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MATHEMATICS (US) **0444/41**

Paper 4 (Extended) **May/June 2021**

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, center 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 work 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 parentheses [ ].

This document has **20** pages. Any blank pages are indicated.

[Turn over

Formula List

For the equation $ax^2 + bx + c = 0$ $\qquad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\qquad A = 2\pi rh$

Lateral surface area, A, of cone of radius r, sloping edge l. $\qquad A = \pi rl$

Surface area, A, of sphere of radius r. $\qquad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\qquad V = \dfrac{1}{3}Ah$
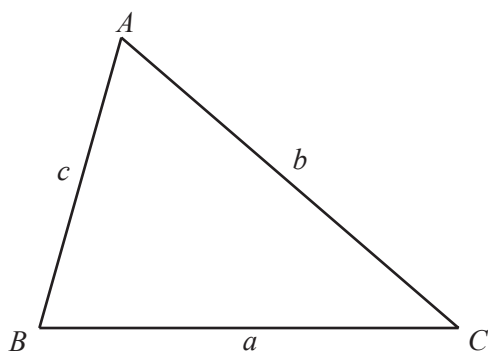
Volume, V, of cone of radius r, height h. $\qquad V = \dfrac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\qquad V = \dfrac{4}{3}\pi r^3$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

$$\text{Area} = \frac{1}{2}bc \sin A$$

3

1 **(a)** The total cost of a taxi journey is calculated as

• $0.50 per kilometer

plus
• $0.40 per minute.

(i) Calculate the total cost of a journey of 32 km that takes 30 minutes.

$ .... [2]

(ii) The total cost of a journey of 100 km is $98.

Show that the time taken is 2 hours.

[3]

(b) Three taxi drivers travel a total of 8190 km in the ratio 5 : 2 : 7.

Calculate the distance each driver travels.

Driver 1 .... km

Driver 2 .... km
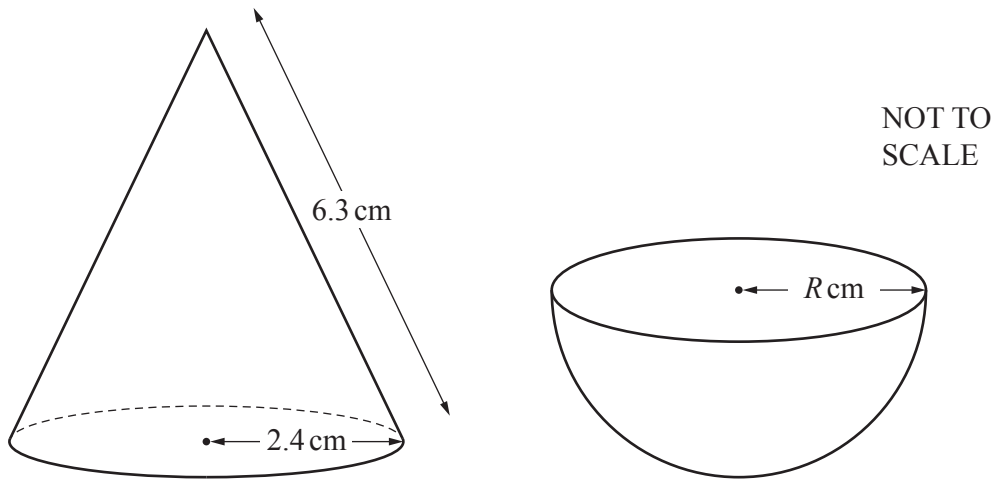
Driver 3 .... km [3]

(c) After midnight, the cost of any taxi journey increases by 45%.
One journey costs $84.10 after midnight.

Calculate the cost of the same journey before midnight.

$ .... [2]

4

2 **(a)**
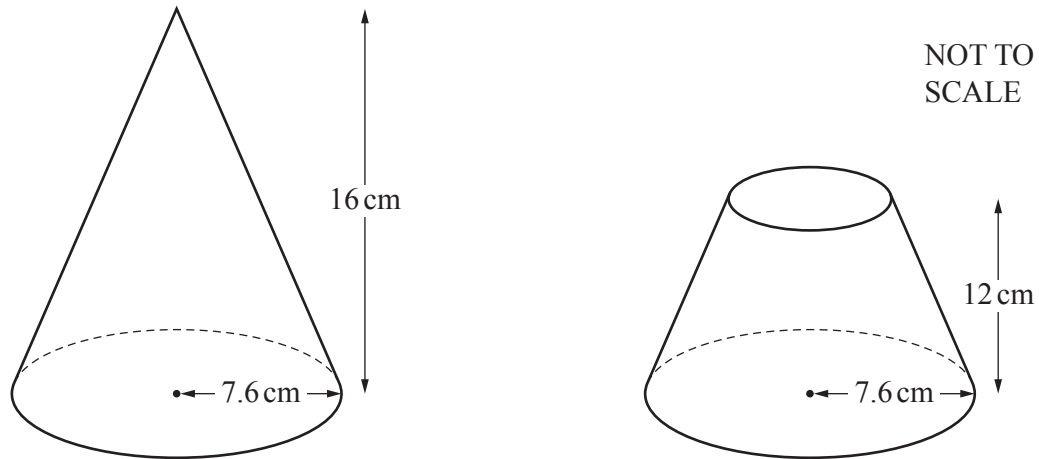

NOT TO
SCALE

6.3 cm

2.4 cm

R cm

The diagram shows a solid cone and a solid hemisphere.
The cone has radius 2.4 cm and slant height 6.3 cm.
The hemisphere has radius *R* cm.
The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

Calculate the value of *R*.

R = ... [4]

(b)

NOT TO SCALE

16 cm

7.6 cm

12 cm

7.6 cm

The diagram shows a solid cone with radius 7.6 cm and height 16 cm.
A cut is made parallel to the base of the cone and the top section is removed.
The remaining solid has height 12 cm, as shown in the diagram.

Calculate the volume of the remaining solid.

.... cm³ [4]

6

3 **(a)** The exchange rate is 1 euro = \$1.142 .

  (i) Johann changes \$500 into euros.

  Calculate the number of euros Johann receives.
  Give your answer correct to the nearest euro.

  .... euros [2]

  (ii) Johann buys a computer for \$329.
  The same computer costs 275 euros.

  Calculate the difference in cost in dollars.

  \$ .... [2]

(b) Lucy spends $\frac{3}{8}$ of the money she has saved this month on a book that costs \$5.25 .

  Calculate how much money Lucy has saved this month.

  \$ .... [2]

(c) Kamal invests \$6130 at a rate of r% per year compound interest.
  The value of his investment at the end of 5 years is \$6669.

  Calculate the value of r.

  $r =$ .... [3]

4 **(a)** **(i)** Write 0.00307 in scientific notation.

.... [1]

(ii) Work out $7.8 \times 10^{200} + 7.8 \times 10^{201}$, giving your answer in scientific notation.

.... [2]

(b) Find the least common multiple (LCM) of 48 and 90.

.... [2]

(c) Expand and simplify.
$$(a\sqrt{3} + 3\sqrt{2})^2$$

.... [3]

(d) Simplify $\sqrt{175} + \sqrt{700}$.
You must show all your work.

.... [2]

5 **(a)**
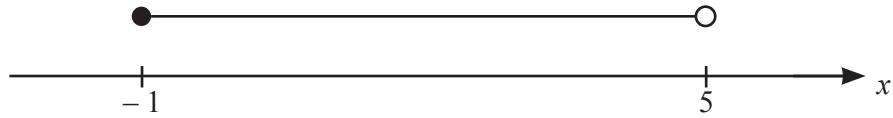
(i) Write down the inequality shown by this number line.

.... [2]

(ii) Find the integers that satisfy this inequality.

.... [2]

(b) Solve the inequality.

$$\frac{3x-2}{4} > 2x$$

.... [2]

(c)
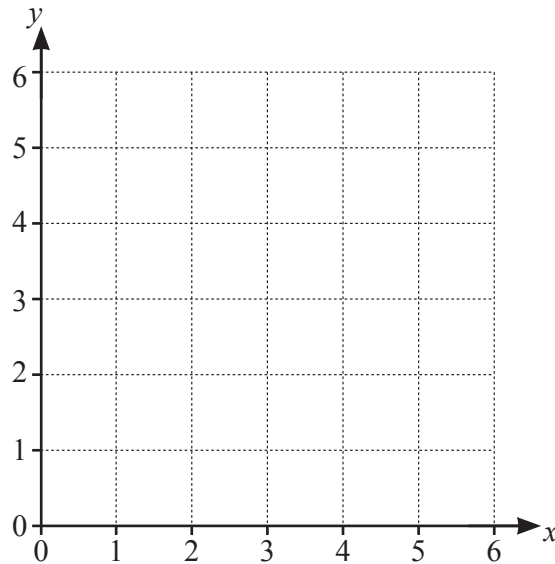
On the grid, find and label the region, R, bounded by the following inequalities.

$x \leqslant 5$ $\qquad$ $y \geqslant 1$ $\qquad$ $y \leqslant x$ $\qquad$ $x+y \geqslant 5$ $\qquad$ [5]

6

NOT TO
SCALE
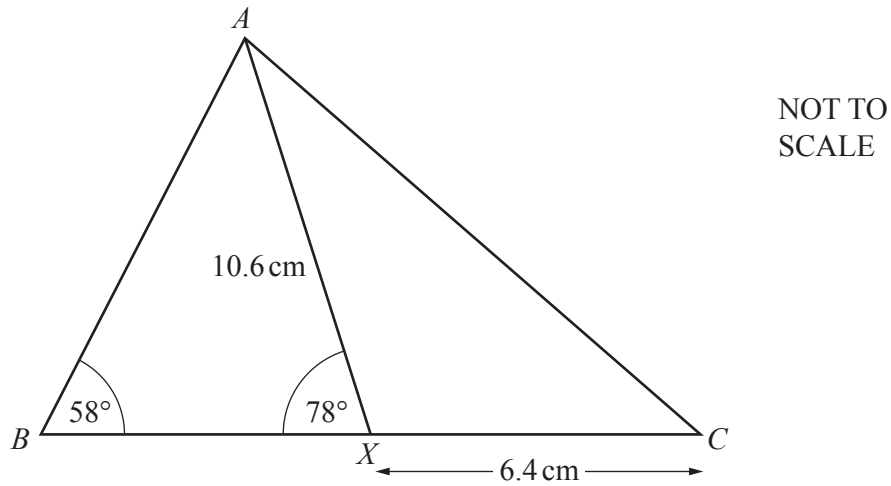
The diagram shows triangle *ABC*.
X is a point on *BC*.
AX = 10.6 cm, *XC* = 6.4 cm, angle *ABC* = 58°, and angle *AXB* = 78°.

(a) Calculate *AC*.

AC = ... cm [4]

(b) Calculate *BX*.

BX = ... cm [4]

(c) Calculate the area of triangle *ABC*.

.... cm^2 [3]

7 **(a)** Factor.
$$3x - 1 - y + 3xy$$

.... [2]

(b) Simplify.

$$\frac{x^2 - 25}{x^2 - x - 20}$$

.... [3]

(c) Write as a single fraction in its simplest form.

$$\frac{x+5}{x} + \frac{x+8}{x-1}$$

.... [3]

8 **(a)**
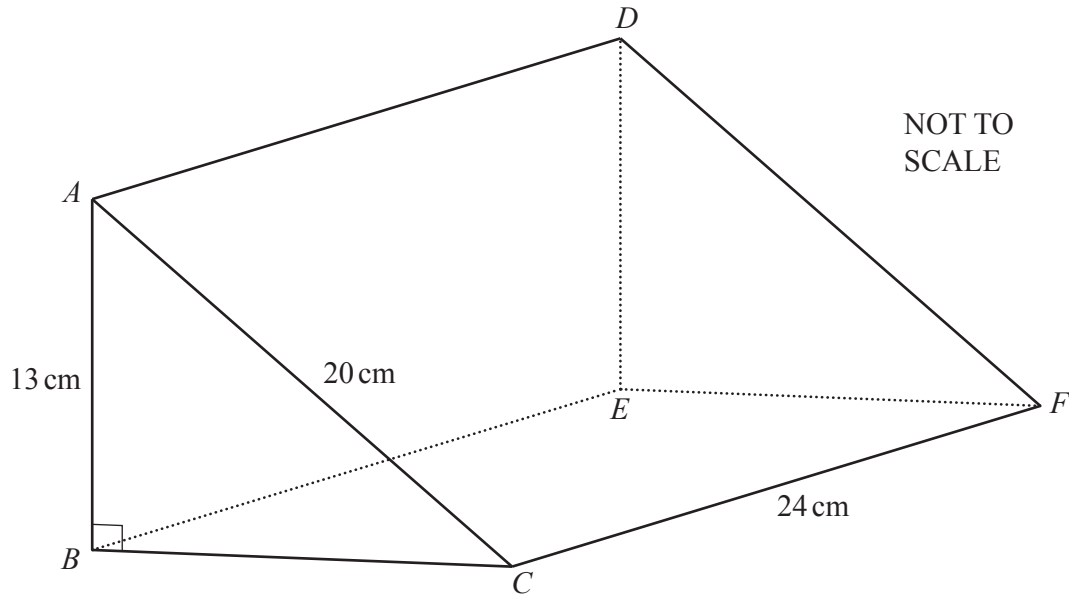
The diagram shows a prism, *ABCDEF*.
AB = 13 cm, *AC* = 20 cm, *CF* = 24 cm, and angle *ABC* = 90°.

(i) Calculate the total surface area of the prism.

.... cm^2 [6]

(ii) Calculate the volume of the prism.

.... cm^3 [1]

(b) A sector of a circle with radius 6 cm has a sector angle of 50°.

Calculate the perimeter of the sector.

.... cm [3]

9 **(a)** The table shows information about the mass, in kilograms, of each of 50 children.

Mass (k kg)	$0 < k \leqslant 10$	$10 < k \leqslant 25$	$25 < k \leqslant 35$	$35 < k \leqslant 40$	$40 < k \leqslant 50$
Frequency	3	19	21	5	2

(i) Complete the cumulative frequency table.

Mass (k kg)	$k \leqslant 10$	$k \leqslant 25$	$k \leqslant 35$	$k \leqslant 40$	$k \leqslant 50$
Cumulative frequency					

[2]

(ii) On the grid, draw a cumulative frequency curve to show this information.
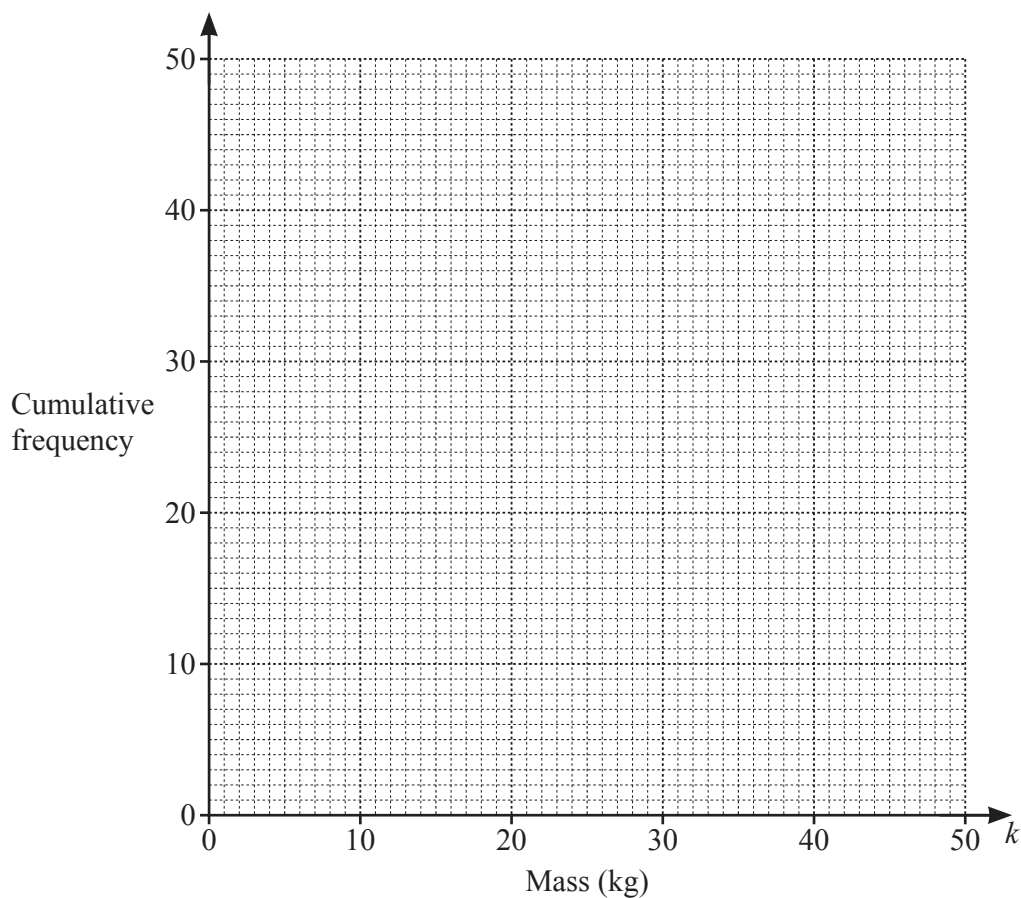
[3]

(iii) Use your diagram to find an estimate of the number of children with a mass of 32 kg or less.

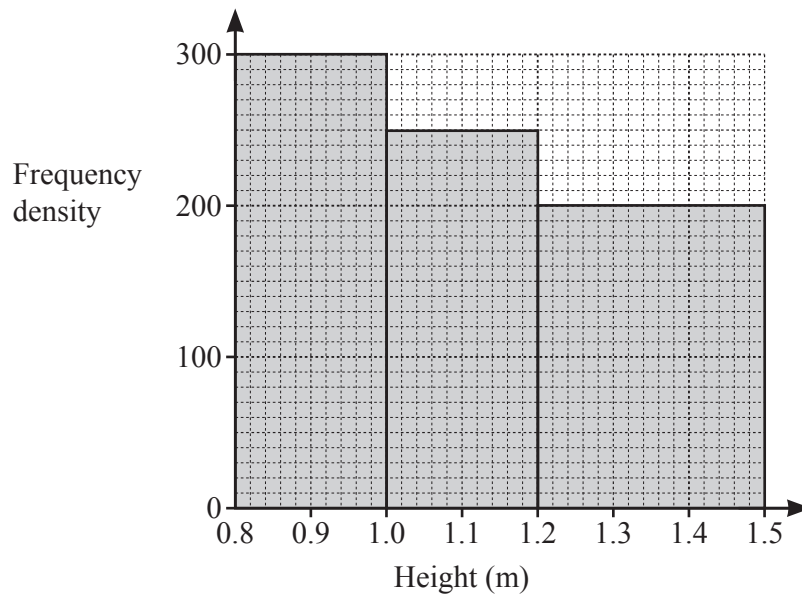.. [1]

(iv) Two of the 50 children are chosen at random.

Find the probability that one child has a mass of 25 kg or less and the other child has a mass of more than 25 kg.
Give your answer correct to 3 decimal places.

.... [3]

(b)

The histogram shows information about the heights, in meters, of 170 children.

Calculate an estimate of the mean height.

.... m [5]

10 (a) Find the size of an exterior angle of a regular polygon with 18 sides.

.... [2]

(b)
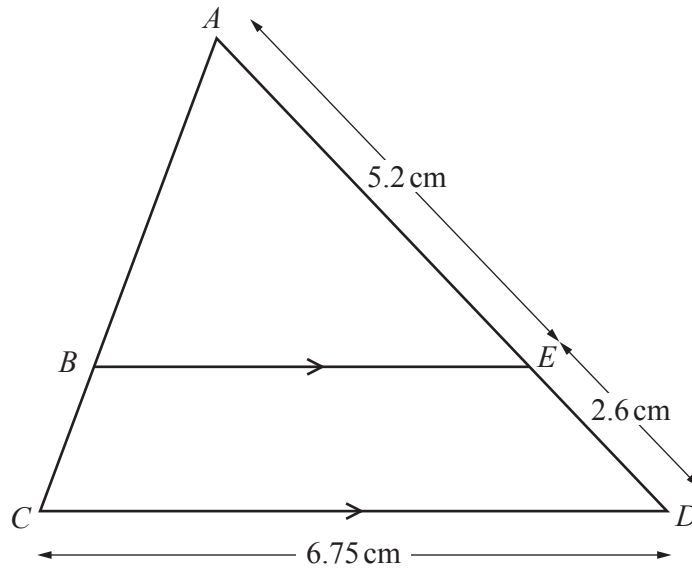
In triangle *ACD*, *B* lies on *AC* and *E* lies on *AD* such that *BE* is parallel to *CD*.
AE = 5.2 cm and *ED* = 2.6 cm.
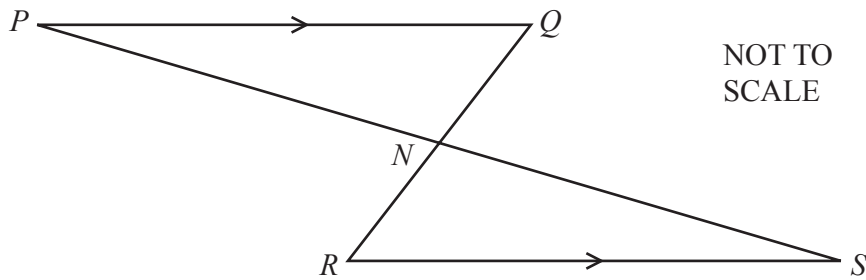
Calculate *BE*.

BE = ... cm [2]

15

(c) Two solids are mathematically similar.
The smaller solid has height 2 cm and volume 32 cm³.
The larger solid has volume 780 cm³.

Calculate the height of the larger solid.

.... cm [3]

(d)

PQ is parallel to *RS*, *PNS* is a straight line and *N* is the midpoint of *RQ*.

Explain, giving reasons, why triangle *PQN* is congruent to triangle *SRN*.

....

....

....

.... [4]

11 $f(x) = 3 - 2x$ $g(x) = x^2 + 5$ $h(x) = x^3$ $j(x) = 3^x$

(a) Find f(5).

.... [1]

(b) Find f(j(5)).

.... [2]

(c) Find f(f(x)).
Give your answer in its simplest form.

.... [2]

(d) Solve $g(x) = f(x) + 7$.
Give your answers in the form $p \pm q\sqrt{6}$.

.... [4]

(e) (i) Find $f^{-1}(x)$.

$f^{-1}(x) = $ .... [2]

(ii) Find $h^{-1}(x)$.

$h^{-1}(x) = $ .... [1]

(f) Find x when $j^{-1}(x) = -2$.

$x = $ .... [2]

12 The table shows some values of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.

x	-1	-0.5	0	1	2	3	4	4.5	5
y	-2			6		6			-2

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.
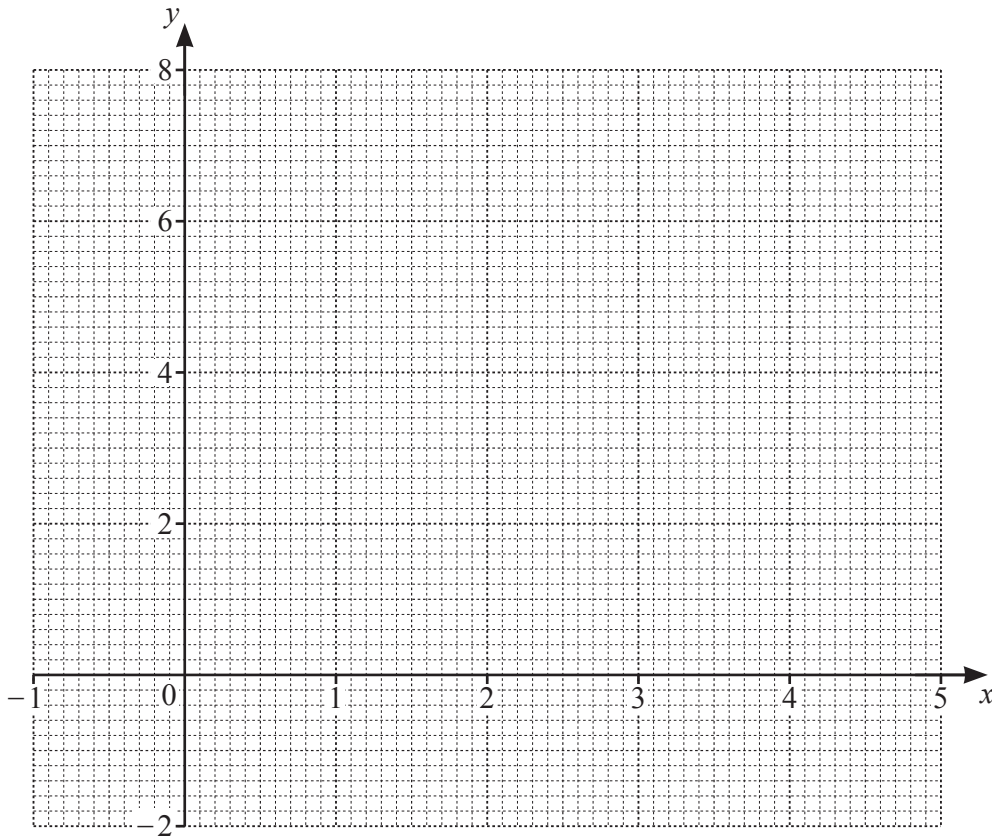
[4]

(c) Write down an **integer** value of k for which the equation $3 + 4x - x^2 = k$ has no solutions.

.... [1]

(d) By drawing a suitable tangent, estimate the slope of the curve when $x = 3$.

.... [2]

(e) By drawing a suitable straight line on the grid, solve the equation $-1 + \dfrac{9}{2}x - x^2 = 0$.

$x =$ .... or $x =$ .... [4]

20

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