Cambridge Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8580661249

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2020**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

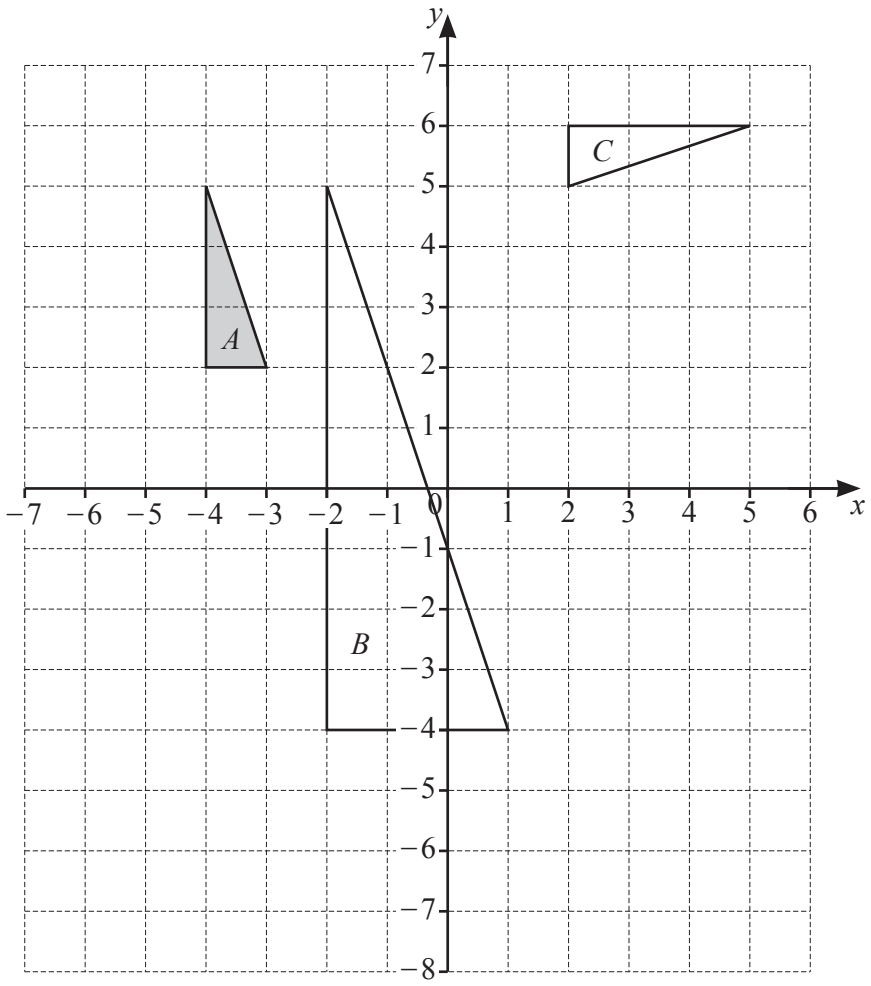
INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Blank pages are indicated.

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1



(a) Draw the image of shape A after a translation by the vector $\begin{pmatrix} 8 \\ -6 \end{pmatrix}$. [2]

(b) Draw the image of shape A after a reflection in the line $y = -1$. [2]

(c) Describe fully the **single** transformation that maps shape A onto shape B.

.....

..... [3]

(d) Describe fully the **single** transformation that maps shape A onto shape C.

.....

..... [3]

2 **(a)** A plane has 14 First Class seats, 70 Premium seats and 168 Economy seats.

Find the ratio First Class seats : Premium seats : Economy seats.
Give your answer in its simplest form.

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

(b) **(i)** For a morning flight, the costs of tickets are in the ratio

First Class : Premium : Economy = 14 : 6 : 5.

The cost of a Premium ticket is $114.

Calculate the cost of a First Class ticket and the cost of an Economy ticket.

First Class $ .....

Economy $ ..... [3]

(ii) For an afternoon flight, the cost of a Premium ticket is reduced from $114 to $96.90 .

Calculate the percentage reduction in the cost of a ticket.

..... % [2]

(c) When the local time in Athens is 09 00, the local time in Berlin is 08 00.
A plane leaves Athens at 13 15.
It arrives in Berlin at 15 05 local time.

(i) Find the flight time from Athens to Berlin.

..... h ..... min [1]

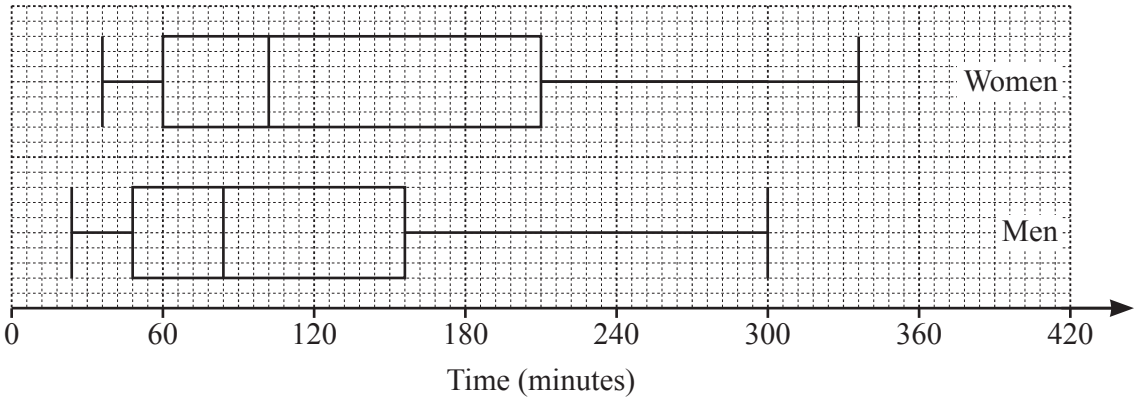
(ii) The distance the plane flies from Athens to Berlin is 1802 km.

Calculate the average speed of the plane.
Give your answer in kilometres per hour.

..... km/h [2]

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3 (a)



The box-and-whisker plots show the times spent exercising in one week by a group of women and a group of men.

Below are two statements comparing these times.
For each one, write down whether you agree or disagree, giving a reason for your answer.

Statement	Agree or disagree	Reason
On average, the women spent less time exercising than the men.		
The times for the women show less variation than the times for the men.		

[2]

(b) The frequency table shows the times, t minutes, each of 100 children spent exercising in one week.

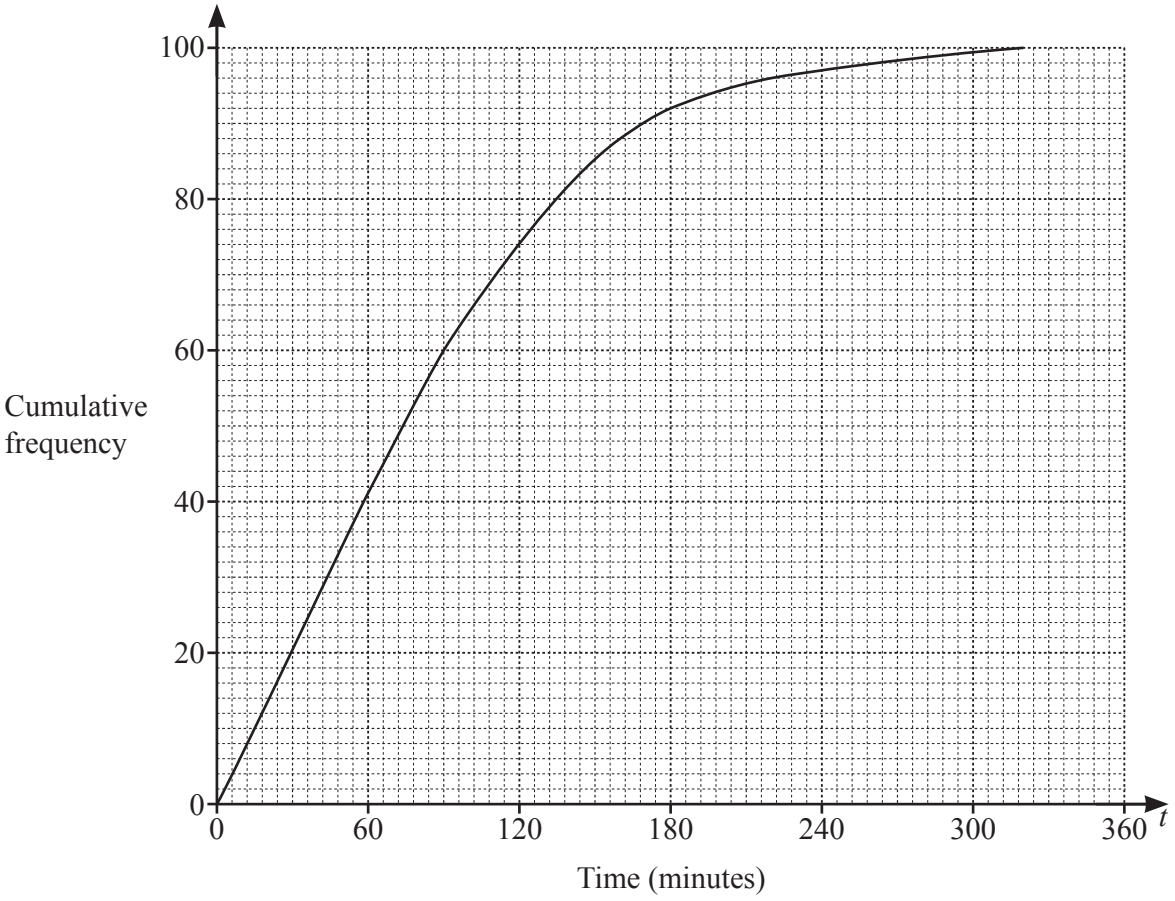
Time (t minutes)	$0 < t \leqslant 60$	$60 < t \leqslant 100$	$100 < t \leqslant 160$	$160 < t \leqslant 220$	$220 < t \leqslant 320$
Frequency	41	24	23	8	4

(i) Calculate an estimate of the mean time.

..... min [4]

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(ii) The information in the frequency table is shown in this cumulative frequency diagram.



Use the cumulative frequency diagram to find an estimate of

(a) the 60th percentile,

..... min [1]

(b) the number of children who spent more than 3 hours exercising.

..... [2]

(iii) A histogram is drawn to show the information in the frequency table.
The height of the bar for the interval $60 < t \leqslant 100$ is 10.8 cm.

Calculate the height of the bar for the interval $160 < t \leqslant 220$.

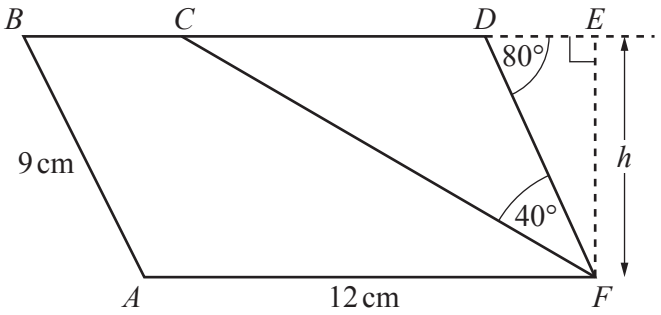
..... cm [2]

4 **(a)** A rectangle measures 8.5 cm by 10.7 cm, both correct to 1 decimal place.

Calculate the upper bound of the perimeter of the rectangle.

..... cm [3]

(b)



NOT TO SCALE

ABDF is a parallelogram and *BCDE* is a straight line.
$AF = 12$ cm, $AB = 9$ cm, angle $CFD = 40°$ and angle $FDE = 80°$.

(i) Calculate the height, h, of the parallelogram.

$h =$ ..... cm [2]

(ii) Explain why triangle *CDF* is isosceles.

.....

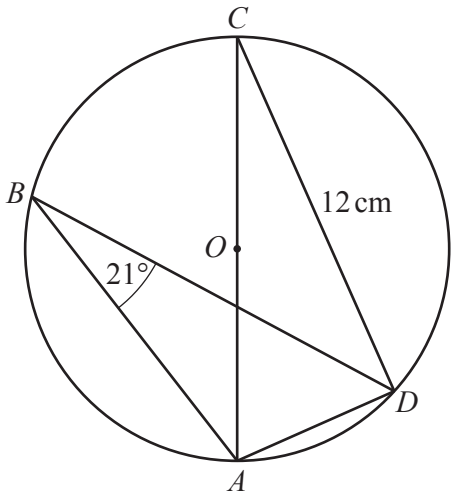
..... [2]

(iii) Calculate the area of the **trapezium** *ABCF*.

..... cm^2 [3]

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(c)



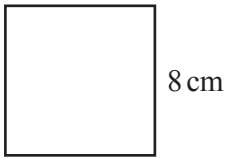
NOT TO SCALE

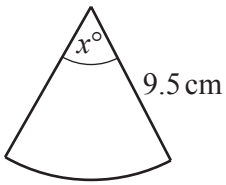
A, B, C and D are points on the circle, centre O.
Angle $ABD = 21°$ and $CD = 12$ cm.

Calculate the area of the circle.

..... cm^2 [5]

(d)





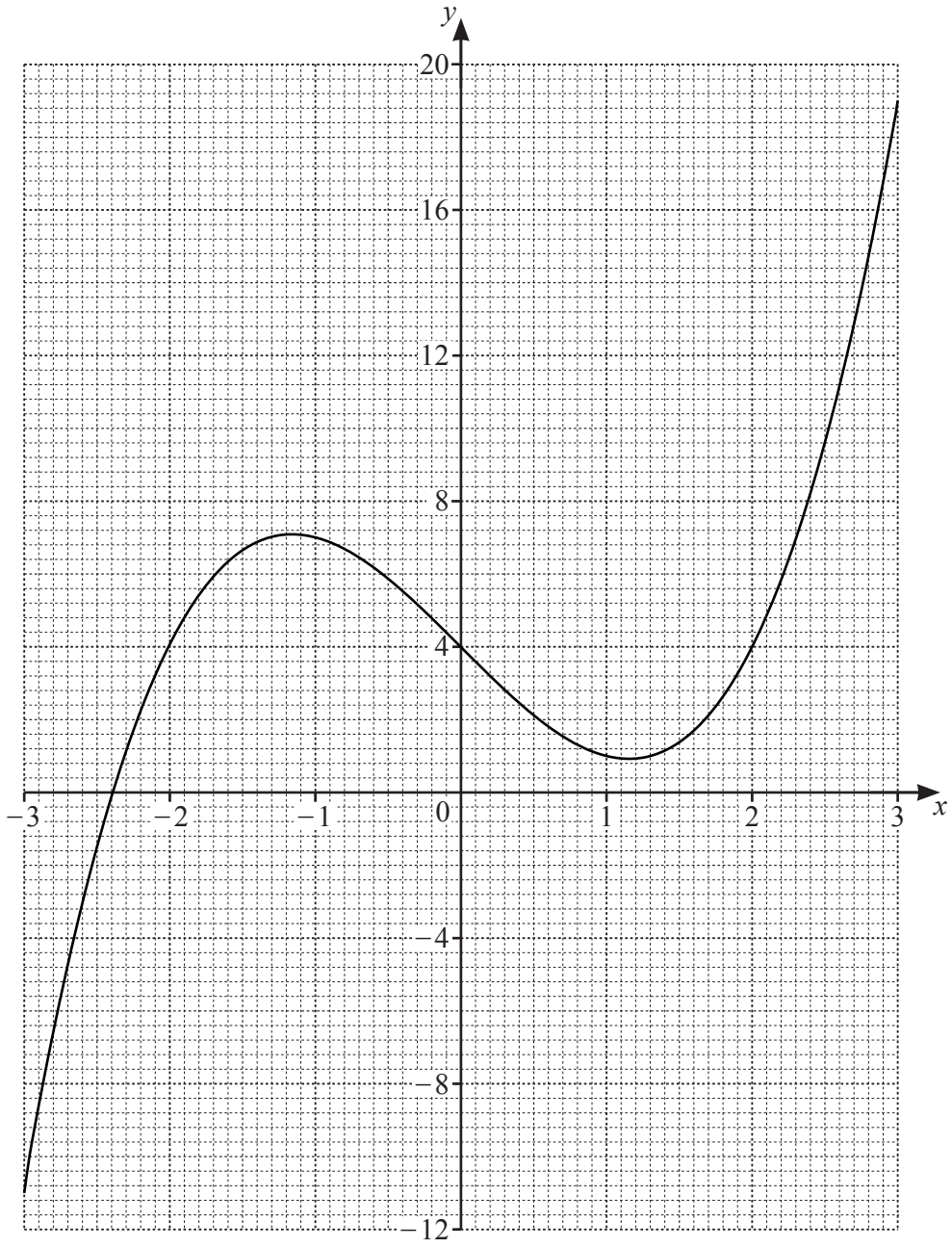
NOT TO SCALE

The diagram shows a square with side length 8 cm and a sector of a circle with radius 9.5 cm and sector angle $x°$.
The perimeter of the square is equal to the perimeter of the sector.

Calculate the value of x.

$x =$ ..... [3]

5 **(a)** The diagram shows the graph of $y = f(x)$ for $-3 \leqslant x \leqslant 3$.



(i) Solve $f(x) = 14$.

$x =$ ..... [1]

(ii) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point $(-2, 4)$.

..... [3]

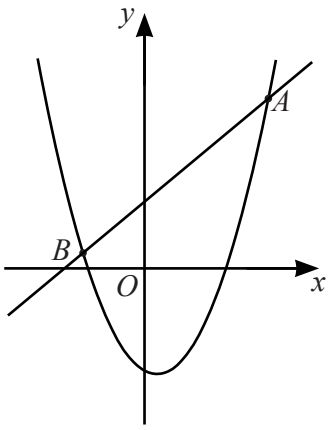
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(iii) By drawing a suitable straight line on the grid, solve $f(x) = 2x - 2$ for $-3 \leqslant x \leqslant 3$.

.

$x =$ ..... [3]

(b)



NOT TO SCALE

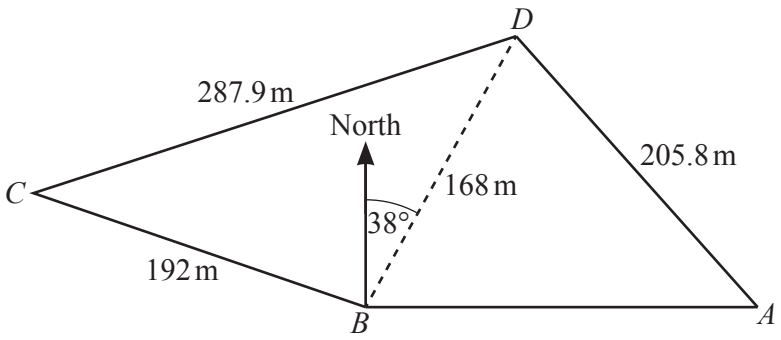
The diagram shows a curve with equation $y = 2x^2 - 2x - 7$.
The straight line with equation $y = 3x + 5$ intersects the curve at the points A and B.

Find the coordinates of the points A and B.

A (..... , ...)

B (..... , ...) [5]

6



NOT TO SCALE

The diagram shows a field, *ABCD*, on horizontal ground.
$BC = 192$ m, $CD = 287.9$ m, $BD = 168$ m and $AD = 205.8$ m.

(a) (i) Calculate angle *CBD* and show that it rounds to 106.0°, correct to 1 decimal place.

[4]

(ii) The bearing of *D* from *B* is 038°.

Find the bearing of *C* from *B*.

..... [1]

(iii) *A* is **due east** of *B*.

Calculate the bearing of *D* from *A*.

..... [5]

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(b) (i) Calculate the area of triangle *BCD*.

..... m^2 [2]

(ii) Tomas buys the triangular part of the field, *BCD*.
The cost is \$35 750 per hectare.

Calculate the amount he pays.
Give your answer correct to the nearest \$100.
[1 hectare = 10 000 m^2]

\$ ..... [2]

7

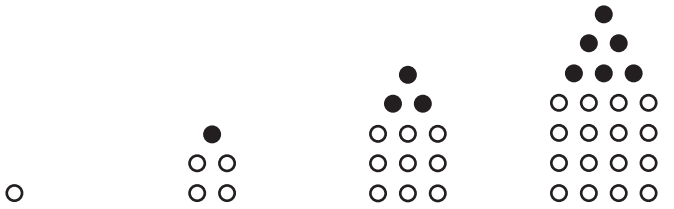


Diagram 1 Diagram 2 Diagram 3 Diagram 4

These are the first four diagrams of a sequence.
The diagrams are made from white dots and black dots.

(a) Complete the table for Diagram 5 and Diagram 6.

Diagram	1	2	3	4	5	6
Number of white dots	1	4	9	16		
Number of black dots	0	1	3	6		
Total number of dots	1	5	12	22		

[2]

(b) Write an expression, in terms of n, for the number of white dots in Diagram n.

..... [1]

(c) The expression for the total number of dots in Diagram n is $\frac{1}{2}(3n^2 - n)$.

(i) Find the total number of dots in Diagram 8.

..... [1]

(ii) Find an expression for the number of black dots in Diagram n.
Give your answer in its simplest form.

..... [2]

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(d) T is the total number of dots used to make **all** of the first n diagrams.

$$T = an^3 + bn^2$$

Find the value of a and the value of b.
You must show all your working.

$a =$ .....

$b =$ ..... [5]

8 **(a)** Factorise completely.

$3a^2b - ab^2$

..... [2]

(b) Solve the inequality.

$3x + 12 < 5x - 3$

..... [2]

(c) Simplify.

$\left(3x^2y^4\right)^3$

..... [2]

(d) Solve.

$\frac{2}{x} = \frac{6}{2-x}$

$x =$ ..... [3]

(e) Expand and simplify.

$(x-2)(x+5)(2x-1)$

..... [3]

(f) Alan invests \$200 at a rate of r% per year compound interest.
After 2 years the value of his investment is \$206.46 .

(i) Show that $r^2 + 200r - 323 = 0$.

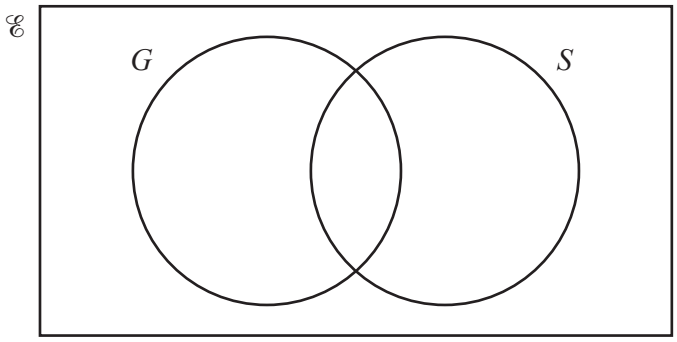
[3]

(ii) Solve the equation $r^2 + 200r - 323 = 0$ to find the rate of interest.
Show all your working and give your answer correct to 2 decimal places.

$r =$ ..... [3]

9 **(a)** There are 32 students in a class.

5 do not study any languages.
15 study German (G).
18 study Spanish (S).



(i) Complete the Venn diagram to show this information. [2]

(ii) A student is chosen at random.

Find the probability that the student studies Spanish but not German.

..... [1]

(iii) A student who studies German is chosen at random.

Find the probability that this student also studies Spanish.

..... [1]

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(b) A bag contains 54 red marbles and some blue marbles.
36% of the marbles in the bag are red.

Find the number of blue marbles in the bag.

..... [2]

(c) Another bag contains 15 red beads and 10 yellow beads.
Ariana picks a bead at random, records its colour and replaces it in the bag.
She then picks another bead at random.

(i) Find the probability that she picks two red beads.

..... [2]

(ii) Find the probability that she does not pick two red beads.

..... [1]

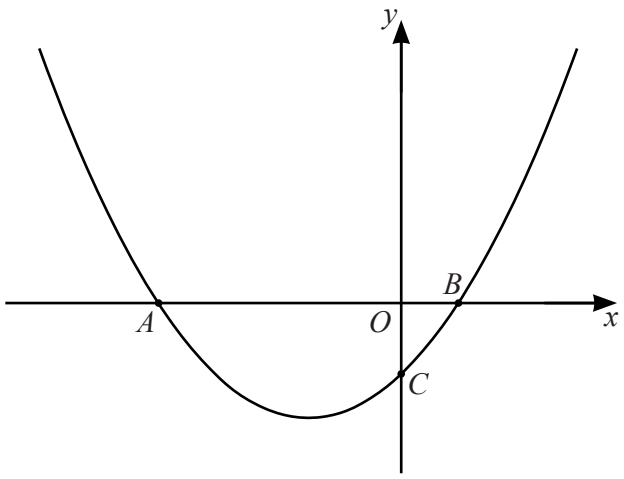
(d) A box contains 15 red pencils, 8 yellow pencils and 2 green pencils.
Two pencils are picked at random without replacement.

Find the probability that at least one pencil is red.

..... [3]

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10 (a)



NOT TO SCALE

The diagram shows a sketch of the curve $y = x^2 + 3x - 4$.

(i) Find the coordinates of the points A, B and C.

A (..... , ...)

B (..... , ...)

C (..... , ...) [4]

(ii) Differentiate $x^2 + 3x - 4$.

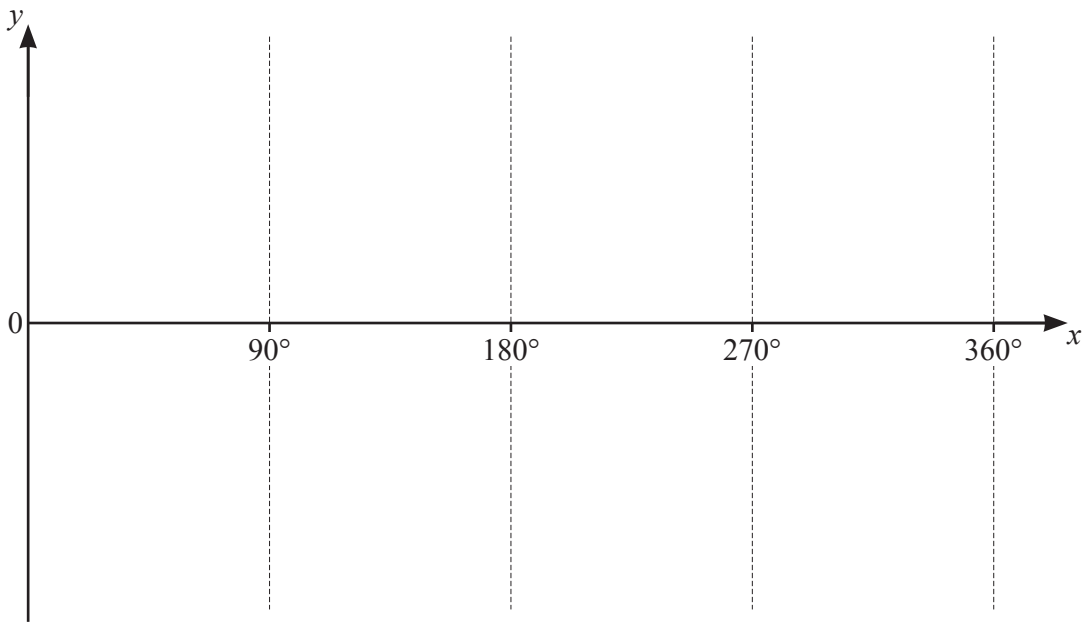
..... [2]

(iii) Find the equation of the tangent to the curve at the point (2, 6).

..... [3]

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(b)



(i) On the diagram, sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $5\tan x = -7$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... or $x =$ ..... [3]

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