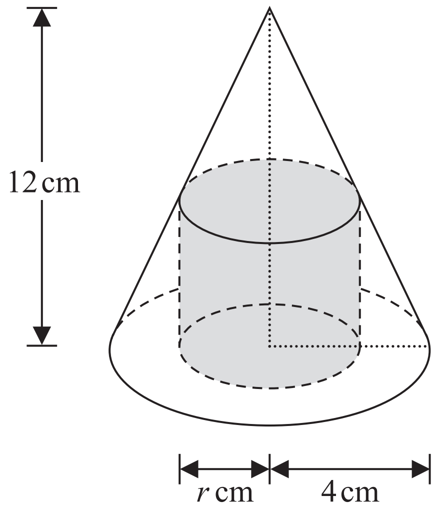


Diagram **NOT** accurately drawn

The height of the cone is 12 cm and the radius of the base of the cone is 4 cm.

(a) Work out the curved surface area of the cone.
Give your answer correct to 3 significant figures.

.... cm^2

(3)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 4 6 9 1 6 A 0 1 6 2 4

The cylinder has radius r cm and volume V cm^3

(b) Show that $V = 12\pi r^2 - 3\pi r^3$

(3)

(c) $V = 12\pi r^2 - 3\pi r^3$

Find the value of r for which V is a maximum.

$r =$ ....

(4)

(Total for Question 15 is 10 marks)

16 $$f(x) = \frac{2x}{x - 1}$$

(a) Find the value of f(11)

....

(1)

(b) State which value of x must be excluded from any domain of f

....

(1)

(c) Find $f^{-1}(x)$

....

(3)

(d) State the value which cannot be in any range of f

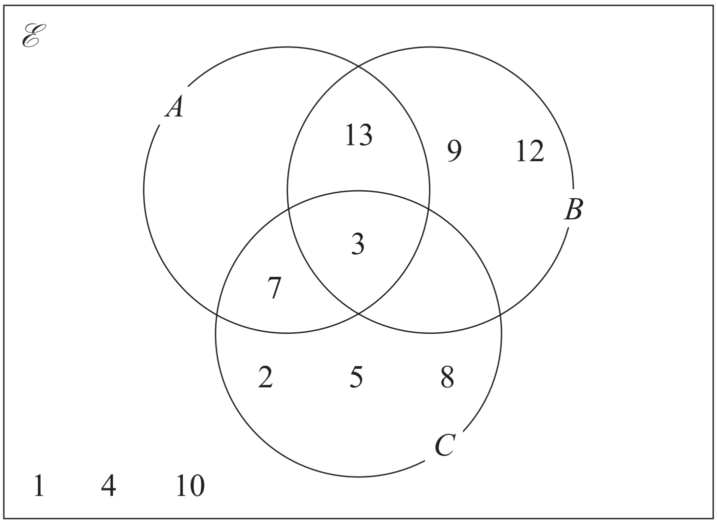
....

(1)

(Total for Question 16 is 6 marks)

17 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$
$A = \{3, 7, 11, 13\}$
$B = \{3, 6, 9, 12, 13\}$
$C = \{2, 3, 5, 6, 7, 8\}$

(a) Complete the Venn diagram.



(1)

(b) List the members of the set $B' \cap C$

....

(1)

(c) List the members of the set $(A \cup C)' \cap B$

....

(1)

(d) Find $n(A' \cap B')$

....

(1)

(Total for Question 17 is 4 marks)

18 There are 100 tiles in a bag.
Each tile is marked with a number.
The table shows information about the tiles.

Number on tile	**Frequency**
0	2
1	68
2	7
3	13
4	10

Carmen takes at random a tile from the bag.
She records the number on the tile and then replaces the tile in the bag.
Pablo takes at random a tile from the bag.

(a) Work out the probability that Carmen takes a tile with the number 0 or the number 1 and Pablo takes a tile with a number greater than 1

....

(2)

All 100 tiles are in the bag.
Juan takes at random a tile from the bag without replacing it.
He then takes a second tile from the bag.

(b) (i) Work out the probability that the number on each tile is 4

....

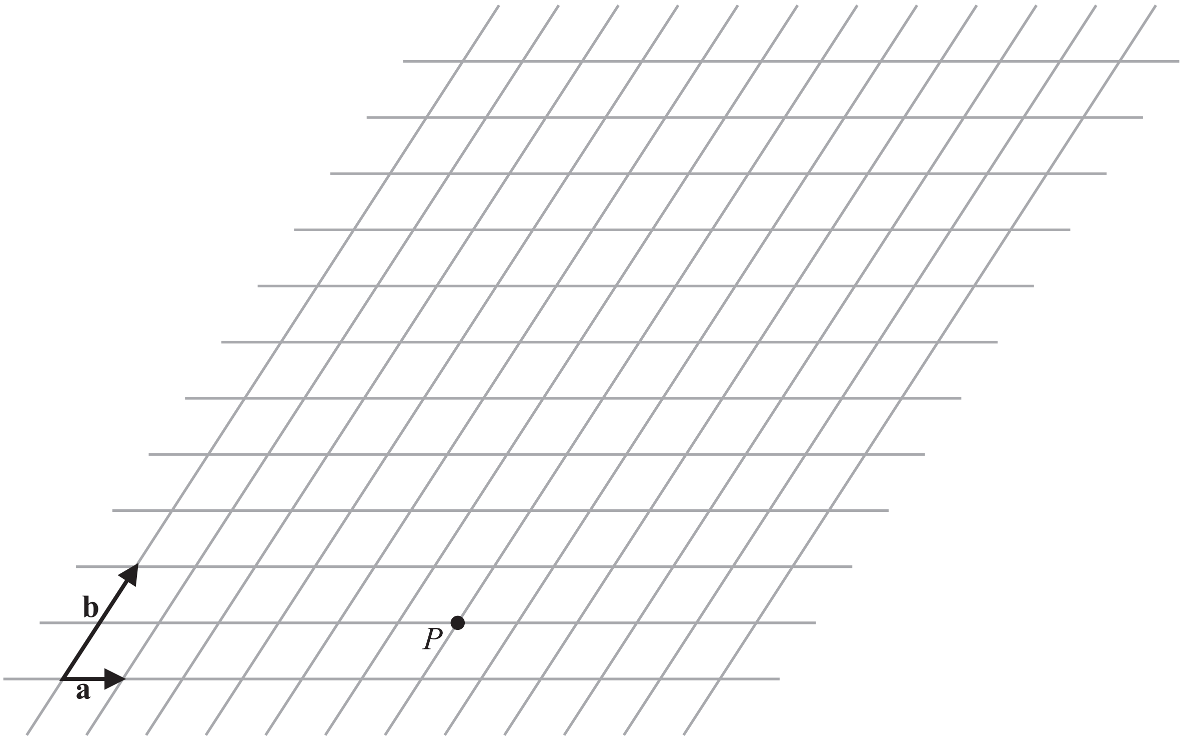
(ii) Work out the probability that the total of the numbers on the two tiles is 2

....

(5)

(Total for Question 18 is 7 marks)

19 The diagram shows a grid of equally spaced parallel lines.
The point P and the vectors **a** and **b** are shown on the grid.



$\overrightarrow{PQ} = 3\mathbf{a} + 4\mathbf{b}$

(a) On the grid, mark the vector $\overrightarrow{PQ}$

(1)

$\overrightarrow{PR} = -4\mathbf{a} + 2\mathbf{b}$

(b) On the grid, mark the vector $\overrightarrow{PR}$

(1)

(c) Find, in terms of **a** and **b**, the vector $\overrightarrow{QR}$

$\overrightarrow{QR}$ = ...

(1)

The point M lies on PR such that $PM = \frac{2}{3}PR$

The point N lies on PQ such that $PN = \frac{1}{3}PQ$

(d) Show that $\overrightarrow{MN} = k\mathbf{a}$ where k is a constant.
State the value of k.

k = ...

(3)

(Total for Question 19 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

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