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MATHEMATICS (US)

0444/31

Paper 3 (Core)

May/June 2020

2 hours

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 104.
- 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

Area, A , of triangle, base b , height h .

$$A = \frac{1}{2}bh$$

Area, A , of circle, radius r .

$$A = \pi r^2$$

Circumference, C , of circle, radius r .

$$C = 2\pi r$$

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

$$A = 2\pi r h$$

Surface area, A , of sphere of radius r .

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

Volume, V , of prism, cross-sectional area A , length l .

$$V = Al$$

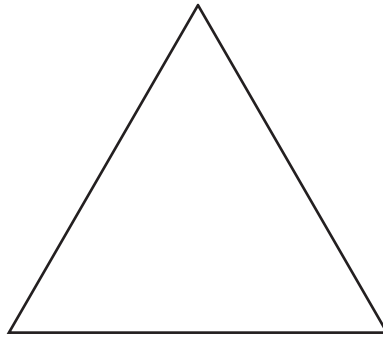
Volume, V , of cylinder of radius r , height h .

$$V = \pi r^2 h$$

Volume, V , of sphere of radius r .

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

- 1 The diagram shows a triangle with each side of length 5 cm.



- (a) Write down the mathematical name for this type of triangle.

..... [1]

- (b) (i) Measure the perpendicular height of the triangle.

..... cm [1]

- (ii) Calculate the area of the triangle.

..... cm^2 [2]

- (iii) The triangle is the cross-section of a prism with length 6 cm.

Calculate the volume of the prism.

..... cm^3 [2]

- 2 Gabriela designs the seating layout for a new theater. There are three sections of seats, A, B, and C.

- (a) Section A has 152 seats.
Section B has 12.5% more seats than Section A.

Section C has $\frac{3}{8}$ of the number of seats in Section A.

- (i) Show that the number of seats in Section B is 171.

[1]

- (ii) Show that the total number of seats is 380.

[2]

- (b) Write down and simplify the ratio of the number of seats in each section A : B : C.

A : B : C = : : [2]

- (c) In Section A:

- There are 12 seats in the front row.
- Each row has 2 more seats than the row in front of it.

Work out the number of rows for the 152 seats in Section A.

..... rows [2]

(d) For a concert in the theater, the ticket prices are in the ratio

$$A : B : C = 9 : 7 : 4.$$

A ticket for Section C costs \$6.

(i) Show that a ticket for Section B costs \$10.50 .

[1]

(ii) Find the cost of a ticket for Section A.

\$ [1]

(iii) The table shows the number of tickets sold in each section.

Section	Number of tickets sold
A	120
B	136
C	30

Calculate the total amount received from the ticket sales.

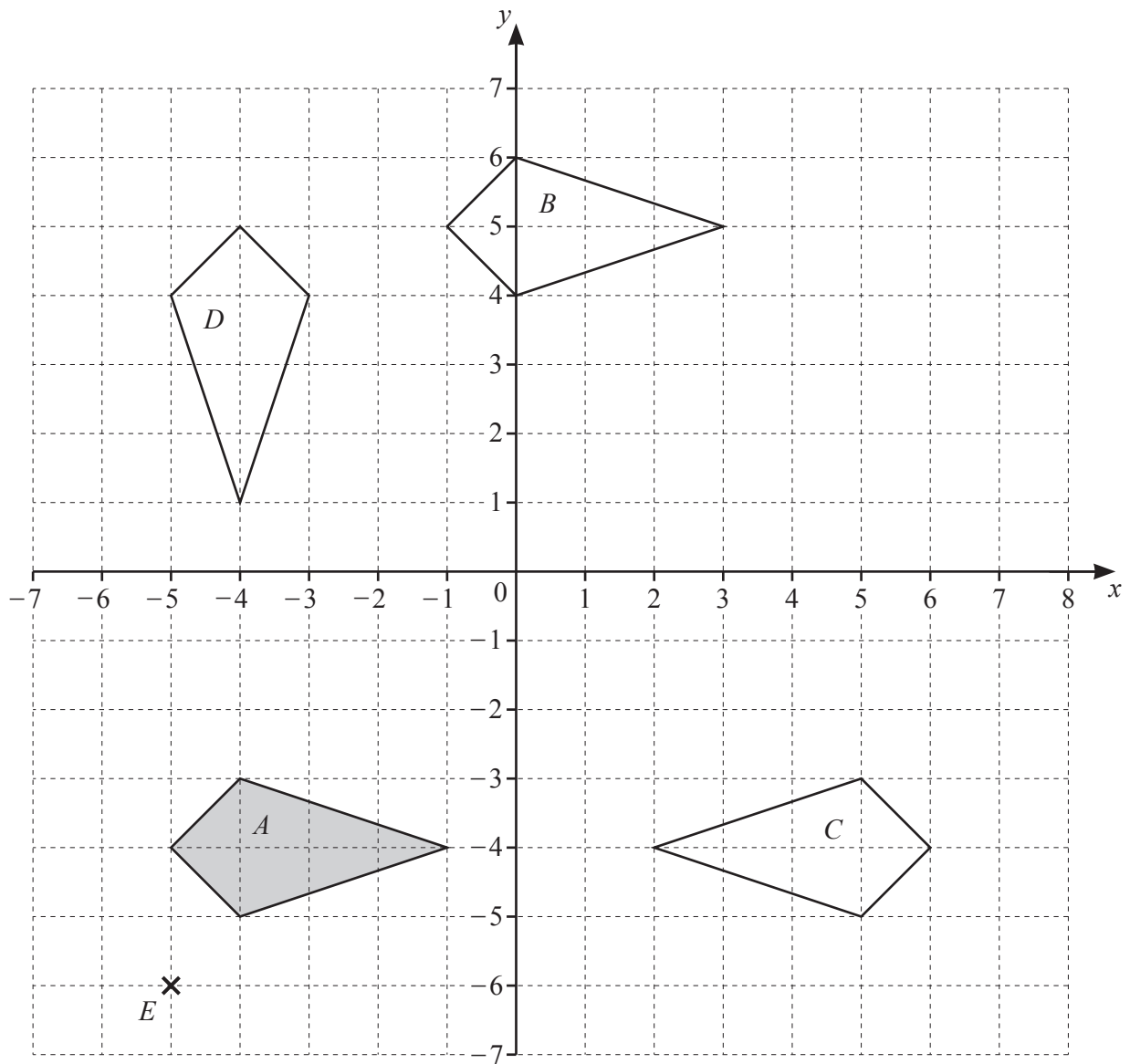
\$ [3]

(iv) The concert costs \$4500 to organize.

Calculate the amount received from the ticket sales as a percentage of the \$4500.

..... % [1]

- 3 The grid shows a point E and four quadrilaterals, A , B , C , and D .



- (a) Write down the mathematical name of shape A .

..... [1]

(b) Describe fully the **single** transformation that maps

(i) shape A onto shape B ,

.....
 [2]

(ii) shape A onto shape C ,

.....
 [2]

(iii) shape A onto shape D .

.....
 [3]

(c) (i) Write down the coordinates of the point E .

(..... ,) [1]

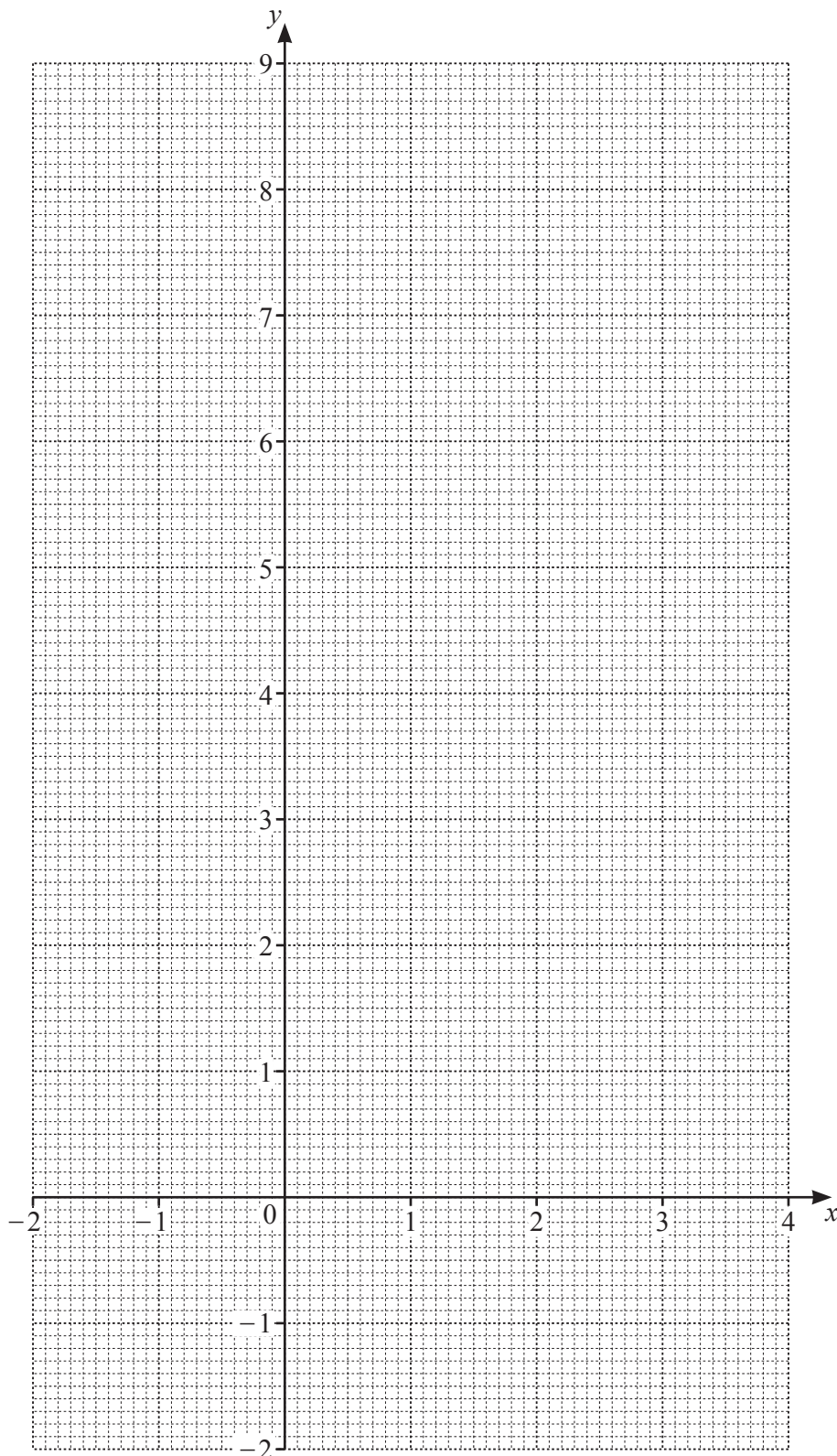
(ii) On the grid, draw the image of shape A after an enlargement by scale factor 3, center E . [2]

- 4 (a) Complete the table of values for $y = 7 + 2x - x^2$.

x	-2	-1	0	1	2	3	4
y	-1			8	7		-1

[2]

- (b) On the grid, draw the graph of $y = 7 + 2x - x^2$ for $-2 \leq x \leq 4$.



[4]

(c) Write down the equation of the line of symmetry of the graph.

..... [1]

(d) Use your graph to solve the equation $7 + 2x - x^2 = 0$.

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

5 (a) Using the integers from 60 to 75 only, find

(i) a multiple of 17,

..... [1]

(ii) the prime numbers.

..... [2]

(b) Find

(i) the square root of 4489,

..... [1]

(ii) 4^3 ,

..... [1]

(iii) $\sqrt[3]{274\,625}$,

..... [1]

(iv) $2^{-3} \times 24^2$.

..... [1]

(c) Write 0.0379 correct to 2 significant figures.

..... [1]

(d) Find the least common multiple (LCM) of 8 and 14.

..... [2]

(e) Write 479 000 000 in scientific notation.

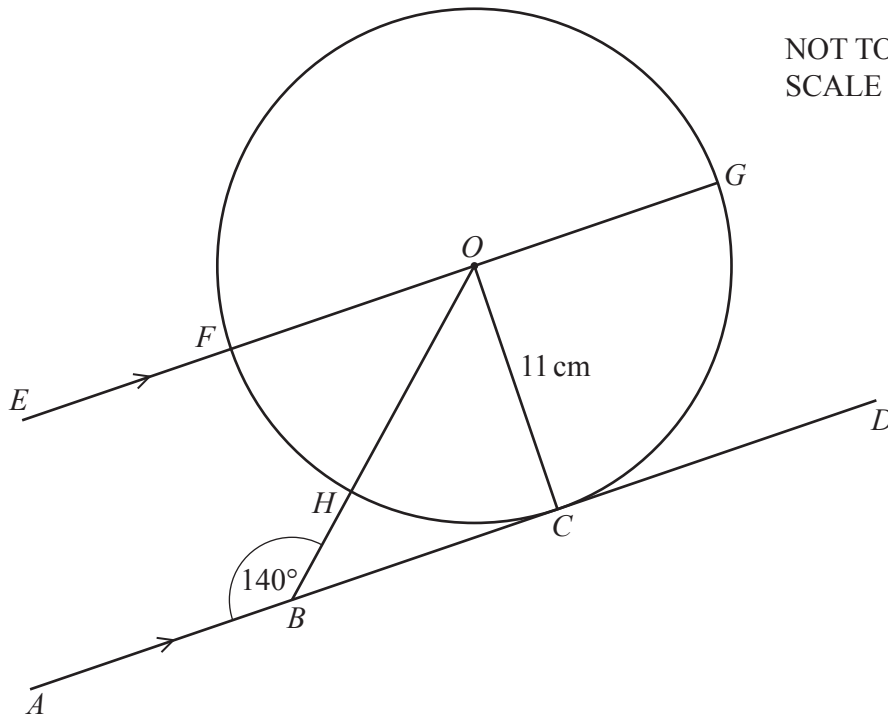
..... [1]

(f) George invests \$8000 at a rate of 3.6% per year compound interest.

Calculate the value of his investment at the end of 9 years.

\$ [2]

NOT TO SCALE



The diagram shows a circle, center O , radius 11 cm.
 $C, F, G,$ and H are points on the circumference of the circle.
 The line AD touches the circle at C and is parallel to the line EG .
 B is a point on AD and angle $ABO = 140^\circ$.

(a) Write down the mathematical name of the straight line AD .

..... [1]

(b) (i) Calculate the circumference of the circle.

..... cm [2]

(ii) Work out angle FOH .

Angle $FOH =$ [2]

(iii) Calculate the length of the minor arc FH .

..... cm [2]

- (c) (i) Give a reason why angle BCO is 90° .

..... [1]

- (ii) Show that $BC = 13.11$ cm, correct to 2 decimal places.

[3]

- (iii) Calculate BH .

$BH =$ cm [3]

- 7 (a) 20 students from College A each run 5 km.
The times, correct to the nearest minute, are recorded.

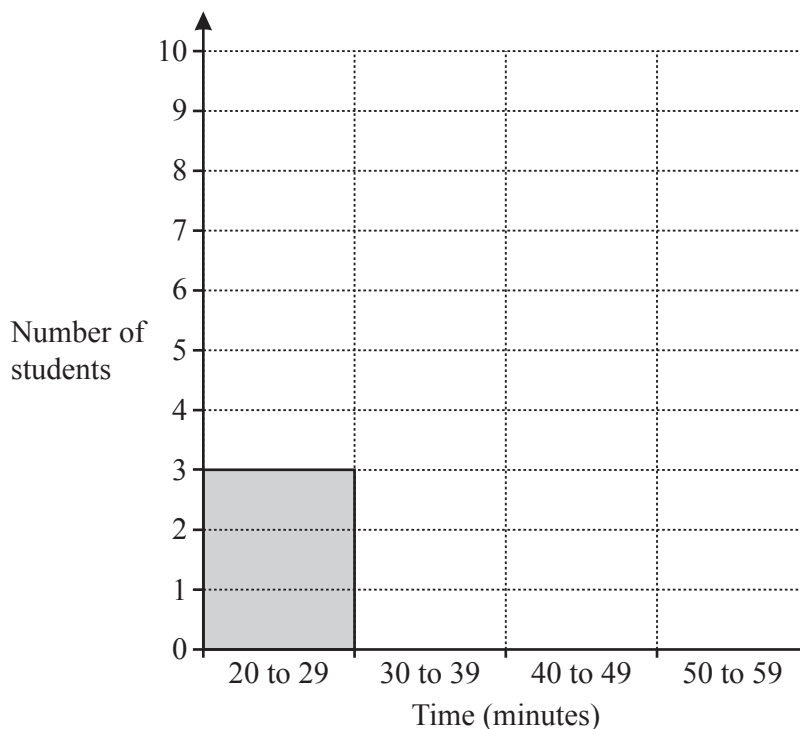
32 51 25 40 47 21 37 32 48 36
46 39 30 29 44 39 53 35 40 31

- (i) Find the median of the times.
..... min [1]
- (ii) Explain why mode is not a suitable measure of average in this case.
..... [1]
- (iii) Find the probability that a student, chosen at random, took less than 33 minutes.
..... [1]
- (iv) Complete the frequency table.

Time (minutes)	Frequency
20 to 29	3
30 to 39	
40 to 49	
50 to 59	

[1]

- (v) Complete the bar chart for the times of the students.



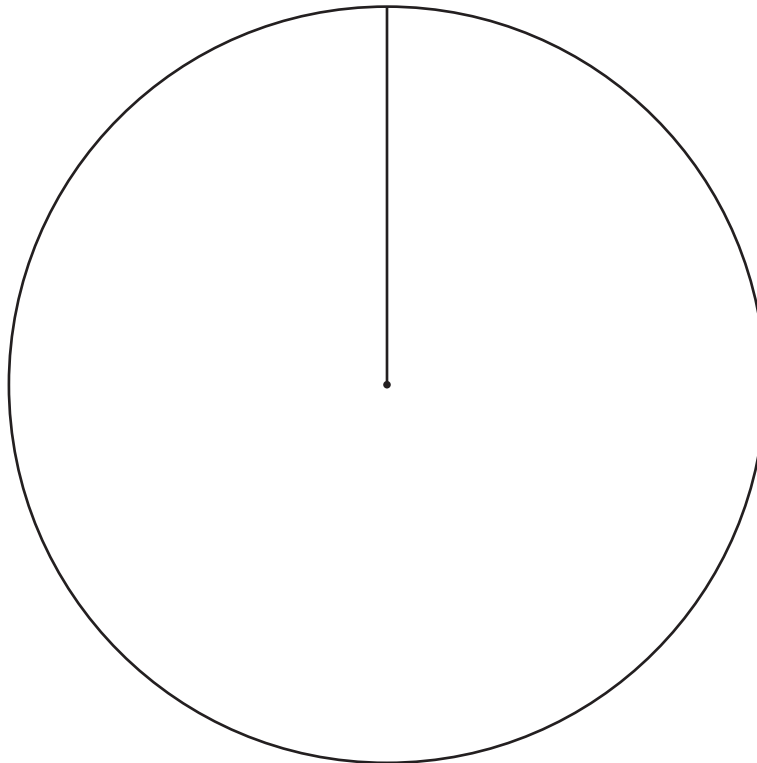
[2]

- (b) 20 students from College B each run 5 km.
 Their times, correct to the nearest minute, are recorded and the results are shown in the table.

Time (minutes)	Number of students	Pie chart sector angle
30 to 39	5	90°
40 to 49	8	
50 to 59	7	

- (i) Complete the table.

[2]



- (ii) Complete the pie chart.

[2]

- (c) Write down two comments comparing the times of students from College A with the times of students from College B.

1

.....

2

.....

[2]

8 (a) Simplify $3c - 5d - c + 2d$.

..... [2]

(b) Solve the equation $12x - 7 = 23$.

$x =$ [2]

(c) Expand.

$$9(3 - x)$$

..... [1]

(d) $A = \frac{(a+b)h}{2}$

Work out the value of h when $A = 38.64$, $a = 5.5$, and $b = 3.7$.

$h =$ [3]

- (e) Alphonse is x years old and Beatrice is y years old.
Three times Alphonse's age is equal to 5 times Beatrice's age.
Twice Beatrice's age is 4 years more than Alphonse's age.

- (i) Use this information to write down two equations in x and y .

.....

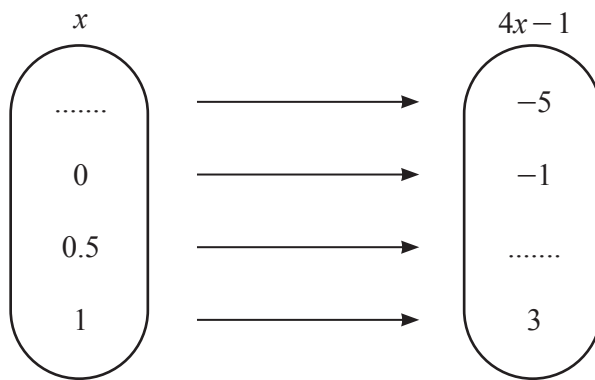
..... [2]

- (ii) Find the age of Alphonse and the age of Beatrice.

Alphonse years old

Beatrice years old [3]

9 (a) (i) Complete the mapping diagram for the function $f: x \rightarrow 4x - 1$.

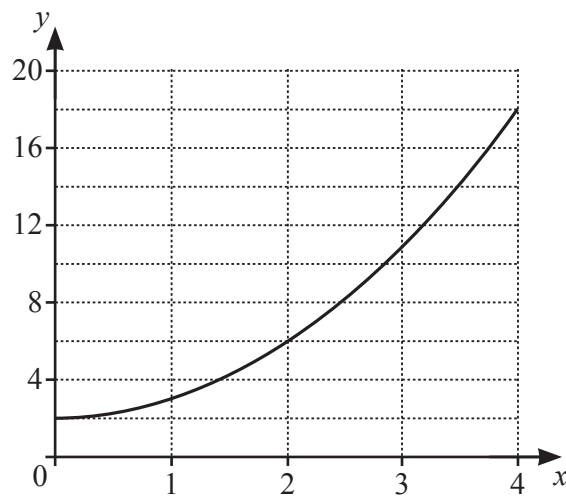


[2]

(ii) Write down the domain of the function f .

..... [1]

(b)

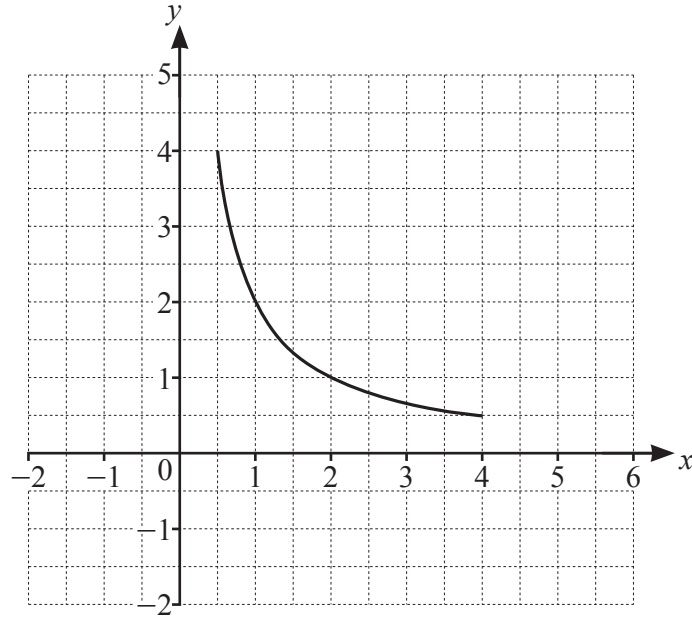


The diagram shows the graph of the function $y = g(x)$ where $g(x) = x^2 + 2$ for $0 \leq x \leq 4$.

Complete the range of $g(x)$.

..... $\leq g \leq$ [2]

(c)



The graph of $y = h(x)$ is shown on the grid.

On this grid, draw the graph of $y = h(x - 1)$.

[2]

Question 10 is printed on the next page.

10 Point B is 36 km from point A on a bearing of 140° .

(a) Using a scale of 1 centimeter to represent 4 kilometers, mark the position of B .



Scale: 1 cm to 4 km

[2]

(b) (i) Point C is 28 km from A and 20 km from B .
The bearing of C from A is less than 140° .

Using a ruler and compasses only, construct triangle ABC .
Show all your construction arcs.

[3]

(ii) Measure angle ACB .

Angle $ACB = \dots\dots\dots$ [1]

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