Cambridge IGCSE™

CANDIDATE NAME

CENTER NUMBER

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MATHEMATICS (US)   **0444/41**

Paper 4 (Extended)   **May/June 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, 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. 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. $\qquad V = \dfrac{4}{3}\pi r^3$
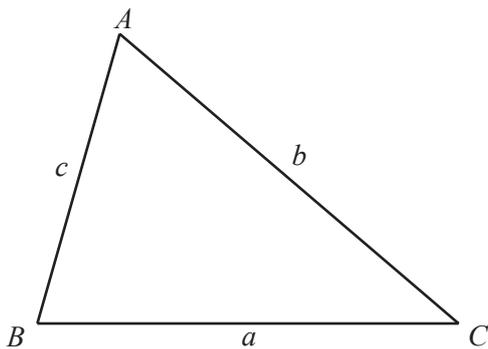
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1
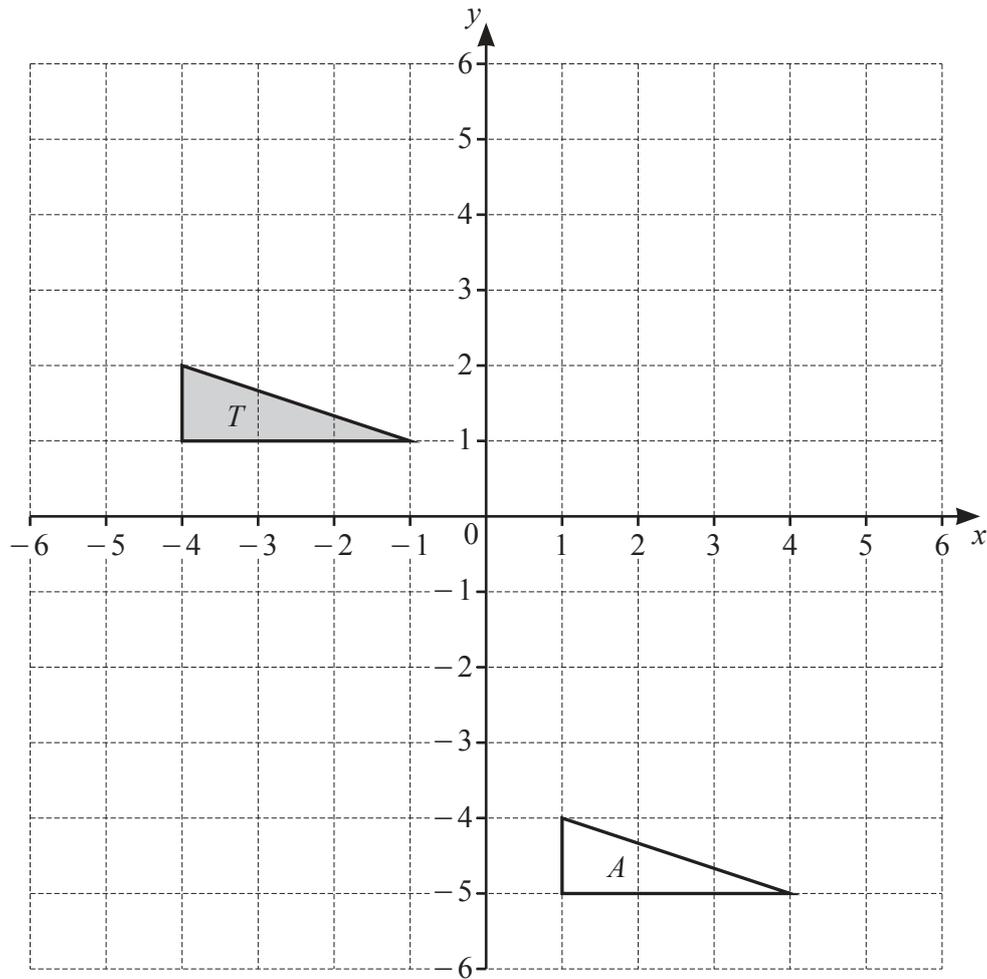
(a) Draw the image of triangle *T* after a reflection in the line *y* = −1.   [2]

(b) Draw the image of triangle *T* after a rotation through 90° clockwise about (0, 0).   [2]

(c) Describe fully the **single** transformation that maps triangle *T* onto triangle *A*.

....

.... [2]

2 **(a)** In 2018, Gretal earned $32 000.

    (i) She paid tax of 24% on these earnings.

       Work out the amount she paid in tax in 2018.

$ .... [2]

    (ii) In 2019, Gretal's earnings increased by 7%.

       Work out her earnings in 2019.

$ .... [2]

(b) Gretal invests $5000 at a rate of 2% per year compound interest.

Calculate the value of her investment at the end of 3 years.

$ .... [2]

(c) One month, Gretal spent a total of $360 on presents.
She spent $\frac{1}{5}$ of this total on presents for her parents.
She spent $\frac{2}{3}$ of the remaining money on presents for her friends.
She spent the rest of the money on presents for her sisters.

Calculate the percentage of the $360 that she spent on presents for her sisters.

.... % [4]

(d) Arjun earned \$36 515 in 2019.
This was an increase of 9% on his earnings in 2018.

Work out his earnings in 2018.

\$ .... [2]

(e) Arjun and Gretal each pay rent.

In 2018, the ratio of the amount each paid in rent was Arjun : Gretal = 5 : 7.
In 2019, the ratio of the amount each paid in rent was Arjun : Gretal = 9 : 13.

Arjun paid the same amount of rent in both 2018 and 2019.
Gretal paid \$290 more rent in 2019 than she did in 2018.

Work out the amount Arjun paid in rent in 2019.

\$ .... [4]

3 The heights, *h* meters, of the 120 boys in an athletics club are recorded.
The table shows information about the heights of the boys.

Height (h meters)	$1.3 < h \leqslant 1.4$	$1.4 < h \leqslant 1.5$	$1.5 < h \leqslant 1.6$	$1.6 < h \leqslant 1.7$	$1.7 < h \leqslant 1.8$	$1.8 < h \leqslant 1.9$
Frequency	7	18	30	24	27	14

(a) (i) Write down the modal class.

.... $< h \leqslant$ .... [1]

(ii) Calculate an estimate of the mean height.

.... m [4]

(b) (i) One boy is chosen at random from the club.

Find the probability that this boy has a height greater than 1.8 m.

.... [1]

(ii) Three boys are chosen at random from the club.

Calculate the probability that one of the boys has a height greater than 1.8 m and the other two boys each have a height of 1.4 m or less.

.... [4]

(c) (i) Use the frequency table on page 6 to complete the cumulative frequency table.

Height (h meters)	h ⩽ 1.4	h ⩽ 1.5	h ⩽ 1.6	h ⩽ 1.7	h ⩽ 1.8	h ⩽ 1.9
Cumulative frequency	7	25				

[2]

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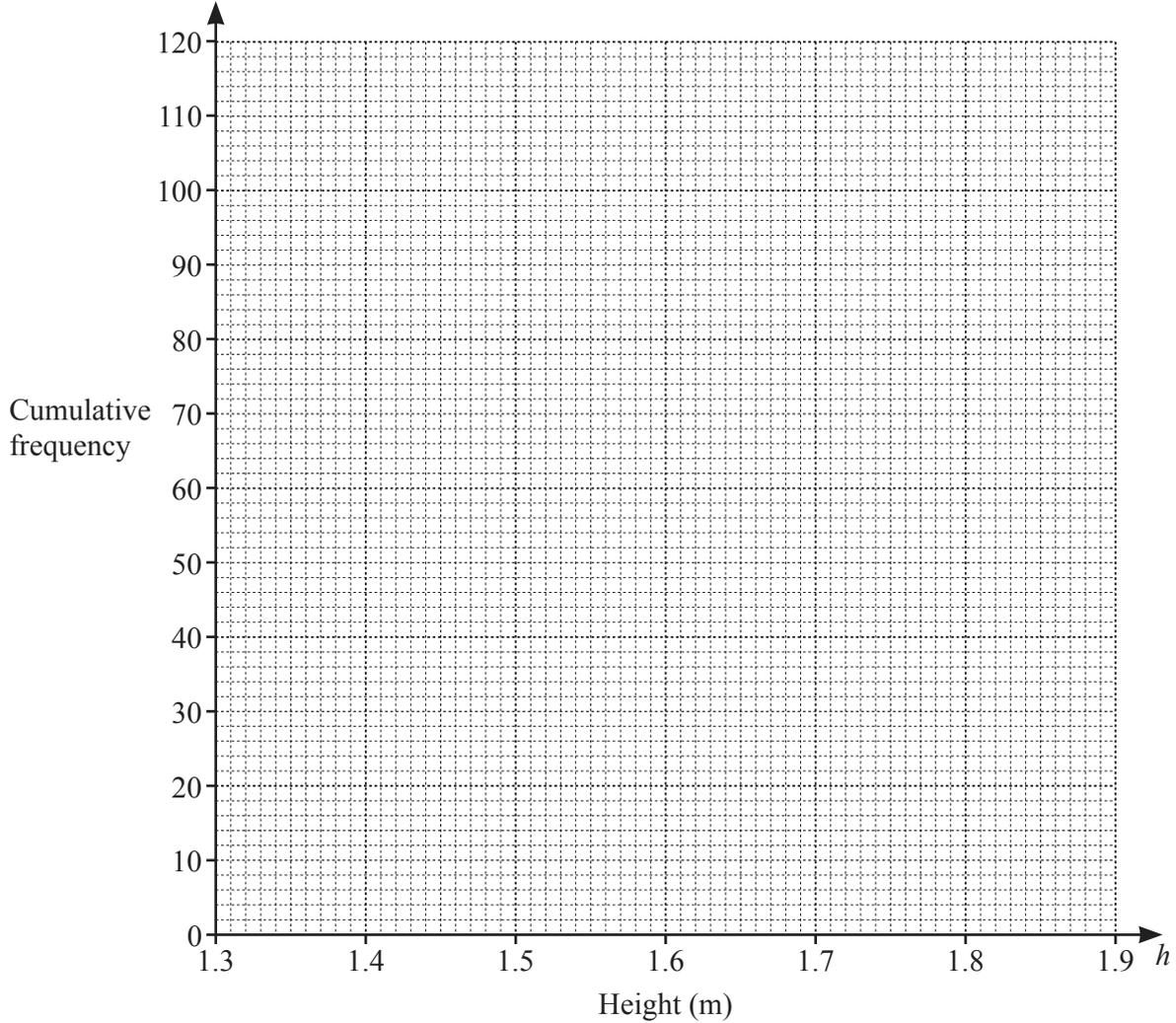
[3]

(d) Use your diagram to find an estimate for

(i) the median height,

.... m [1]

(ii) the 40th percentile.

.... m [2]

4 **(a)** $s = ut + \frac{1}{2}at^2$

Find the value of s when $u = 5.2$, $t = 7$ and $a = 1.6$.

$s =$ .... [2]

(b) Simplify.

(i) $3a - 5b - a + 2b$

.... [2]

(ii) $\dfrac{5}{3x} \times \dfrac{9x}{20}$

.... [2]

(c) Solve.

(i) $\dfrac{15}{x} = -3$

$x =$ .... [1]

(ii) $4(5 - 3x) = 23$

$x =$ .... [3]

(d) Simplify.
$$(27x^9)^{\frac{2}{3}}$$

.... [2]

(e) Expand and simplify.
$$(3x - 5y)(2x + y)$$

.... [2]

5

North

B

80 m

A

72°

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115 m

C
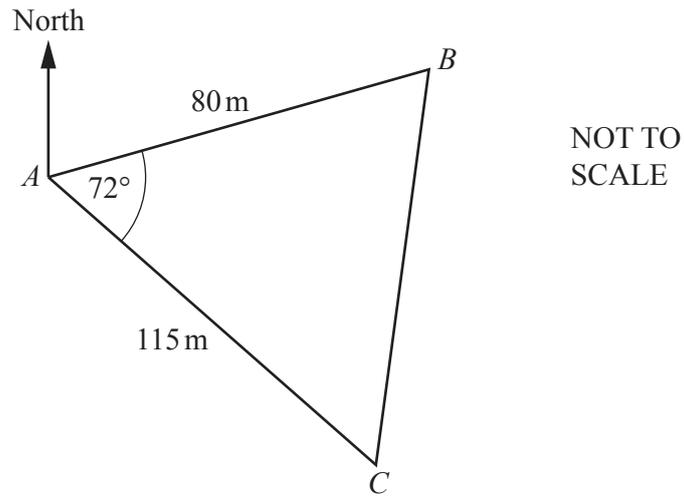
The diagram shows the positions of three points *A*, *B*, and *C* in a field.

(a) Show that *BC* is 118.1 m, correct to 1 decimal place.

[3]

(b) Calculate angle *ABC*.

Angle *ABC* = ... [3]

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(c) The bearing of C from A is 147°.

Find the bearing of

(i) A from B,

.... [3]

(ii) B from C.

.... [2]

(d) Mitchell takes 35 seconds to run from A to C.

Calculate his average running speed in kilometers per hour.

.... km/h [3]

(e) Calculate the shortest distance from point B to AC.

.... m [3]

6 **(a)** **(i)** On the axes, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.
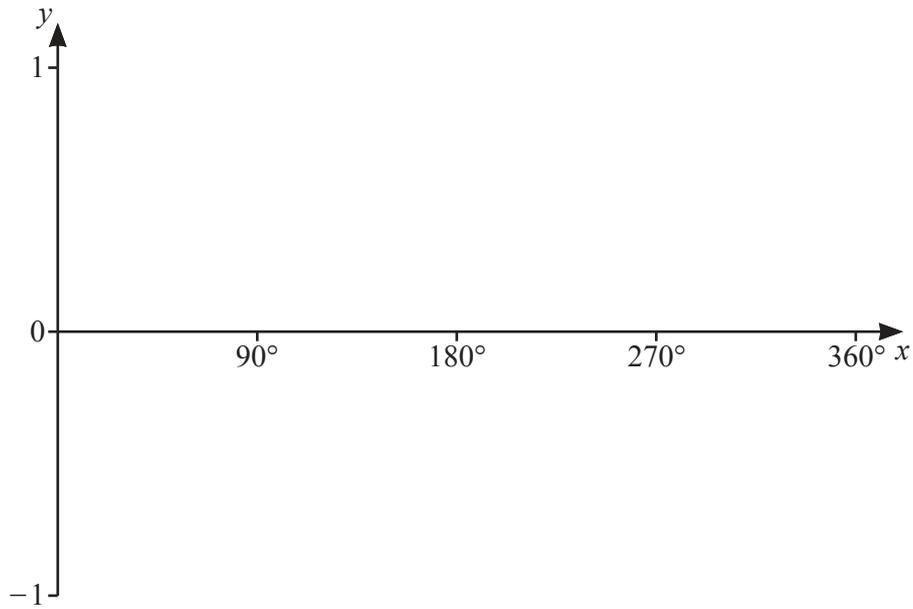
[2]

(ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

....

.... [2]

(iii) On the same diagram, sketch the line $y = \dfrac{1}{2}$. [1]

(iv) Find the two exact values of x when $\sin x = \dfrac{1}{2}$ for $0° \leqslant x \leqslant 360°$.

$x =$ .... or $x =$ .... [2]

(b) (i) Write $x^2 + 10x + 14$ in the form $(x+a)^2 + b$.

.... [2]

(ii) Write down the coordinates of the minimum point on the graph of $y = x^2 + 10x + 14$.

(......................... , ...) [2]

(iii) On the axes, sketch the graph of $y = x^2 + 10x + 14$.
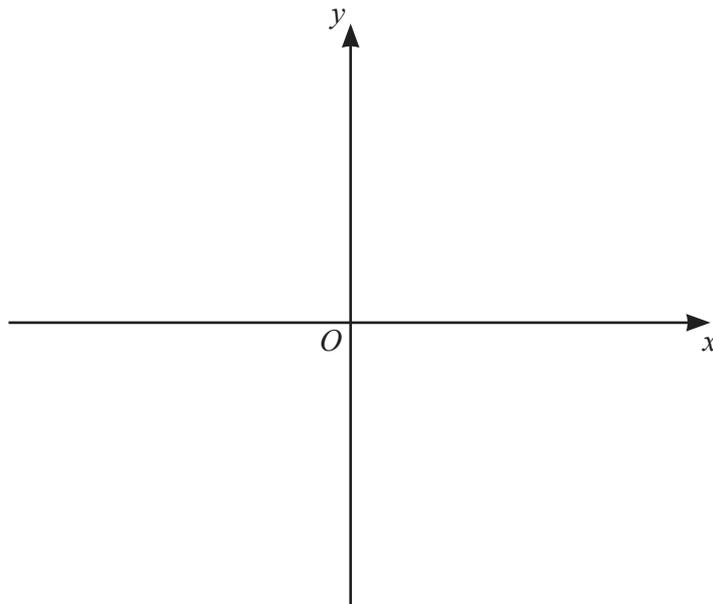
[1]

7
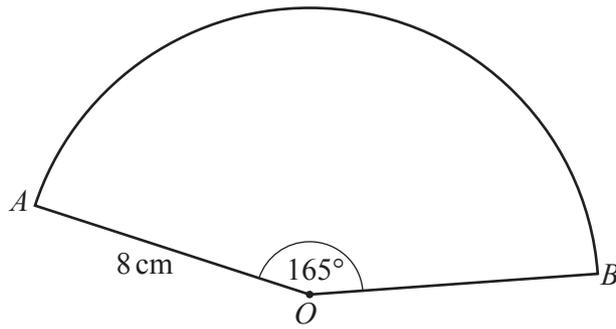
NOT TO SCALE

The diagram shows a sector of a circle with center O, radius 8 cm and sector angle 165°.

(a) Calculate the total perimeter of the sector.

.... cm [3]

(b) The surface area of a sphere is the same as the area of the sector.

Calculate the radius of the sphere.

.... cm [4]

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(c)
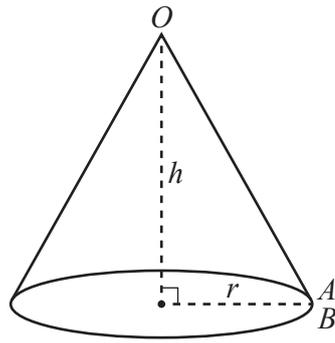
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A cone is made from the sector by joining *OA* to *OB*.

(i) Calculate the radius, *r*, of the cone.

$r =$ .... cm [2]

(ii) Calculate the volume of the cone.

.... cm^3 [4]

8 A rhombus *ABCD* has a diagonal *AC* where *A* is the point $(-3, 10)$ and *C* is the point $(4, -4)$.

(a) Calculate the length *AC*.

.... [3]

(b) Show that the equation of the line *AC* is $y = -2x + 4$.

[2]

(c) Find the equation of the line *BD*.

.... [4]

9 **(a)** The cost of one apple is a cents and the cost of one pear is p cents.
5 apples and 1 pear cost a total of $2.21 .
3 apples and 2 pears cost a total of $1.97 .

Find the value of a and the value of p.

$a =$ ....

$p =$ .... [5]

(b)
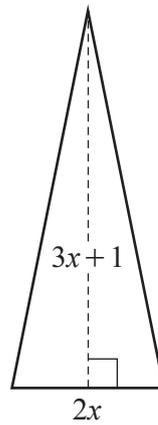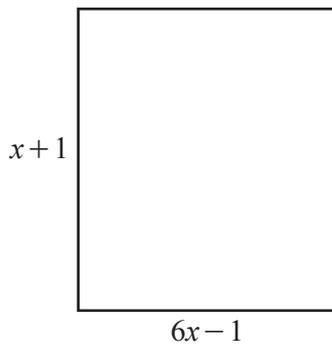
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The area of the rectangle is double the area of the triangle.

Find the value of x.

$x =$ .... [4]

10
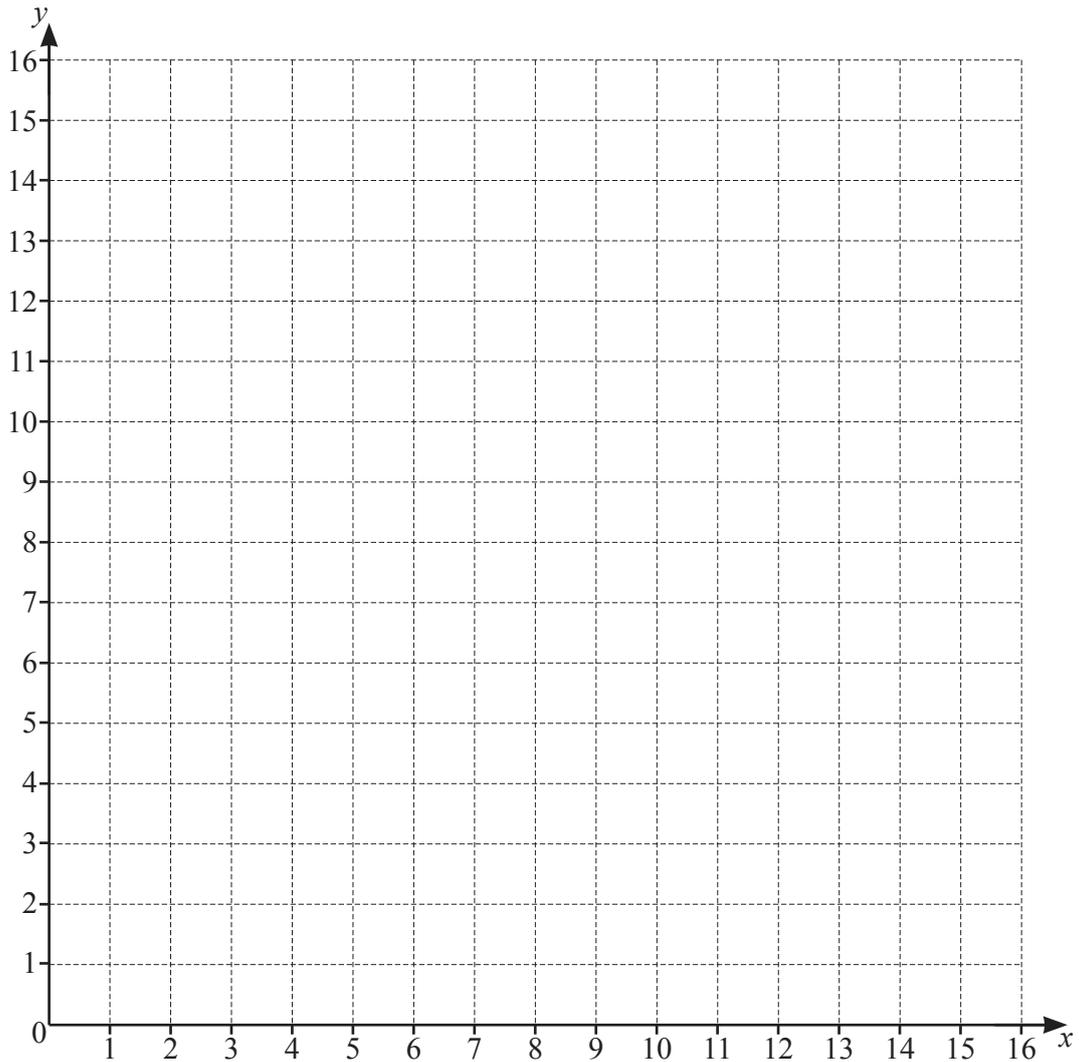
(a) On the grid, draw the lines $y = 4$, $y = 10$, $y = x$ and $3x + 2y = 30$. [5]

(b) Label the region R where $x \geqslant 0$, $y \geqslant 4$, $y \leqslant 10$, $y \geqslant x$ and $3x + 2y \leqslant 30$. [1]

(c) For points in the region R, find

  (i) the smallest value of $x + y$,

  .... [1]

  (ii) the largest value of $x + y$ when x and y are integers.

  .... [1]

(d) Label the region S where $y \geqslant 10$, $y \geqslant x$ and $3x + 2y \geqslant 30$. [1]

11 (a)
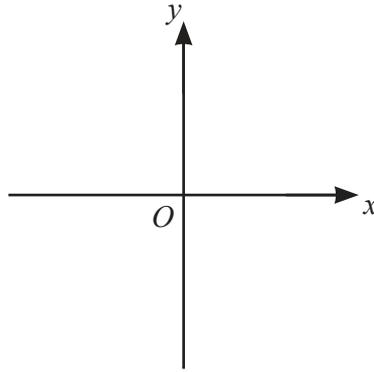
On the diagram, sketch the graph of $y = 2^x$. [1]

(b)
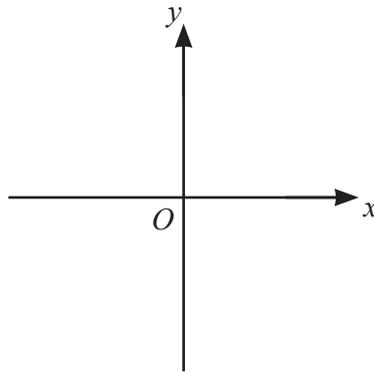
On the diagram, sketch the graph of $y = 0.9^x$. [1]

(c) Find the exact value of x when $2^x = \dfrac{1}{4\sqrt{2}}$.

$x =$ .... [2]

(d) (i) $f(x) = 3(1.04)^x$
$f(x)$ is an exponential function representing a rate of increase of $r\%$.

Find the value of r.

$r =$ .... [1]

(ii) $g(x)$ is an exponential function representing a rate of decrease of 2%.
$g(0) = 7$

Find $g(x)$, giving your answer in its simplest form.

$g(x) =$ .... [2]

20

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