THE G C SCHOOL OF CAREERS

MATHEMATICS DEPARTMENT
SCHOOL YEAR 2021 – 2022

SAMPLE EXAMINATION PAPER

FORM 3

INFORMATION TO CANDIDATES

Answer **ALL** the questions in the space provided.

In calculations, you are advised to show all the steps in your working.

Calculator is allowed.

A graph paper is provided.

This paper has **21 questions**.

The total mark for this paper is **114**.

There are 18 pages in this question paper.

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1. Simplify fully:

(a) $9x^4 \div 3x^{-2} =$

Answer: _____

(2)

(b) $(8x^9)^{\frac{1}{3}} =$

Answer: _____

(2)

(c) $\left(\dfrac{x^2}{4}\right)^{-\frac{1}{2}} =$

Answer: _____

(3)

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3. Find the value of x which satisfies the equation

$$4^{3x} = \frac{1}{2}$$

Answer: _____

(3)

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4. Factorize the following expressions completely:

(a) $4x^3 - 9x =$

Answer: _____

(3)

(b) $2x^2 + 9x - 5 =$

Answer: _____

(2)

(c) $6x^2 - 7x + 2 =$

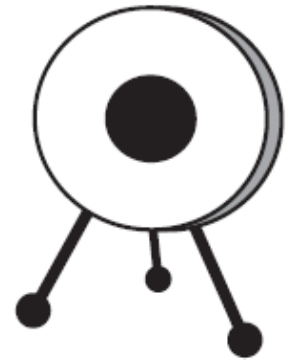**Answer:** _____

(2)

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5. Simplify fully the following expression.

$$\frac{3p - 6}{p^2 - p - 6} \div \frac{p - 2}{p + 2} =$$

Answer: _____

(4)

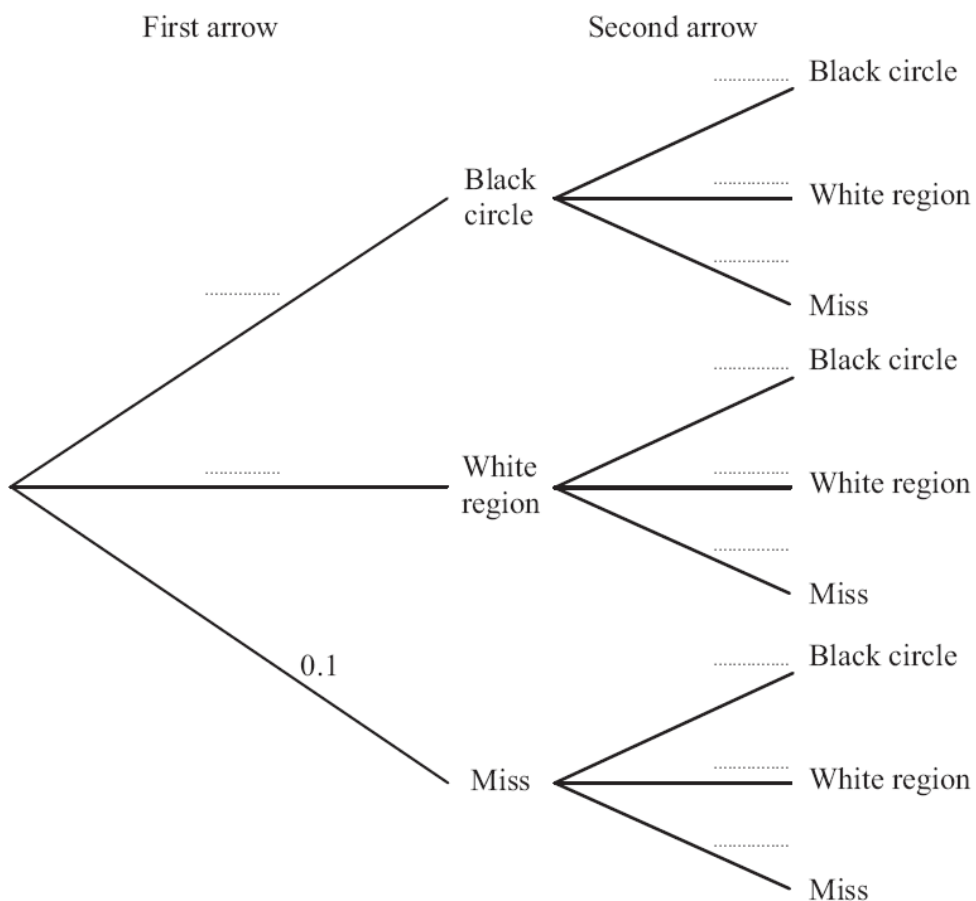**6.** A target has a black circle and a white region.

Arrows can hit the black circle, the white region or miss the target.
Nicos shoots two arrows at the target.
On each shot, the probability that Nicos arrow misses the target is 0.1.
On each shot, the probability that Nicos arrow hits the white region is twice the probability that it hits the black circle.

(a) Complete the probability tree diagram for Nicos two arrows.

First arrow   Second arrow

Black circle

White region

Miss

Black circle

White region

Miss

Black circle

White region

Miss

Black circle

White region

Miss

0.1

Black circle

White region

Miss

(4)

4

(b) An arrow which hits the black circle scores 10 points.

An arrow which hits the white region scores 5 points.
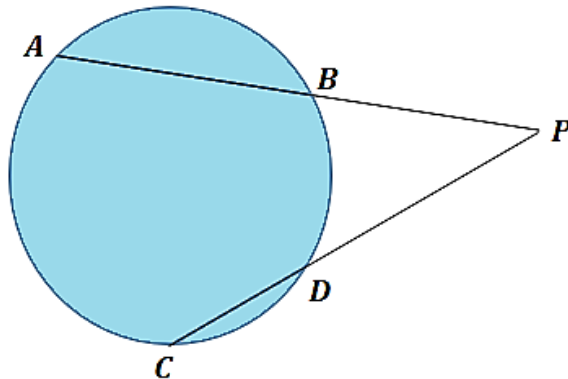An arrow which misses the target scores 0 points.
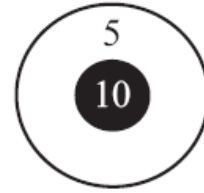
Calculate the probability that Dareios scores exactly 10 points with his 2 arrows.

Answer: _____

(4)

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7. Given that $AB = 7\ cm$, $BP = 5\ cm$ and $CD = 4\ cm$, find the length of DP.

Answer: _____

(4)

8. In the diagram, O is the centre of the circle and B, D and E are points on the circumference.

ABC is a tangent to the circle.
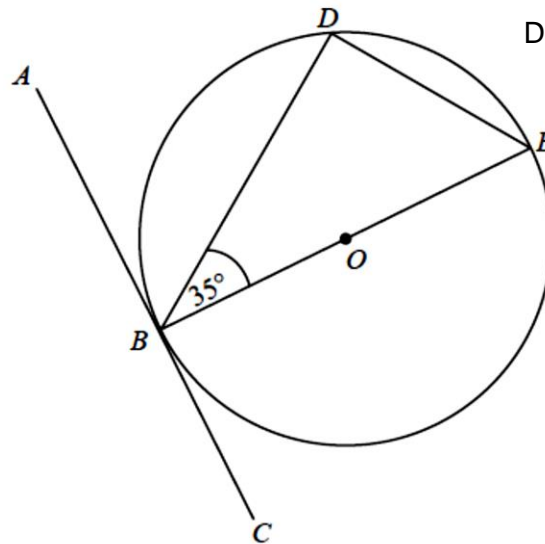
BE is the diameter of the circle.

Angle $DBE = 35°$.

Diagram NOT accurately drawn.

(a) Find the size of the angle DEB. Give reasons for your answer.

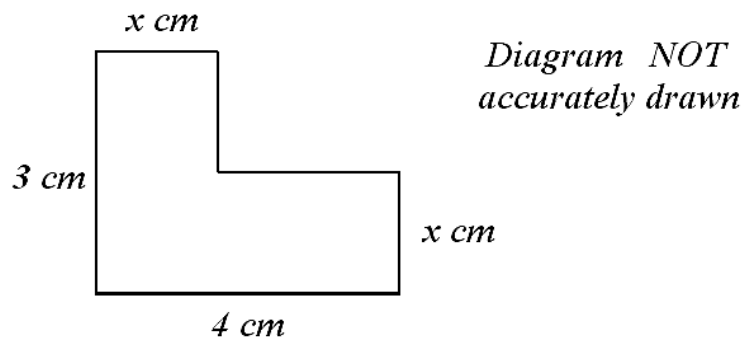**Answer:** Angle $DEB = $ _____ °

(3)

(b) Write down the size of the angle ABD. Give reason for your answer.

Answer: Angle $ABD = $ _____ °

(2)

9. The diagram shows a shape. All the corners are right angles.

The area of the shape is $11 \ cm^2$.

x cm

Diagram NOT accurately drawn

3 cm

x cm

4 cm

(a) Show that $x^2 - 7x + 11 = 0$.

(3)

(b) Find the value of x in the diagram.
Give your answer correct to 3 significant figures.

Answer: _____

(3)

10. Solve the following equations. Give your answer correct to 1 decimal place where necessary.
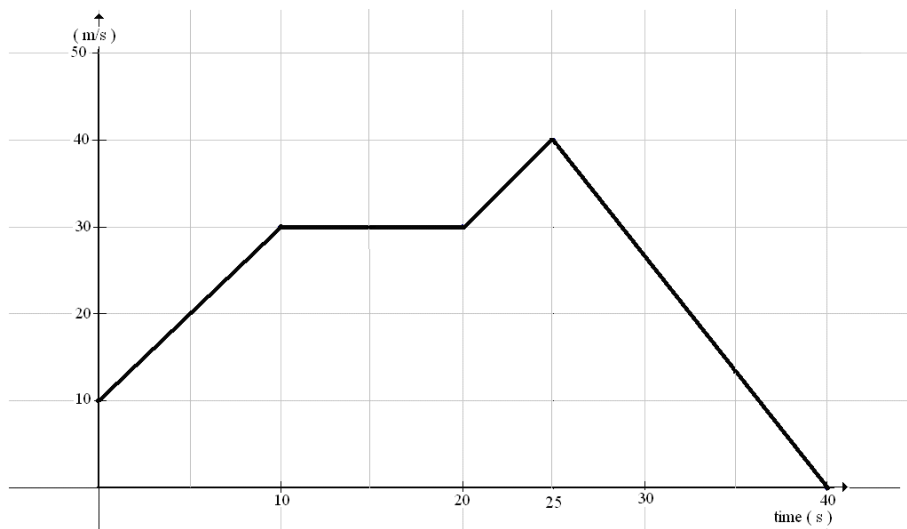
(a) $\dfrac{(x+1)}{2} - \dfrac{3(1-2x)}{5} = \dfrac{3}{10}$

(3)

(b) $\dfrac{2}{x} - \dfrac{5}{x+2} = 4$

(4)

11. The diagram shows the speed – time graph of a motor bike traveling.

Find:

(a) The initial speed of the motor bike.

Answer: _____

(1)

(b) The acceleration when *t = 12* sec.

Answer: _____

(1)

(c) The deceleration.

Answer: _____

(2)

(d) The time *t* at which the car **at rest**.

Answer: _____
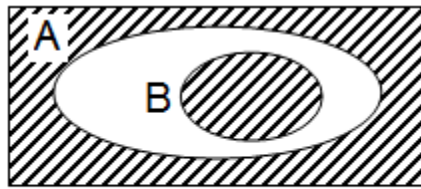
(1)

(e) The distance travelled in 25 seconds.
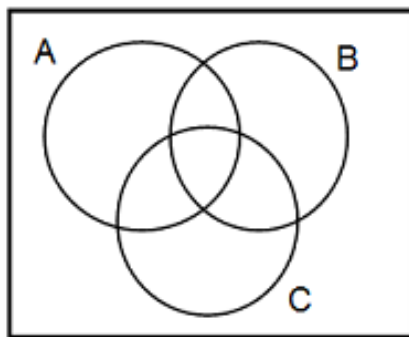
Answer: _____

(3)

12.

(a) Describe the shaded set using set notation.

_____

(1)

(b) On the diagram, shade the set $(A \cap C) \cup B$.

(2)

_____

13. The formula $I = \dfrac{W}{h^2}$ gives the Body Mass Index, I, of a person with weight W kilograms and height h metres.

Jose's weight is $70\ kg$, correct to 1 significant figure.
His height is $1.79\ m$, correct to the nearest centimetre.
Calculate the upper bound of Jose's Body Mass Index, giving your answer correct to 3 decimal places.

Answer: _____

(3)

_____

10

14. There are 80 members at a sports club.

All the members play at least one of the sports.

19 play bowling **only**

8 play cricket **only**
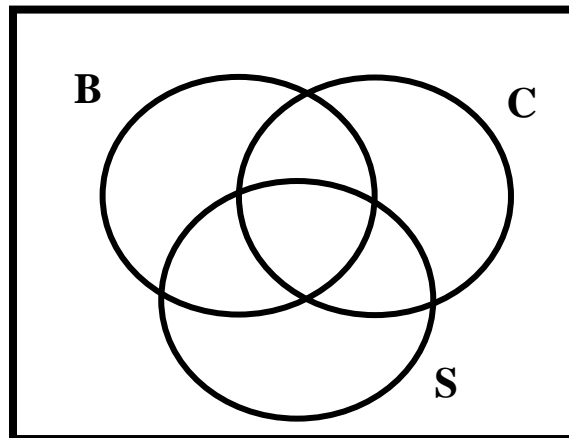
12 play soccer **only**

13 play bowling and cricket

28 play cricket and soccer

3 play bowling and soccer **BUT NOT** cricket

Let x be the members of the club who play bowling, soccer and cricket.

(a) Complete the Venn Diagram to represent the above information.

(4)

(b) Form an equation in x and solve it to find x.

Answer: _____

(2)

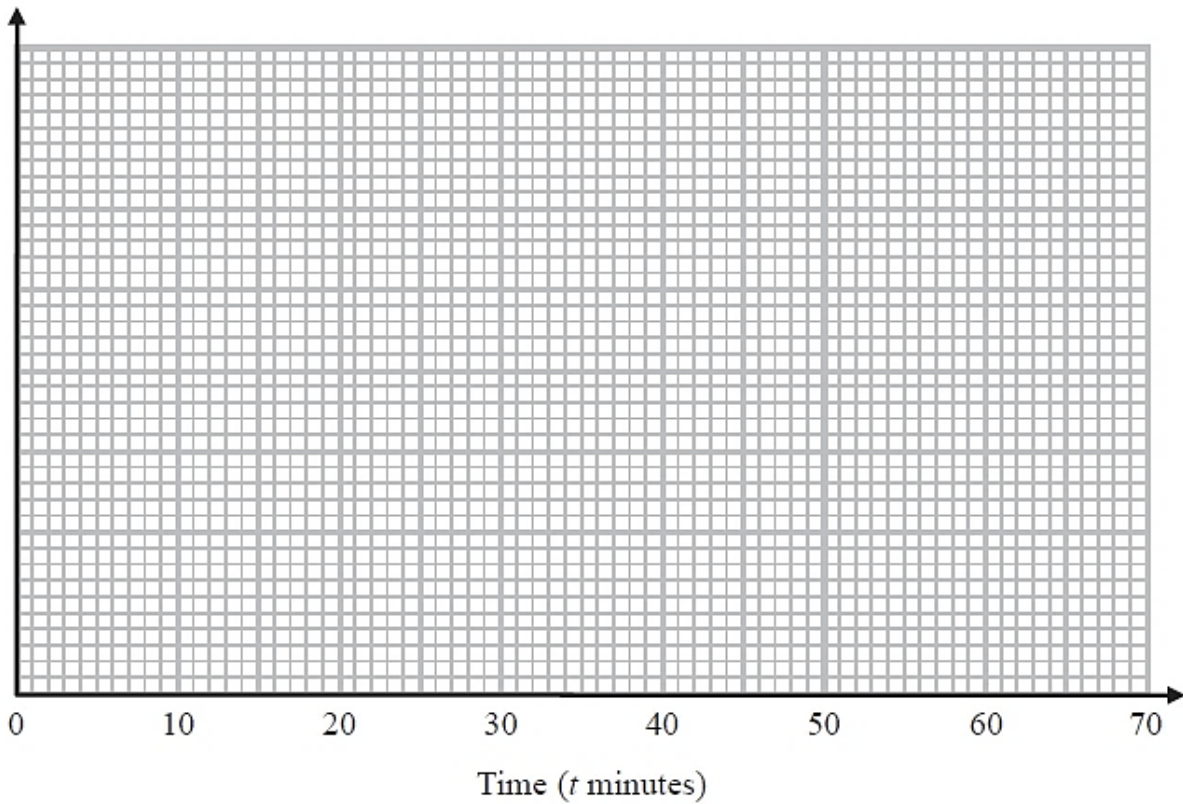**(c)** How many members play exactly 2 sports?

Answer: _____

(1)

15. The table gives information about the lengths of time some people were in the supermarket.

Time (*t* minutes)	Frequency
$0 < t \leq 5$	8
$5 < t \leq 15$	32
$15 < t \leq 30$	36
$30 < t \leq 40$	18
$40 < t \leq 60$	6

(a) On the grid, draw a histogram to show this information.

Time (*t* minutes)

(4)

12

(b) How many people were in the supermarket for a length of time between 20 and 50 minutes?

Answer: _____

(1)

16.(a) Solve the inequality $4(x - 2) < 1 + x$.

Answer: _____

(2)

(b) Solve the inequality $2x^2 \leq 7x + 9$.

Answer: _____

(3)

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17. In the figure below B and C are points on a circle with centre O.

The straight line DCE is a tangent to the circle at C and DA is a tangent to the circle at A. Angle $ABC = 40°$.
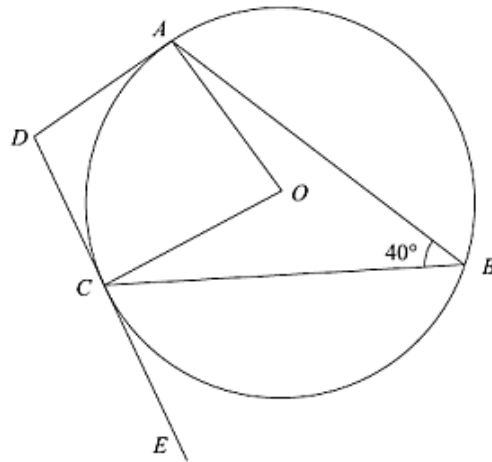

Diagram NOT accurately drawn

By showing all your workings and giving reasons for your answers, calculate the size, in degrees, of:

(a) $< OAC$,

Answer: $< OAC = $ _____ $°$

(4)

(b) $< ADC$.

Answer: $< ADC = $ _____ $°$

(3)

14

18. Solve the following pair of simultaneous equations,

$$y + 2x - 3 = 0$$
$$10 - 3xy = y^2$$

Answer: _____

(4)

19.

(a) Write $\left(3 + \sqrt{12}\right)\left(7 - 2\sqrt{3}\right)$ in the form $a + b\sqrt{3}$, where a and b are integers.

Answer: _____

(3)

(b) Simplify fully $\dfrac{\left(5+2\sqrt{3}\right)\left(5-2\sqrt{3}\right)}{\sqrt{3}}$

Answer: _____

(4)

_____

20.
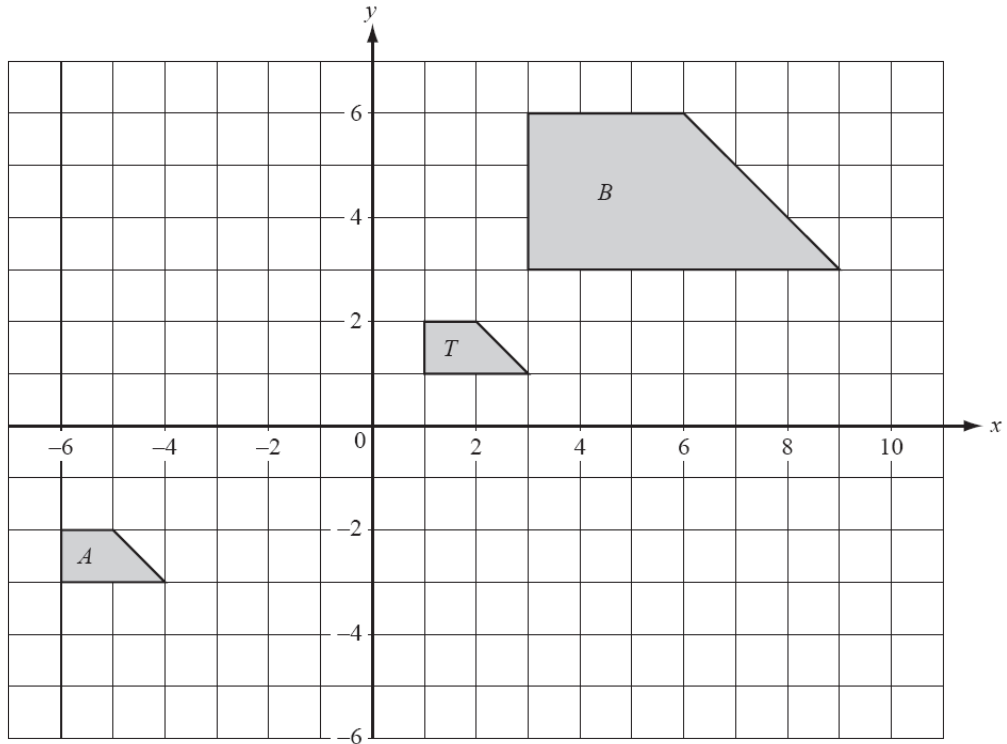
The shapes T, A and B are drawn on the grid.

(a) In each case describe fully the single transformation that maps:

(i) T onto A,

Answer: _____

(2)

(ii) T onto B.

Answer: _____

(3)

(b) Draw on the grid the Rotation of T by 90° anti-clockwise about $(0, 0)$.
Label the image R.

(2)

21.

(a) Complete the table of values for $y = x^3 - 4x$.

x	-3	-2	-1	0	1	2	3
y			3	0			15

(2)

(b) On the grid provided on the following page, draw the graph of $y = x^3 - 4x$,

from $x = -3$ to $x = 3$.

(2)

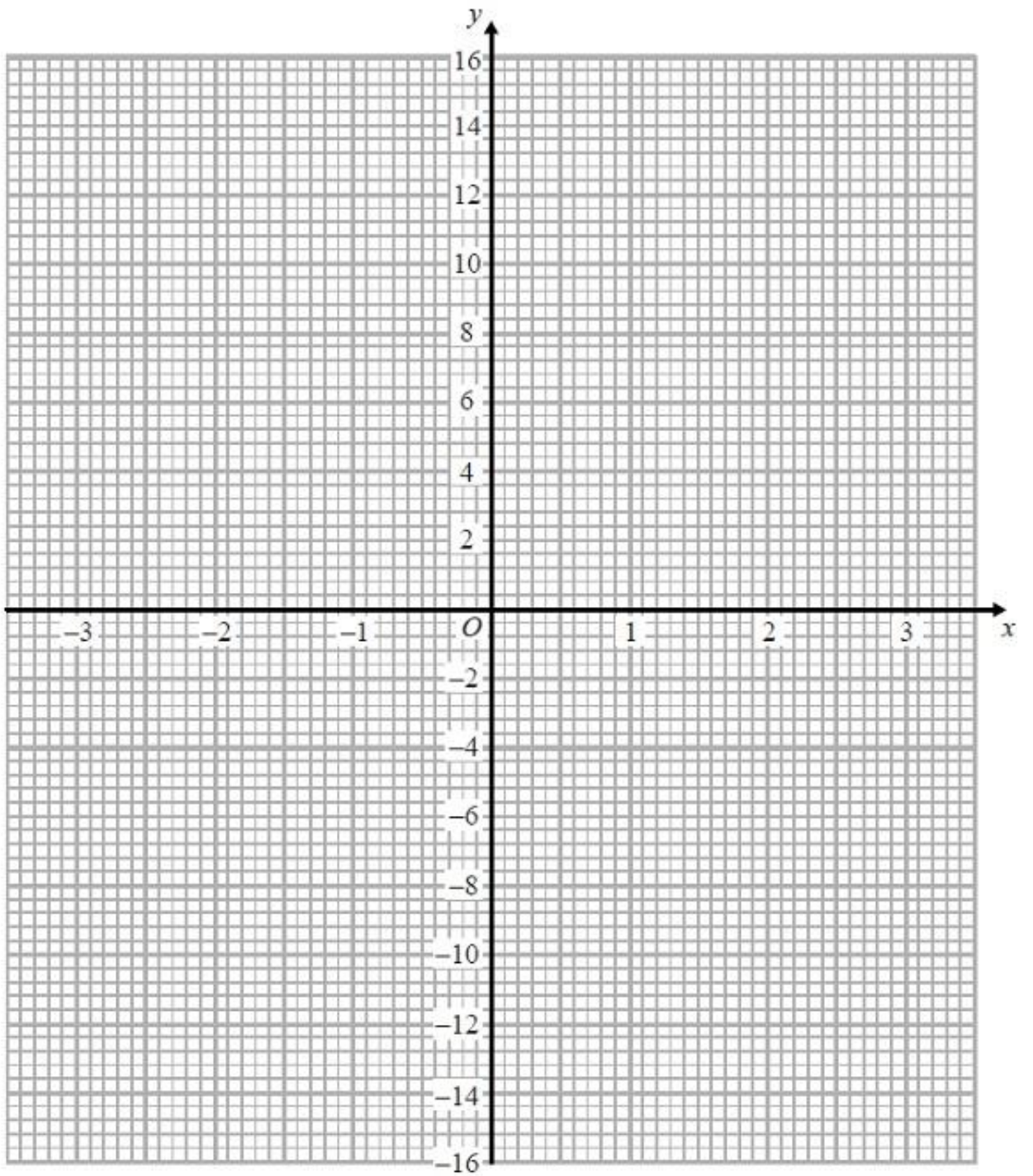**(c) Use the graph** to find the coordinates of the minimum point.

(1)

(d) Use the graph to solve the equation $x^3 - 4x - 4 = 0$.

Show clearly all the steps.

....

(2)

17

Extra Paper