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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.

Formula List

For the equation

$$ax^2 + bx + c = 0$$

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

Lateral surface area, A , of cylinder of radius r , height h .

$$A = 2\pi rh$$

Lateral surface area, A , of cone of radius r , sloping edge l .

$$A = \pi rl$$

Surface area, A , of sphere of radius r .

$$A = 4\pi r^2$$

Volume, V , of pyramid, base area A , height h .

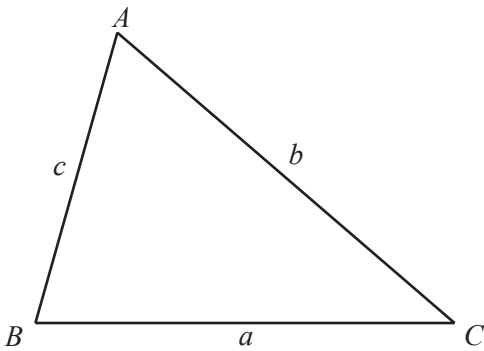
$$V = \frac{1}{3}Ah$$

Volume, V , of cone of radius r , height h .

$$V = \frac{1}{3}\pi r^2 h$$

Volume, V , of sphere of radius r .

$$V = \frac{4}{3}\pi r^3$$

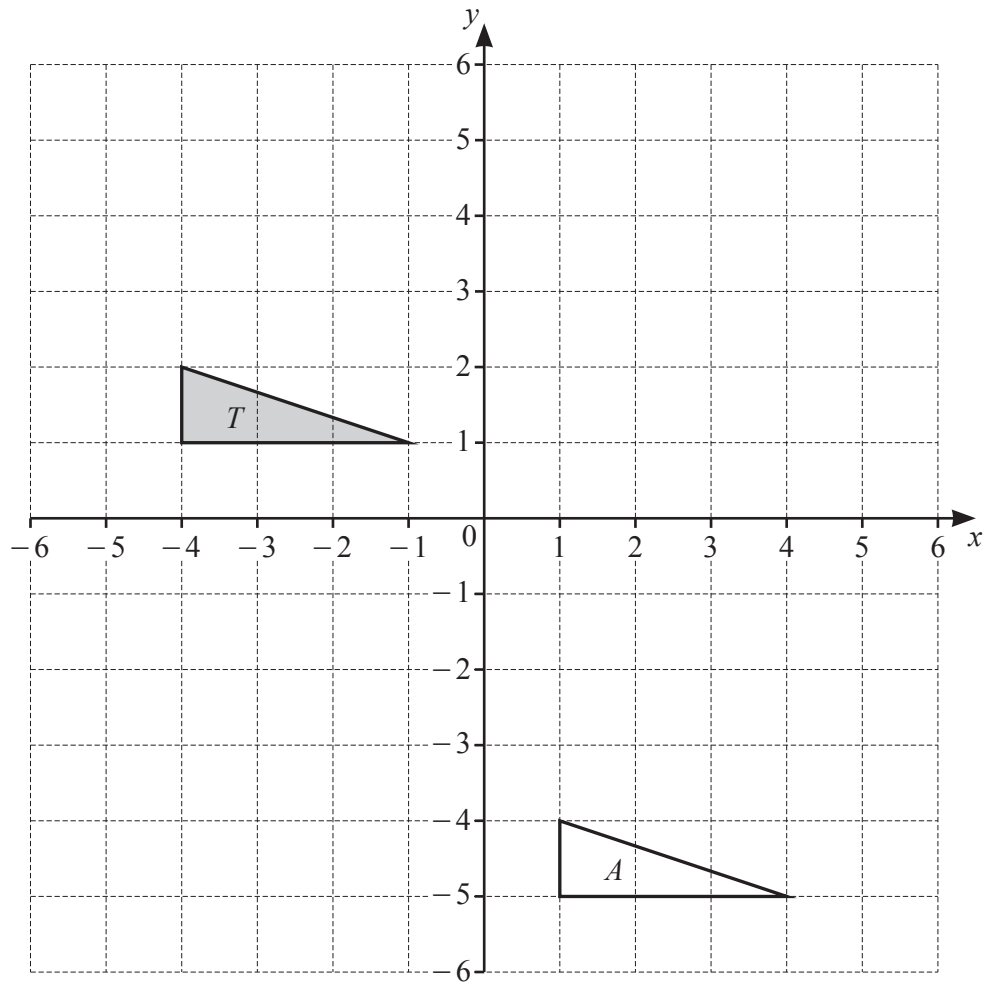


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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)	$1.3 < h \leq 1.4$	$1.4 < h \leq 1.5$	$1.5 < h \leq 1.6$	$1.6 < h \leq 1.7$	$1.7 < h \leq 1.8$	$1.8 < h \leq 1.9$
Frequency	7	18	30	24	27	14

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

..... $< h \leq$ [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.

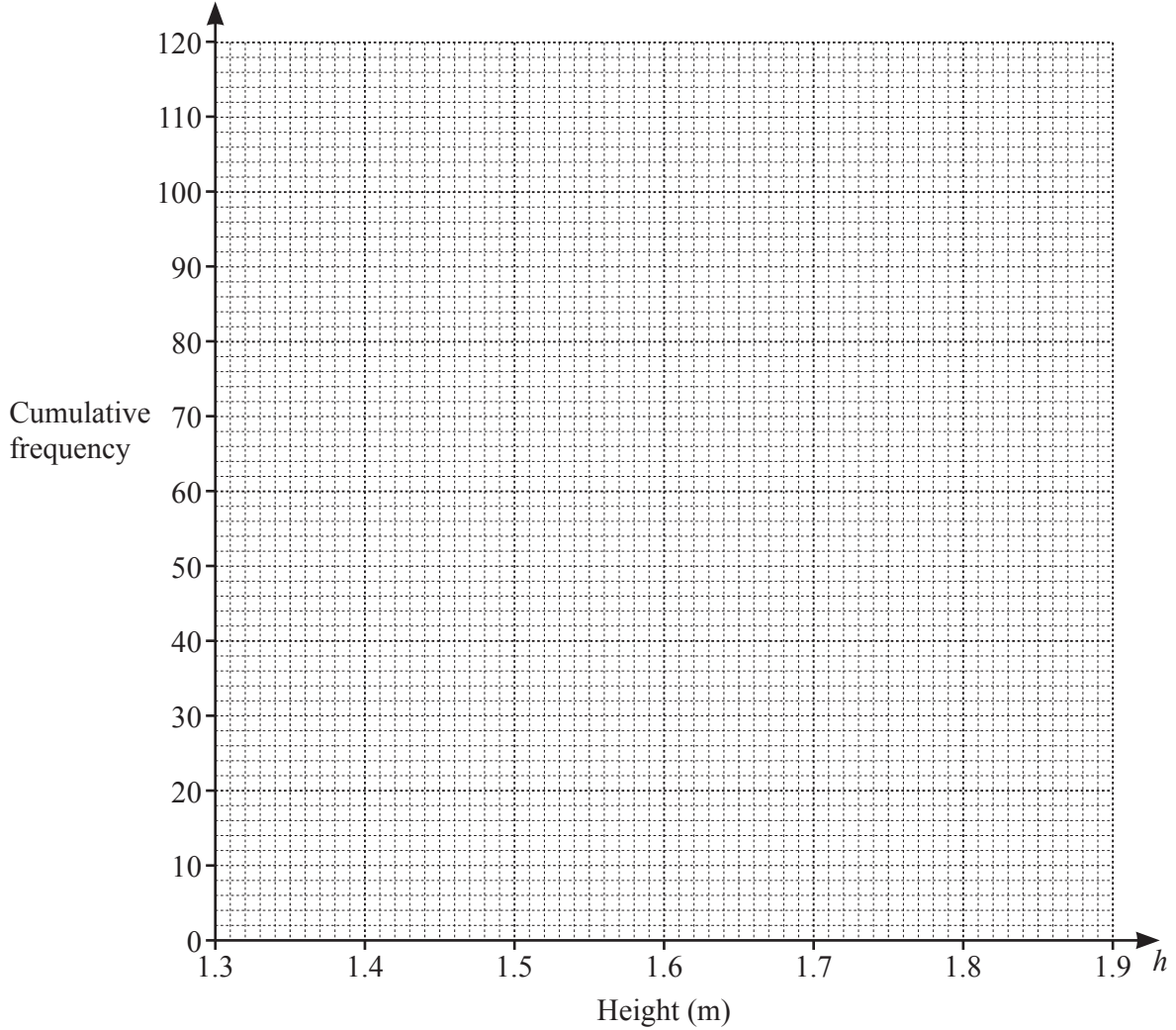
..... [4]

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

Height (h meters)	$h \leq 1.4$	$h \leq 1.5$	$h \leq 1.6$	$h \leq 1.7$	$h \leq 1.8$	$h \leq 1.9$
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]

[Turn over

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

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

$s = \dots\dots\dots$ [2]

(b) Simplify.

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

$\dots\dots\dots$ [2]

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

$\dots\dots\dots$ [2]

(c) Solve.

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

$x = \dots\dots\dots$ [1]

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

$x = \dots\dots\dots$ [3]

(d) Simplify.

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

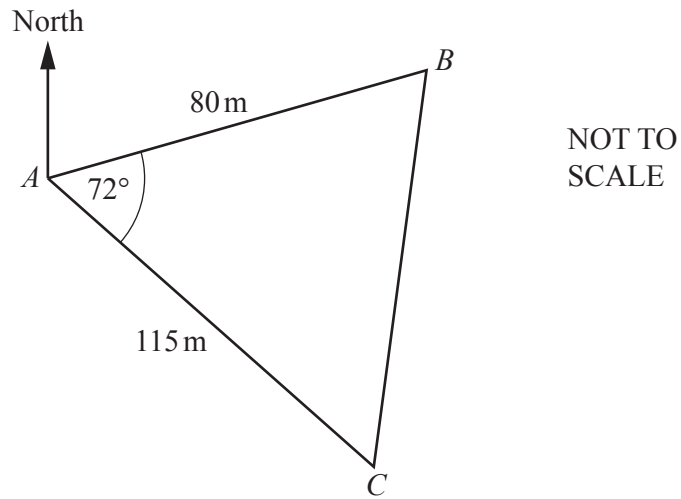
..... [2]

(e) Expand and simplify.

$$(3x - 5y)(2x + y)$$

..... [2]

5



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 $ABC = \dots\dots\dots$ [3]

(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 .

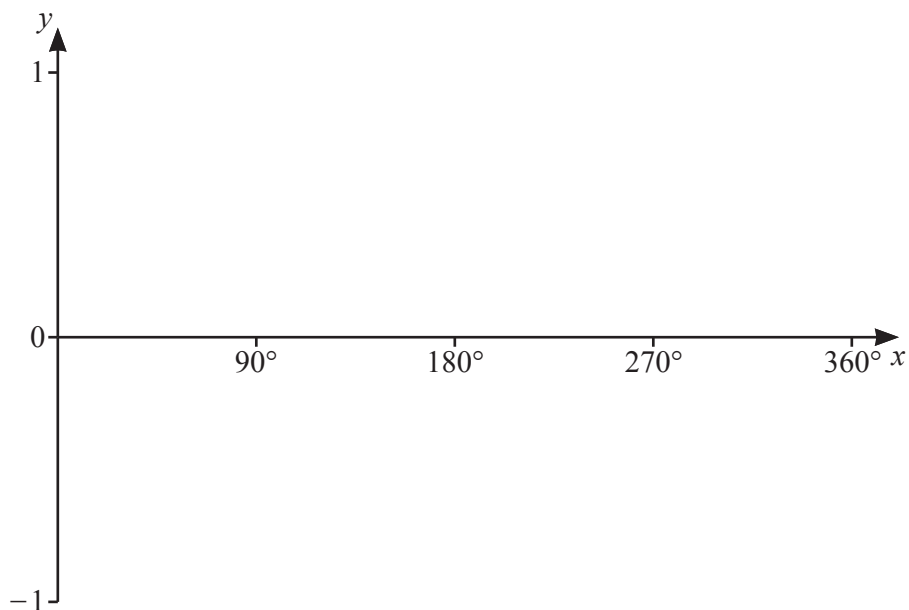
Calculate his average running speed in kilometers per hour.

..... 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 $0^\circ \leq x \leq 360^\circ$.



[2]

- (ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

.....

..... [2]

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

- (iv) Find the two exact values of x when $\sin x = \frac{1}{2}$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

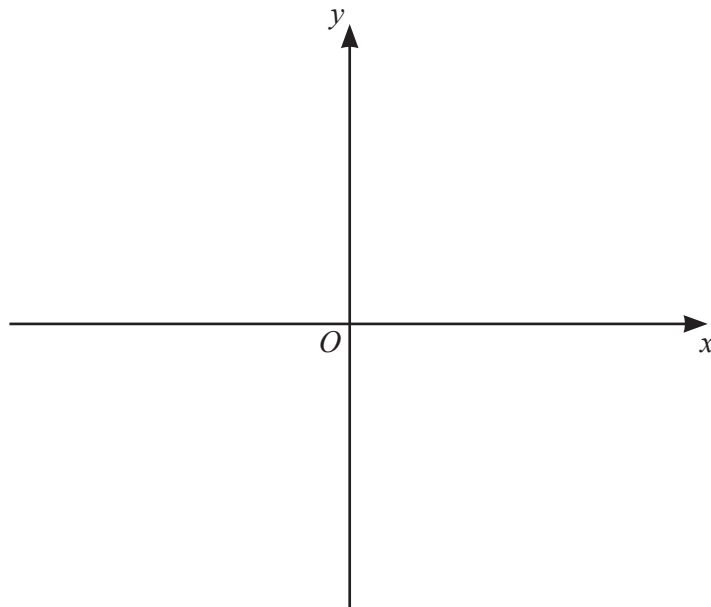
(b) (i) Write $x^2 + 10x + 14$ in the form $(x + a)^2 + b$.

..... [2]

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

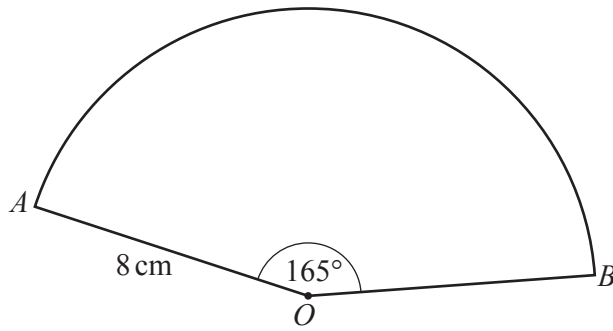
(.....,) [2]

(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.

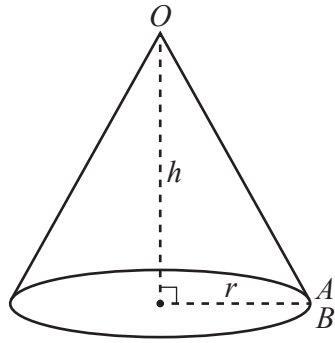
..... cm [3]

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

Calculate the radius of the sphere.

..... cm [4]

(c)

NOT TO
SCALE

A cone is made from the sector by joining OA to OB .

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

$r = \dots\dots\dots$ cm [2]

(ii) Calculate the volume of the cone.

$\dots\dots\dots$ cm³ [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]

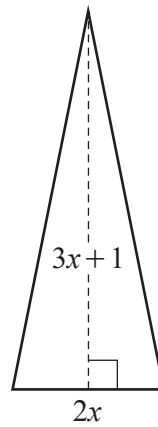
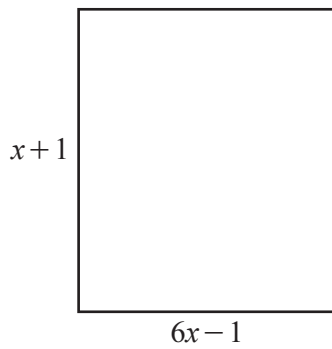
- 9 (a) The cost of one apple is a cents and the cost of one pear is p cents.
 5 apples and 1 pear cost a total of \$2.21 .
 3 apples and 2 pears cost a total of \$1.97 .

Find the value of a and the value of p .

$$a = \dots\dots\dots$$

$$p = \dots\dots\dots [5]$$

(b)



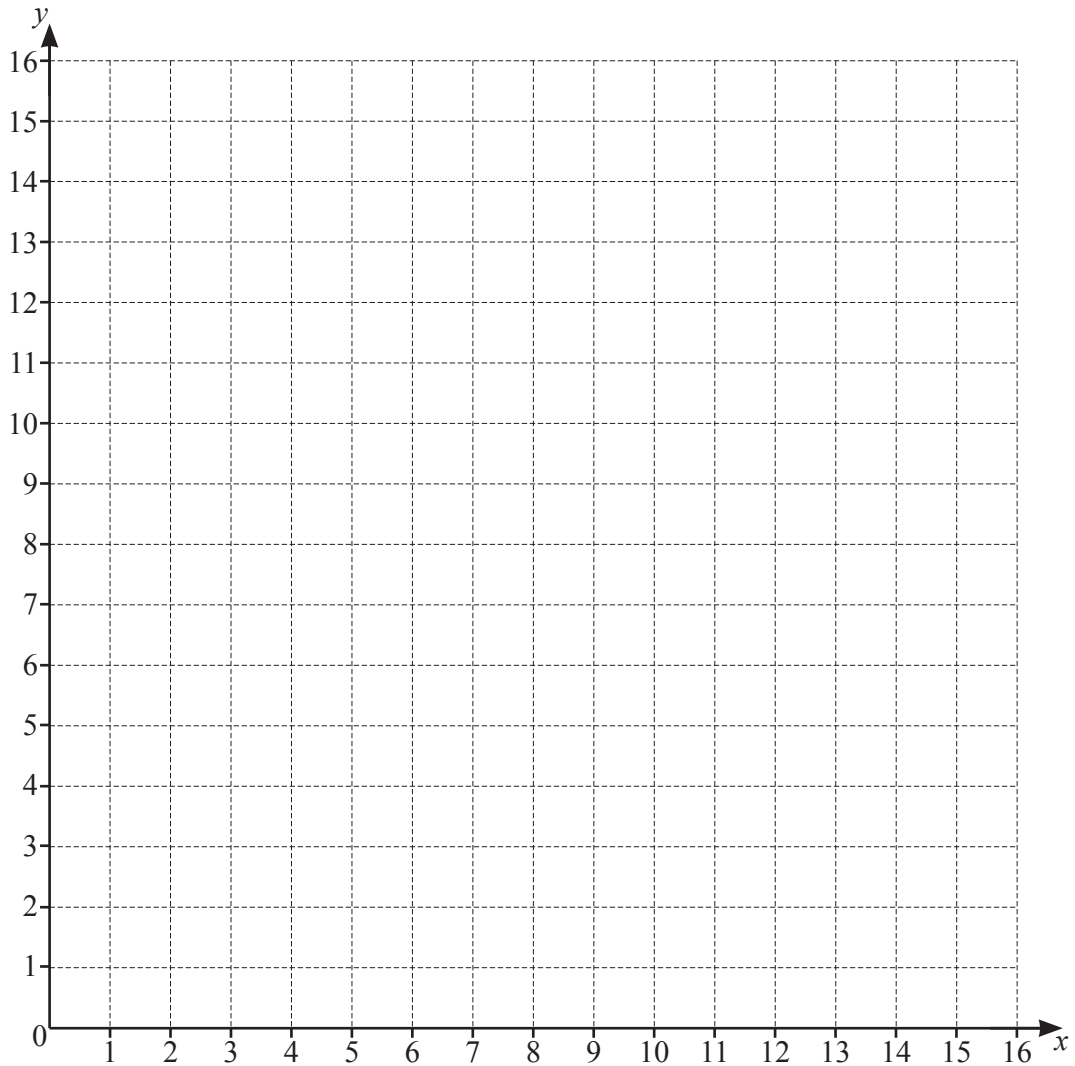
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The area of the rectangle is double the area of the triangle.

Find the value of x .

$$x = \dots\dots\dots [4]$$

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 $x \geq 0$, $y \geq 4$, $y \leq 10$, $y \geq x$ and $3x + 2y \leq 30$. [1]

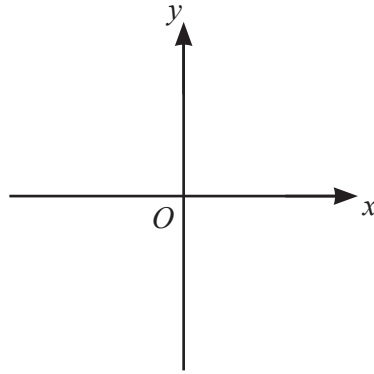
(c) For points in the region R , find

(i) the smallest value of $x + y$,
 [1]

(ii) the largest value of $x + y$ when x and y are integers.
 [1]

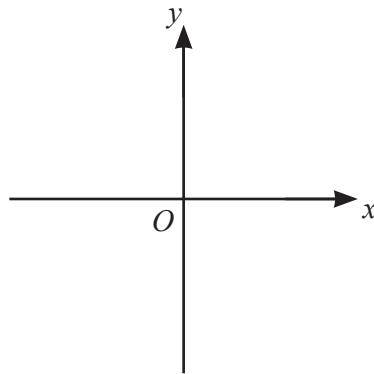
(d) Label the region S where $y \geq 10$, $y \geq x$ and $3x + 2y \geq 30$. [1]

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 $2^x = \frac{1}{4\sqrt{2}}$.

$x = \dots\dots\dots$ [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 .

$r = \dots\dots\dots$ [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.

$g(x) = \dots\dots\dots$ [2]

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