

--

--	--	--	--	--

--	--	--	--

0580/41

May/June 2016

2 hours 30 minutes

Additional Materials: Electronic calculator Geometrical instruments
Tracing paper (optional).

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

For π , use either your calculator value or 3.142.

The total of the marks for this paper is 130.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

- 1 (a) Kristian and Stephanie share some money in the ratio 3 : 2.
Kristian receives \$72.

(i) Work out how much Stephanie receives.

\$ [2]

- (ii) Kristian spends 45% of his \$72 on a computer game.

Calculate the price of the computer game.

\$ [1]

- (iii) Kristian also buys a meal for \$8.40 .

Calculate the fraction of the \$72 Kristian has left after buying the computer game and the meal.
Give your answer in its lowest terms.

..... [2]

- (iv) Stephanie buys a book in a sale for \$19.20 .
This sale price is after a reduction of 20%.

Calculate the original price of the book.

\$ [3]

- (b) Boris invests \$550 at a rate of 2% per year simple interest.

Calculate the amount Boris has after 10 years.

\$ [3]

- (c) Marlene invests \$550 at a rate of 1.9% per year compound interest.

Calculate the amount Marlene has after 10 years.

\$ [2]

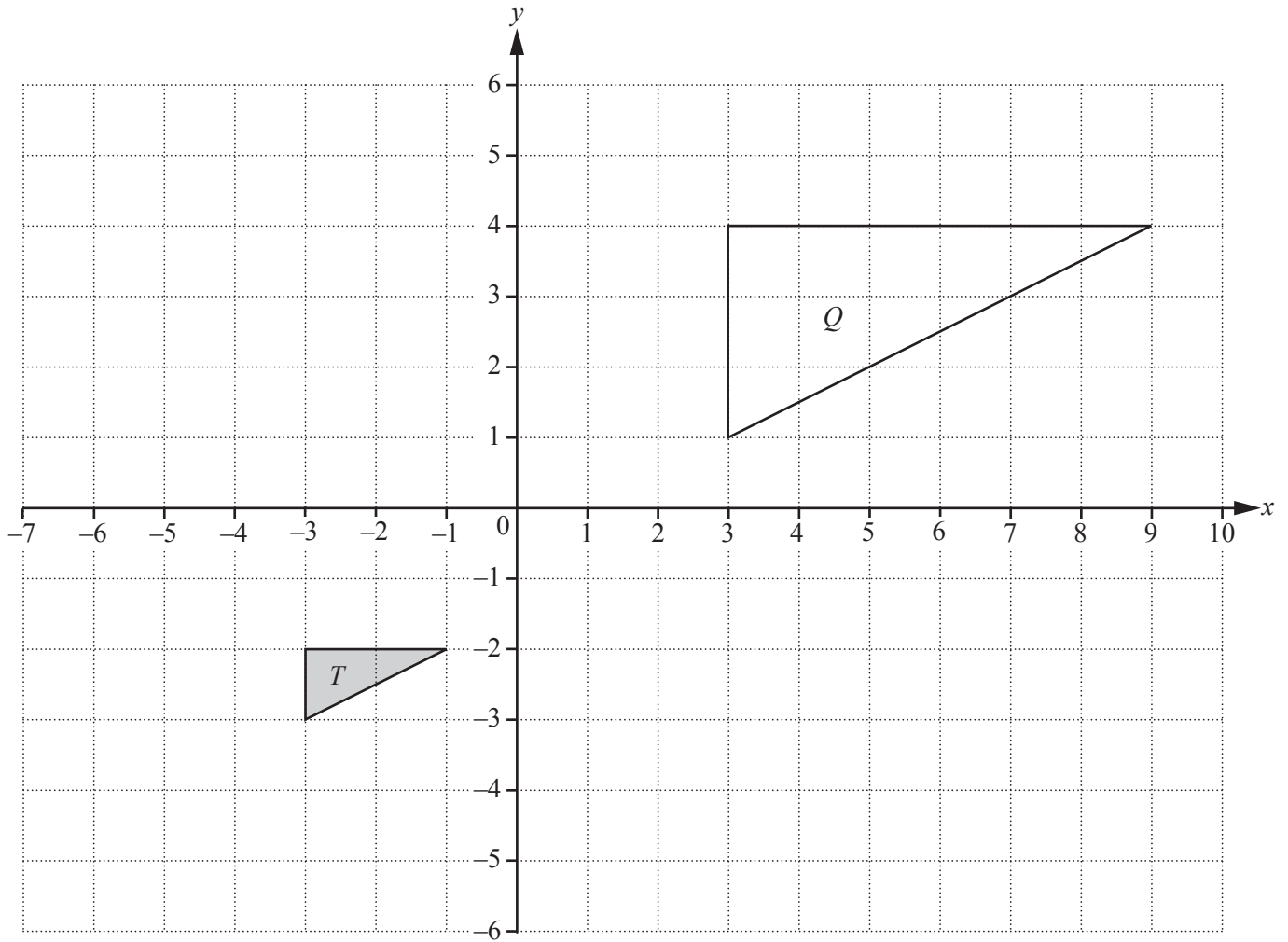
- (d) Hans invests \$550 at a rate of $x\%$ per year compound interest.

At the end of 10 years he has a total amount of \$638.30, correct to the nearest cent.

Find the value of x .

$x =$ [3]

2 (a)



- (i) Draw the image of triangle T after a translation by the vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$. [2]
- (ii) Draw the image of triangle T after a reflection in the line $y = 1$. [2]
- (iii) Describe fully the **single** transformation that maps triangle T onto triangle Q .

.....

..... [3]

(b) $\mathbf{M} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} 4 & 3 \\ 1 & k \end{pmatrix}$ $\mathbf{P} = \begin{pmatrix} 1 & 3 \\ 0 & 6 \end{pmatrix}$

(i) Work out $\mathbf{M} + \mathbf{P}$.

$$\begin{pmatrix} & \\ & \end{pmatrix} \quad [1]$$

(ii) Work out $\mathbf{PM}$.

$$\begin{pmatrix} & \\ & \end{pmatrix} \quad [2]$$

(iii) $|\mathbf{M}| = |\mathbf{N}|$

Find the value of k .

$$k = \dots\dots\dots [3]$$

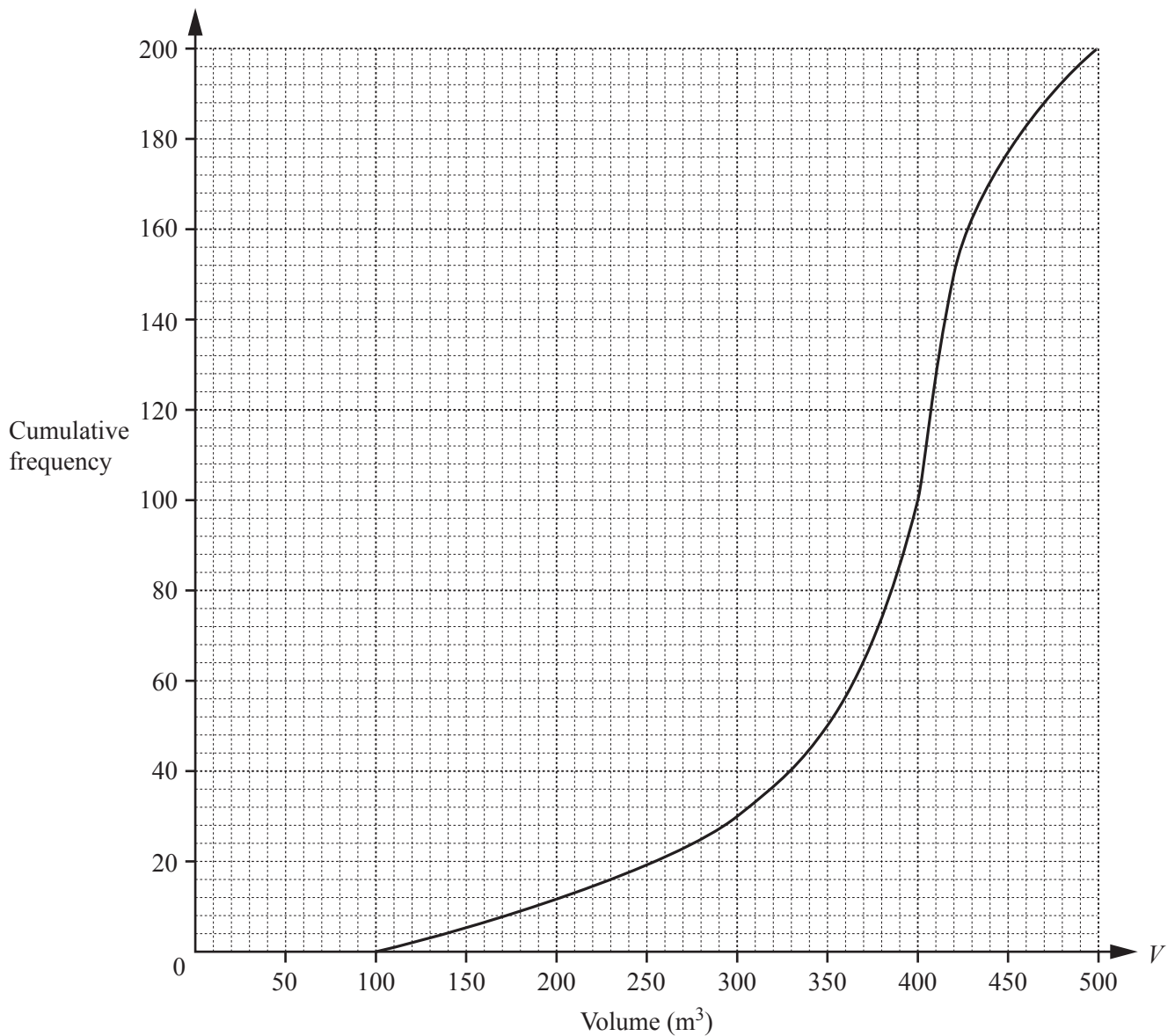
(c) (i) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.

.....
 [3]

(ii) Find the matrix which represents a reflection in the line $y = x$.

$$\begin{pmatrix} & \\ & \end{pmatrix} \quad [2]$$

- 3 (a) 200 students estimate the volume, $V \text{ m}^3$, of a classroom. The cumulative frequency diagram shows their results.



Find

- (i) the median,

..... m^3 [1]

- (ii) the lower quartile,

..... m^3 [1]

- (iii) the inter-quartile range,

..... m^3 [1]

- (iv) the number of students who estimate that the volume is greater than 300 m^3 .

..... [2]

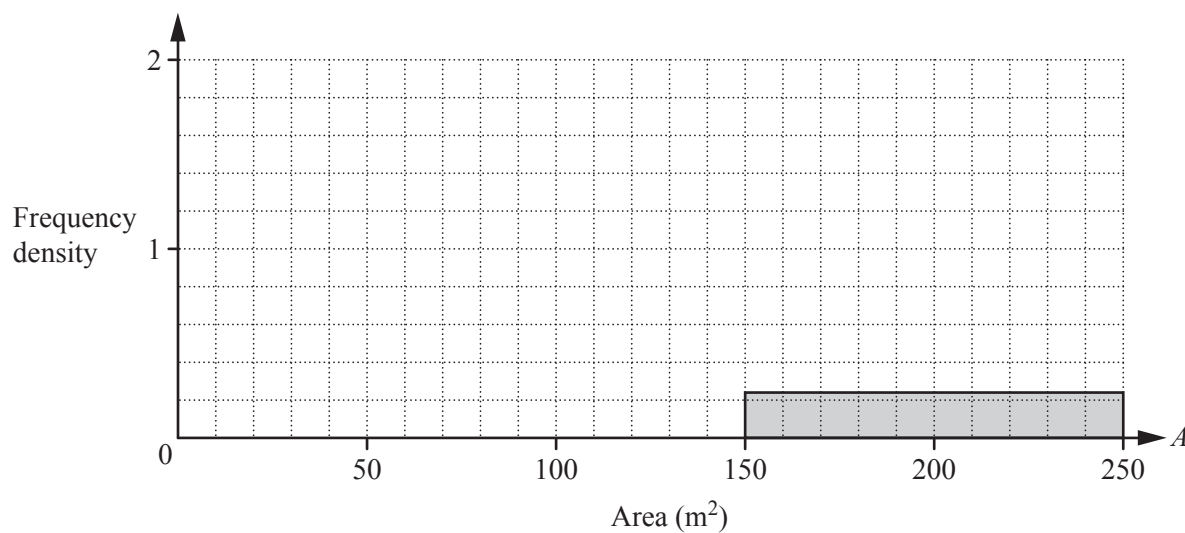
- (b) The 200 students also estimate the total area, $A \text{ m}^2$, of the windows in the classroom. The results are shown in the table.

Area ($A \text{ m}^2$)	$20 < A \leq 60$	$60 < A \leq 100$	$100 < A \leq 150$	$150 < A \leq 250$
Frequency	32	64	80	24

- (i) Calculate an estimate of the mean.
Show all your working.

..... m^2 [4]

- (ii) Complete the histogram to show the information in the table.



[4]

- (iii) Two of the 200 students are chosen at random.

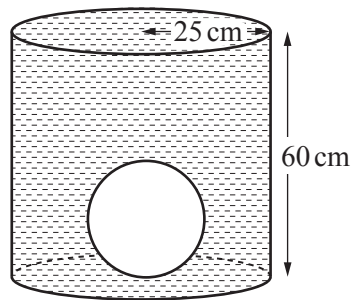
Find the probability that they both estimate that the area is greater than 100 m^2 .

..... [2]

- 4 (a) Calculate the volume of a metal sphere of radius 15 cm and show that it rounds to $14\,140\text{ cm}^3$, correct to 4 significant figures.
 [The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[2]

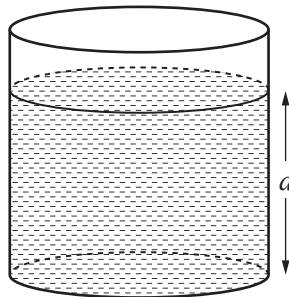
- (b) (i) The sphere is placed inside an empty cylindrical tank of radius 25 cm and height 60 cm. The tank is filled with water.

NOT TO
SCALE

Calculate the volume of water required to fill the tank.

..... cm^3 [3]

- (ii) The sphere is removed from the tank.

NOT TO
SCALE

Calculate the depth, d , of water in the tank.

$d =$ cm [2]

(c) The sphere is melted down and the metal is made into a solid cone of height 54 cm.

(i) Calculate the radius of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm [3]

(ii) Calculate the **total** surface area of the cone.

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

..... cm² [4]

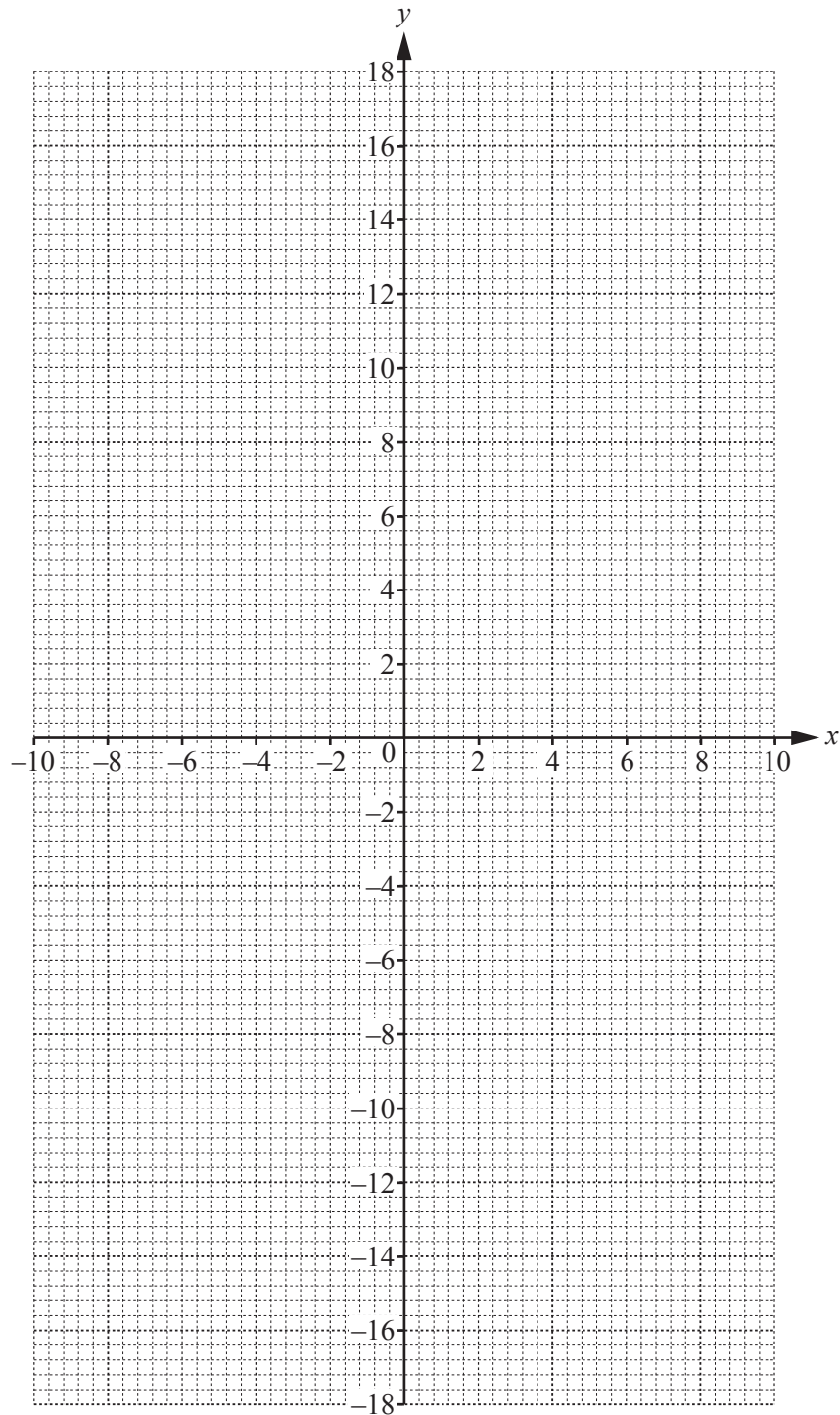
5 $f(x) = \frac{20}{x} + x, \quad x \neq 0$

(a) Complete the table.

x	-10	-8	-5	-2	-1.6		1.6	2	5	8	10
$f(x)$	-12	-10.5	-9	-12	-14.1		14.1	12			12

[2]

(b) On the grid, draw the graph of $y = f(x)$ for $-10 \leq x \leq -1.6$ and $1.6 \leq x \leq 10$.



[5]

- (c) Using your graph, solve the equation $f(x) = 11$.

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

- (d) k is a prime number and $f(x) = k$ has no solutions.

Find the possible values of k .

$\dots\dots\dots$ [2]

- (e) The gradient of the graph of $y = f(x)$ at the point $(2, 12)$ is -4 .

Write down the co-ordinates of the other point on the graph of $y = f(x)$ where the gradient is -4 .

$(\dots\dots\dots, \dots\dots\dots)$ [1]

- (f) (i) The equation $f(x) = x^2$ can be written as $x^3 + px^2 + q = 0$.

Show that $p = -1$ and $q = -20$.

[2]

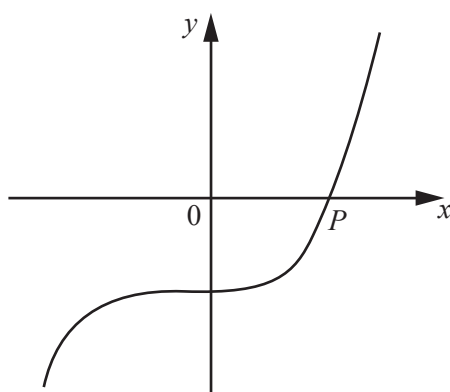
- (ii) On the grid opposite, draw the graph of $y = x^2$ for $-4 \leq x \leq 4$.

[2]

- (iii) Using your graphs, solve the equation $x^3 - x^2 - 20 = 0$.

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

- (iv)



NOT TO
SCALE

The diagram shows a **sketch** of the graph of $y = x^3 - x^2 - 20$.
 P is the point $(n, 0)$.

Write down the value of n .

$n = \dots\dots\dots$ [1]

6 (a)

NOT TO
SCALE

The perimeter of the rectangle is 80 cm.
The area of the rectangle is $A \text{ cm}^2$.

(i) Show that $x^2 - 40x + A = 0$.

[3]

(ii) When $A = 300$, solve, by factorising, the equation $x^2 - 40x + A = 0$.

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

(iii) When $A = 200$, solve, by using the quadratic formula, the equation $x^2 - 40x + A = 0$.
Show all your working and give your answers correct to 2 decimal places.

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

- (b) A car completes a 200 km journey with an average speed of x km/h.
The car completes the return journey of 200 km with an average speed of $(x + 10)$ km/h.

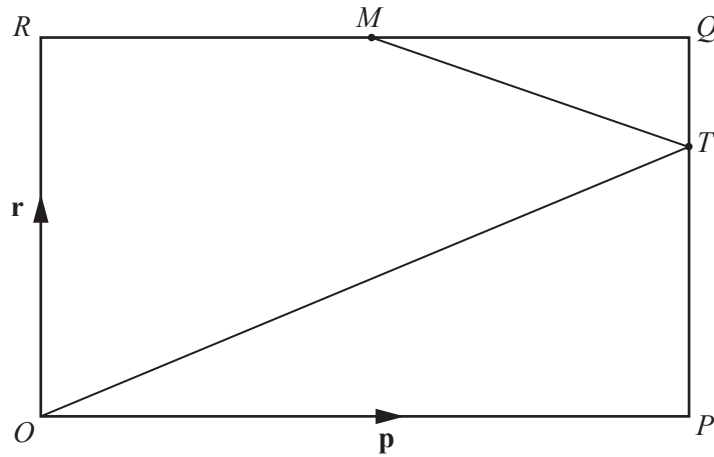
(i) Show that the difference between the time taken for each of the two journeys is $\frac{2000}{x(x+10)}$ hours.

[3]

- (ii) Find the difference between the time taken for each of the two journeys when $x = 80$.
Give your answer in **minutes** and **seconds**.

..... min s [3]

7

NOT TO
SCALE

$OPQR$ is a rectangle and O is the origin.
 M is the midpoint of RQ and $PT : TQ = 2 : 1$.
 $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OR} = \mathbf{r}$.

(a) Find, in terms of $\mathbf{p}$ and/or $\mathbf{r}$, in its simplest form

(i) $\overrightarrow{MQ}$,

$$\overrightarrow{MQ} = \dots\dots\dots [1]$$

(ii) $\overrightarrow{MT}$,

$$\overrightarrow{MT} = \dots\dots\dots [1]$$

(iii) $\overrightarrow{OT}$.

$$\overrightarrow{OT} = \dots\dots\dots [1]$$

(b) RQ and OT are extended to meet at U .

Find the position vector of U in terms of $\mathbf{p}$ and $\mathbf{r}$.
 Give your answer in its simplest form.

$$\dots\dots\dots [2]$$

(c) $\overrightarrow{MT} = \begin{pmatrix} 2k \\ -k \end{pmatrix}$ and $|\overrightarrow{MT}| = \sqrt{180}$.

Find the positive value of k .

$k = \dots\dots\dots [3]$

8

$$f(x) = 2x + 1$$

$$g(x) = x^2 + 4$$

$$h(x) = 2^x$$

(a) Solve the equation $f(x) = g(1)$.

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

(b) Find the value of $fh(3)$.

$$\dots\dots\dots [2]$$

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

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

(d) Find $gf(x)$ in its simplest form.

$$\dots\dots\dots [3]$$

- (e) Solve the equation $h^{-1}(x) = 0.5$.

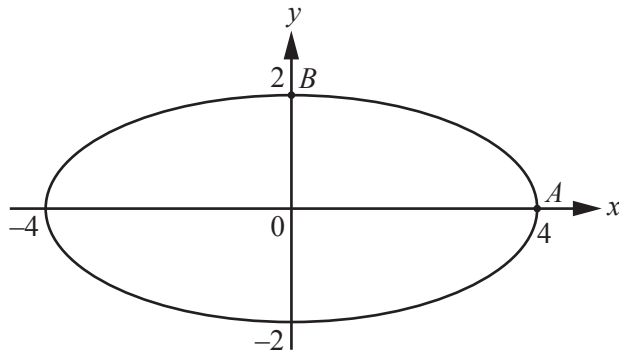
$x =$ [1]

(f) $\frac{1}{h(x)} = 2^{kx}$

Write down the value of k .

$k =$ [1]

9

NOT TO
SCALE

The diagram shows a curve with equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

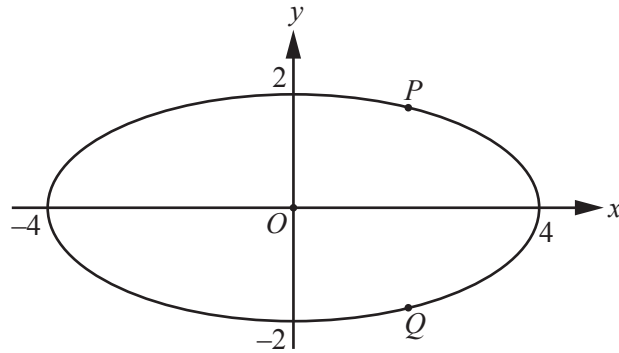
- (a) A is the point $(4, 0)$ and B is the point $(0, 2)$.
- (i) Find the equation of the straight line that passes through A and B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

- (ii) Show that $a^2 = 16$ and $b^2 = 4$.

[2]

(b)

NOT TO
SCALE

$P(2, k)$ and $Q(2, -k)$ are points on the curve $\frac{x^2}{16} + \frac{y^2}{4} = 1$.

(i) Find the value of k .

$k = \dots\dots\dots [3]$

(ii) Calculate angle POQ .

Angle $POQ = \dots\dots\dots [3]$

(c) The area enclosed by a curve with equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is πab .

(i) Find the area enclosed by the curve $\frac{x^2}{16} + \frac{y^2}{4} = 1$.

Give your answer as a multiple of π .

$\dots\dots\dots [1]$

(ii) A curve, mathematically similar to the one in the diagrams, intersects the x -axis at $(12, 0)$ and $(-12, 0)$.

Work out the area enclosed by this curve, giving your answer as a multiple of π .

$\dots\dots\dots [2]$

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.