QUESTION BANK

May/June-OCT/NOV **2011**

EXTENDED MATHEMATICS

Compiled & Edited
By

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

7755338632

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Mathematical tables (optional), Geometrical instruments, Tracing paper (optional)

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For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
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The total of the marks for this paper is 70.

This document consists of **12** printed pages.

For Examiner's Use

1 Use your calculator to find $\sqrt{\dfrac{45 \times 5.75}{3.1 + 1.5}}$.

Answer .... [2]

---

2 Work out $2(3 \times 10^8 - 4 \times 10^6)$, giving your answer in standard form.

Answer .... [2]

---

3 Write the following in order of size, **largest** first.

sin 158° cos 158° cos 38° sin 38°

Answer .... > .... > .... > .... [2]

---

4 Write down all the working to show that $\dfrac{\frac{3}{5} + \frac{2}{3}}{\frac{3}{5} \times \frac{2}{3}} = 3\frac{1}{6}$.

Answer

[3]

For Examiner's Use

5 A circle has a radius of 50 cm.

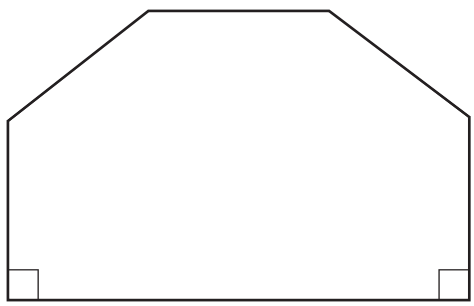
(a) Calculate the area of the circle in cm^2.

Answer(a) .... cm^2 [2]

(b) Write your answer to **part (a)** in m^2.

Answer(b) .... m^2 [1]

6



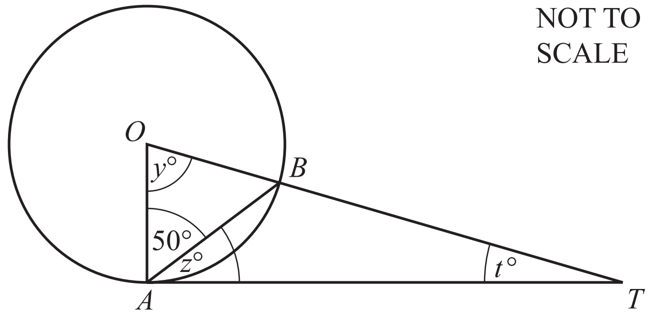
The front of a house is in the shape of a hexagon with two right angles.
The other four angles are all the same size.

Calculate the size of one of these angles.

Answer .... [3]

For Examiner's Use

7



NOT TO SCALE

TA is a tangent at A to the circle, centre O.
Angle $OAB = 50°$.

Find the value of

(a) y,

Answer(a) $y =$ .... [1]

(b) z,

Answer(b) $z =$ .... [1]

(c) t.

Answer(c) $t =$ .... [1]

---

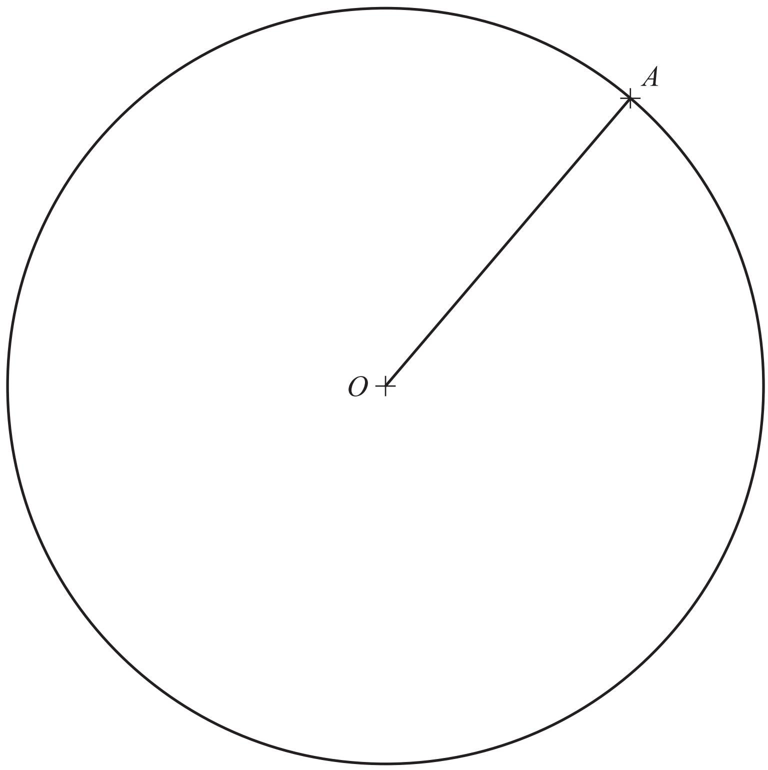
8 Seismic shock waves travel at speed v through rock of density d.
v varies **inversely** as the **square root** of d.

$v = 3$ when $d = 2.25$.

Find v when $d = 2.56$.

Answer $v =$ .... [3]

9



The point A lies on the circle centre O, radius 5 cm.

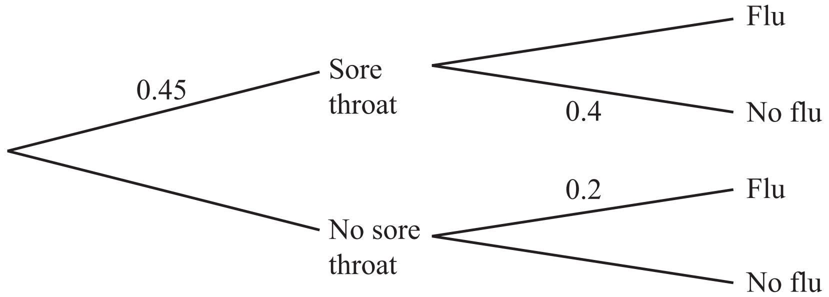
(a) **Using a straight edge and compasses only,** construct the perpendicular bisector of the line OA. [2]

(b) The perpendicular bisector meets the circle at the points C and D.

Measure and write down the size of the angle AOD.

Answer(b) Angle AOD = ... [1]

10 In a flu epidemic 45% of people have a sore throat.
If a person has a sore throat the probability of **not** having flu is 0.4.
If a person does not have a sore throat the probability of having flu is 0.2.



Calculate the probability that a person chosen at random has flu.

Answer .... [4]

---

11 Work out.

(a) $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}^2$

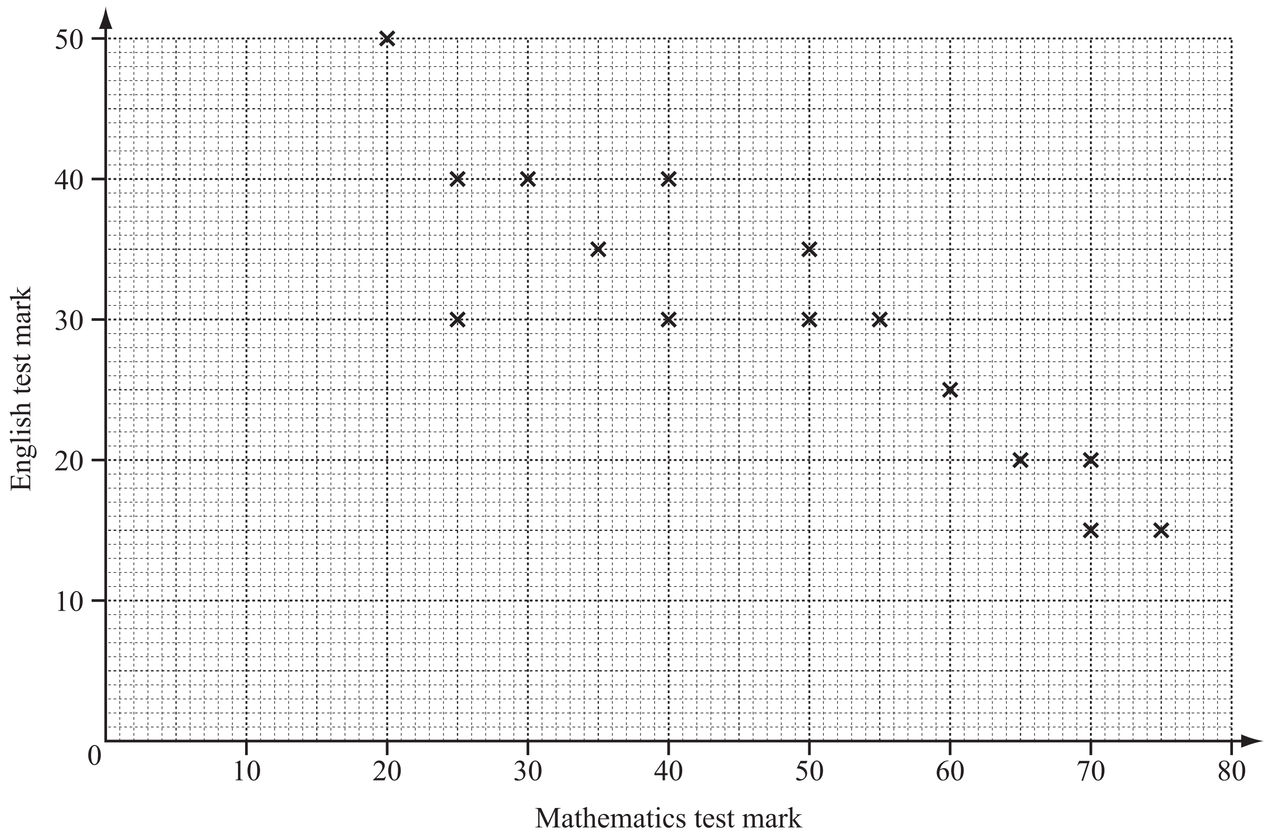
Answer(a) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

(b) $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}^{-1}$

Answer(b) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

For Examiner's Use

12



The scatter diagram shows the marks obtained in a Mathematics test and the marks obtained in an English test by 15 students.

(a) Describe the correlation.

Answer(a) .... [1]

(b) The mean for the Mathematics test is 47.3 .
The mean for the English test is 30.3 .

Plot the mean point (47.3, 30.3) on the scatter diagram above. [1]

(c) **(i)** Draw the line of best fit on the diagram above. [1]

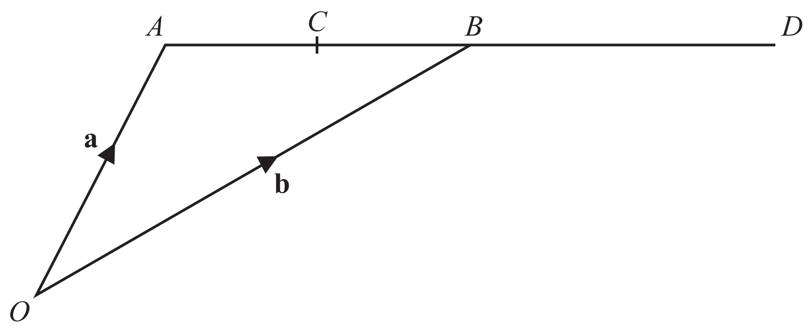
(ii) One student missed the English test.
She received 45 marks in the Mathematics test.

Use your line to estimate the mark she might have gained in the English test.

Answer(c)(ii) .... [1]

For Examiner's Use

13



A and *B* have position vectors **a** and **b** relative to the origin *O*.
C is the midpoint of *AB* and *B* is the midpoint of *AD*.

Find, in terms of **a** and **b**, in their simplest form

(a) the position vector of *C*,

Answer(a) .... [2]

(b) the vector $\overrightarrow{CD}$.

Answer(b) .... [2]

14

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

(a) Find *T* when $g = 9.8$ and $\ell = 2$.

Answer(a) T = ... [2]

(b) Make *g* the subject of the formula.

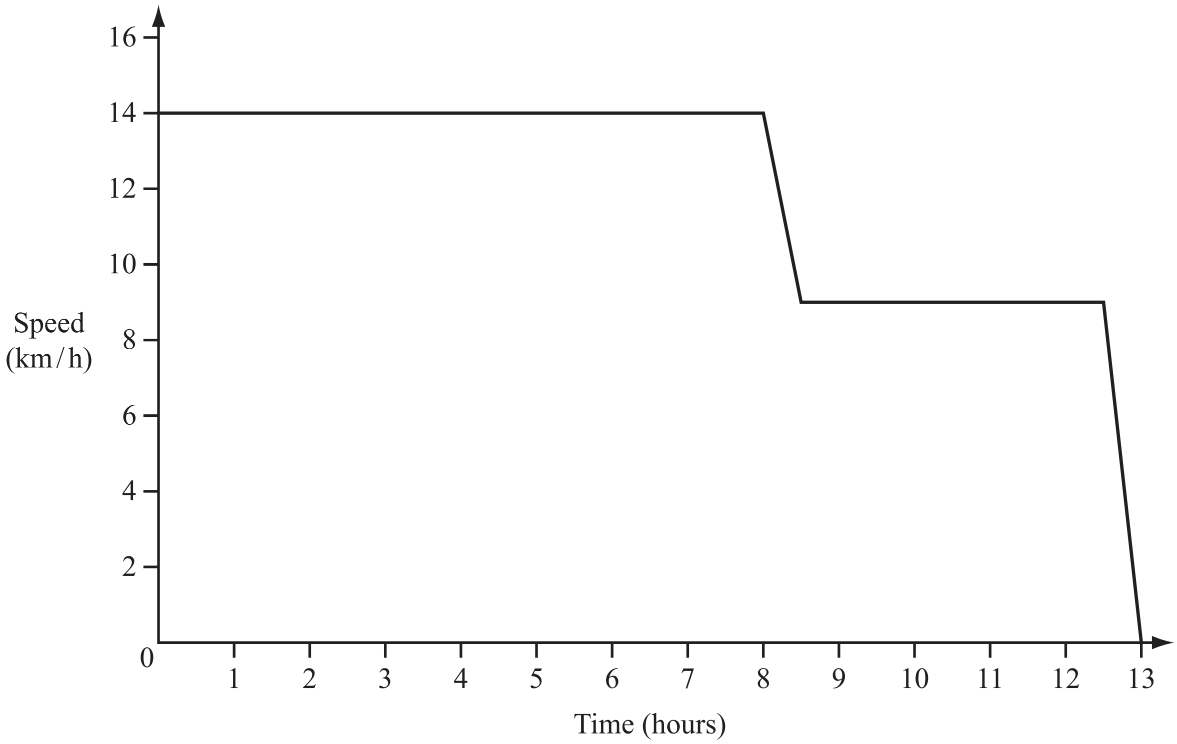
Answer(b) g = ... [3]

For Examiner's Use

15 A container ship travelled at 14 km/h for 8 hours and then slowed down to 9 km/h over a period of 30 minutes.

It travelled at this speed for another 4 hours and then slowed to a stop over 30 minutes.

The speed-time graph shows this voyage.



(a) Calculate the total distance travelled by the ship.

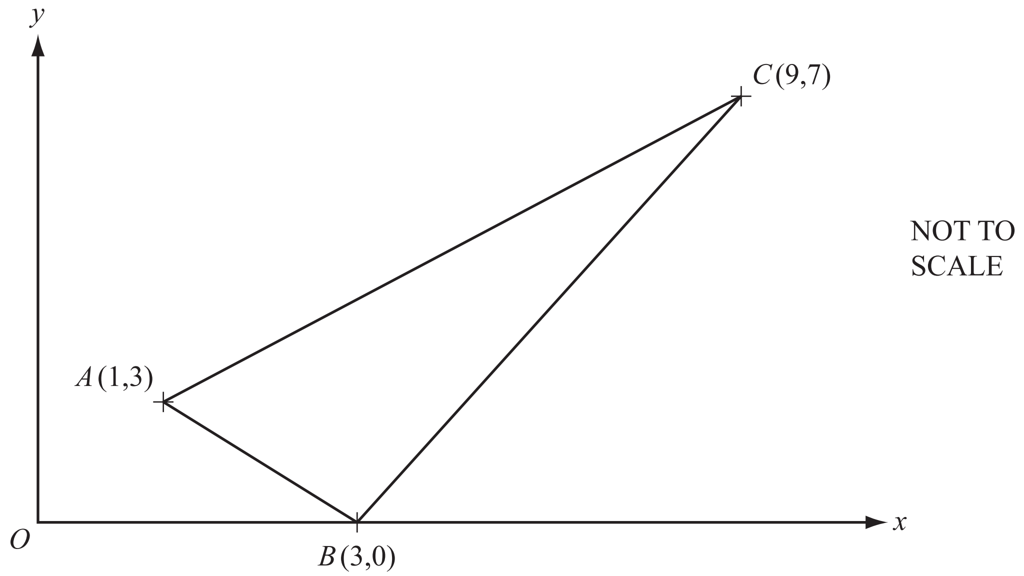
Answer(a) .... km [4]

(b) Calculate the average speed of the ship for the whole voyage.

Answer(b) .... km/h [1]

For Examiner's Use

16



The co-ordinates of *A*, *B* and *C* are shown on the diagram, which is not to scale.

(a) Find the length of the line *AB*.

Answer(a) AB = ... [3]

(b) Find the equation of the line *AC*.

Answer(b) .... [3]

For Examiner's Use

17 $$f(x) = \frac{1}{x+4} \quad (x \neq -4)$$

$$g(x) = x^2 - 3x$$

$$h(x) = x^3 + 1$$

(a) Work out fg(1).

Answer(a) .... [2]

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

Answer(b) $h^{-1}(x) =$ .... [2]

(c) Solve the equation $g(x) = -2$.

Answer(c) $x =$ .... or $x =$ .... [3]

Question 18 is printed on the next page.

For Examiner's Use

18 The first four terms of a sequence are

$T_1 = 1^2 \qquad T_2 = 1^2 + 2^2 \qquad T_3 = 1^2 + 2^2 + 3^2 \qquad T_4 = 1^2 + 2^2 + 3^2 + 4^2.$

(a) The nth term is given by $T_n = \frac{1}{6}n(n+1)(2n+1)$.

Work out the value of T_{23}.

Answer(a) T_{23} = ... [2]

(b) A new sequence is formed as follows.

$U_1 = T_2 - T_1 \qquad U_2 = T_3 - T_2 \qquad U_3 = T_4 - T_3 \qquad \ldots\ldots$

(i) Find the values of U_1 and U_2.

Answer(b)(i) U_1 = ... and U_2 = ... [2]

(ii) Write down a formula for the nth term, U_n .

Answer(b)(ii) U_n = ... [1]

(c) The first four terms of another sequence are

$V_1 = 2^2 \qquad V_2 = 2^2 + 4^2 \qquad V_3 = 2^2 + 4^2 + 6^2 \qquad V_4 = 2^2 + 4^2 + 6^2 + 8^2.$

By comparing this sequence with the one in **part (a)**, find a formula for the nth term, V_n .

Answer(c) V_n = ... [2]

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5208945727

MATHEMATICS **0580/22**

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1 hour 30 minutes

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IB11 11_0580_22/2RP

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[Turn over

For Examiner's Use

1 A bus leaves a port every 15 minutes, starting at 09 00.
The last bus leaves at 17 30.

How many times does a bus leave the port during one day?

Answer .... [2]

---

2 Factorise completely $ax + bx + ay + by$.

Answer .... [2]

---

3 Use your calculator to find the value of

(a) $3^0 \times 2.5^2$,

Answer(a) .... [1]

(b) 2.5^{-2}.

Answer(b) .... [1]

---

4 The cost of making a chair is \$28 correct to the nearest dollar.

Calculate the lower and upper bounds for the cost of making 450 chairs.

Answer lower bound \$ ....

upper bound \$ .... [2]

For Examiner's Use

5 Jiwan incorrectly wrote $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 1\frac{3}{9}$.

Show the correct working and write down the answer as a mixed number.

Answer .... [3]

---

6 The force, F, between two magnets varies **inversely** as the **square** of the distance, d, between them.

$F = 150$ when $d = 2$.

Calculate F when $d = 4$.

Answer $F =$ .... [3]

[Turn over

For Examiner's Use

7 $\begin{pmatrix} 0 & 2 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 8 \\ 25 \end{pmatrix}$

Find the value of a and the value of b.

Answer a = ...

b = ... [3]

---

8 A cruise ship travels at 22 knots.

[1 knot is 1.852 kilometres per hour.]

Convert this speed into metres per second.

Answer .... m/s [3]

For Examiner's Use

9 A sequence is given by $u_1 = \sqrt{1}$, $u_2 = \sqrt{3}$, $u_3 = \sqrt{5}$, $u_4 = \sqrt{7}$, …

(a) Find a formula for u_n, the nth term.

Answer(a) $u_n =$ .... [2]

(b) Find u_{29} .

Answer(b) $u_{29} =$ .... [1]

---

10 Write as a single fraction in its simplest form.

$$\frac{3}{x+10} - \frac{1}{x+4}$$

Answer .... [3]

[Turn over

11 Find the values of *m* and *n*.

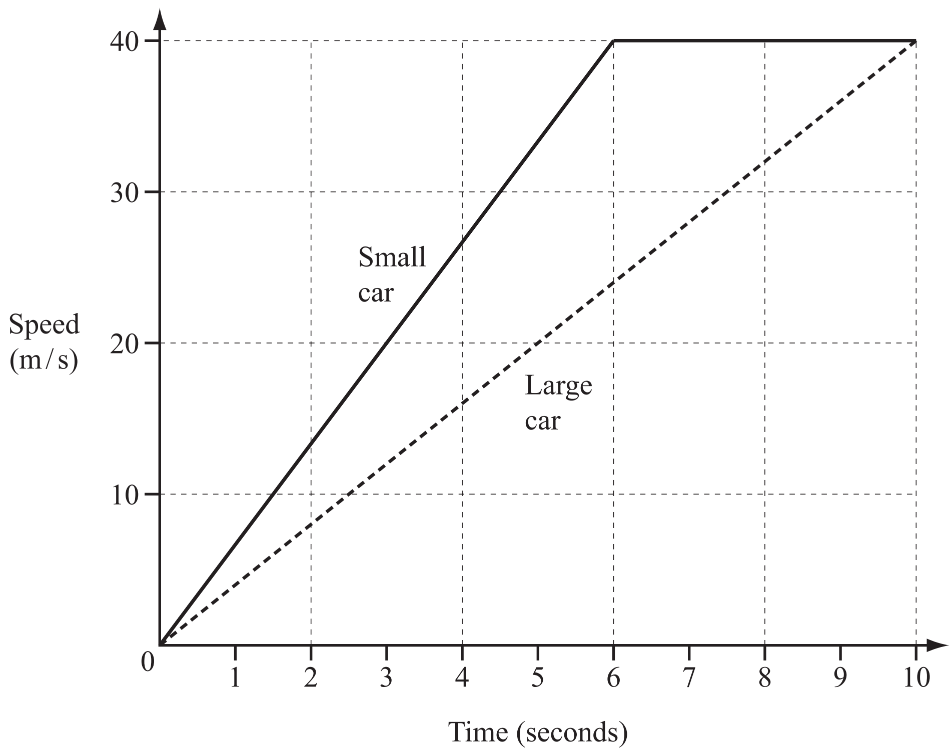
(a) $2^m = 0.125$

Answer(a) m = ... [2]

(b) $2^{4n} \times 2^{2n} = 512$

Answer(b) n = ... [2]

12

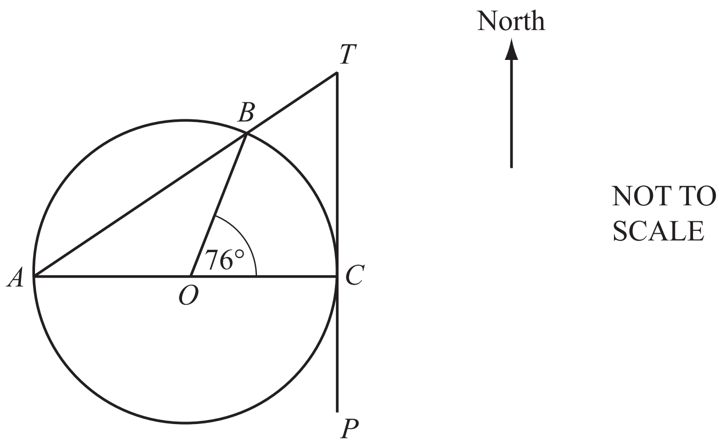


A small car accelerates from 0 m/s to 40 m/s in 6 seconds and then travels at this constant speed.
A large car accelerates from 0 m/s to 40 m/s in 10 seconds.

Calculate how much further the small car travels in the first 10 seconds.

Answer .... m [4]

13



AOC is a diameter of the circle, centre *O*.
AT is a straight line that cuts the circle at *B*.
PT is the tangent to the circle at *C*.
Angle *COB* = 76°.

(a) Calculate angle *ATC*.

Answer(a) Angle *ATC* = ... [2]

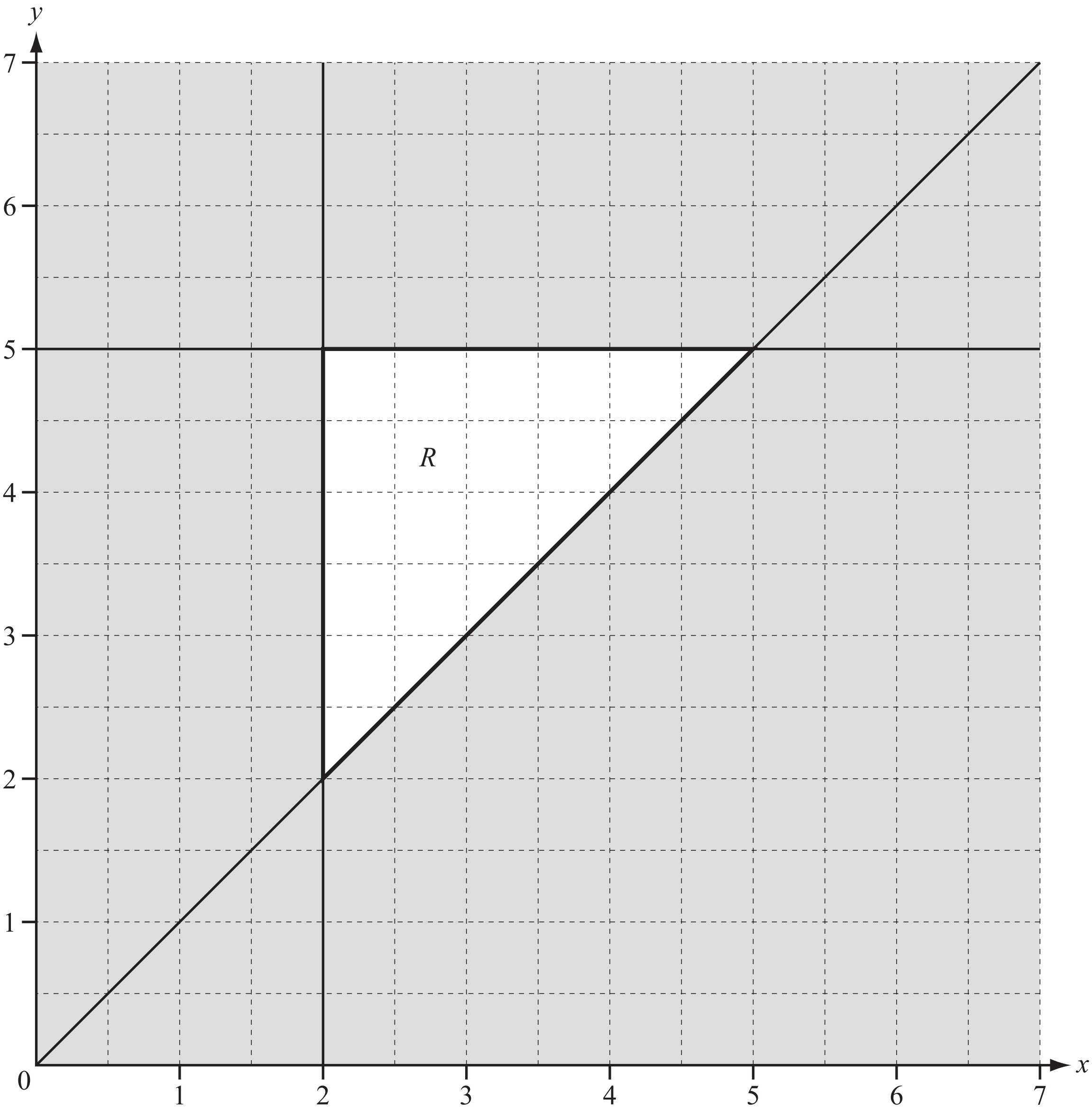
(b) *T* is due north of *C*.

Calculate the bearing of *B* from *C*.

Answer(b) .... [2]

For Examiner's Use

14



The region R is bounded by three lines.

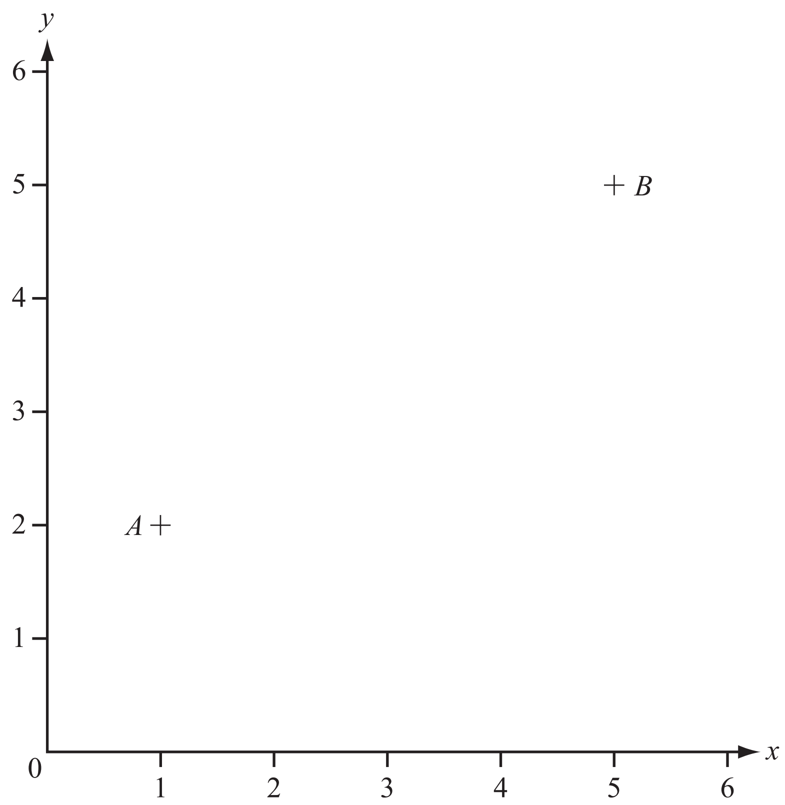
Write down the three inequalities which define the region R.

Answer ....

....

.... [4]

15



The points $A(1, 2)$ and $B(5, 5)$ are shown on the diagram .

(a) Work out the co-ordinates of the midpoint of AB.

Answer(a) (.............. , ...) [1]

(b) Write down the column vector $\overrightarrow{AB}$.

Answer(b) $\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(c) **Using a straight edge and compasses only,** draw the locus of points which are equidistant from A and from B. [2]

16 In a survey of 60 cars, the type of fuel that they use is recorded in the table below.

For Examiner's Use

Each car only uses one type of fuel.

Petrol	Diesel	Liquid Hydrogen	Electricity
40	12	2	6

(a) Write down the mode.

Answer(a) .... [1]

(b) Olav drew a pie chart to illustrate these figures.

Calculate the angle of the sector for Diesel.

Answer(b) .... [2]

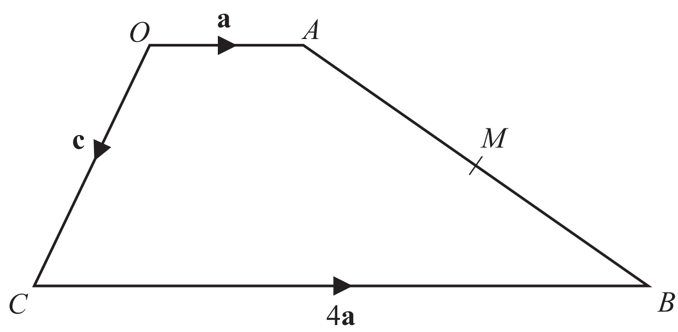
(c) Calculate the probability that a car chosen at random uses Electricity.

Write your answer as a fraction in its simplest form.

Answer(c) .... [2]

For Examiner's Use

17



O is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = 4\mathbf{a}$.
M is the midpoint of AB.

(a) Find, in terms of **a** and **c**, in their simplest form

(i) the vector $\overrightarrow{AB}$,

Answer(a)(i) $\overrightarrow{AB}$ = ... [2]

(ii) the position vector of M.

Answer(a)(ii) .... [2]

(b) Mark the point D on the diagram where $\overrightarrow{OD} = 3\mathbf{a} + \mathbf{c}$. [2]

18

$$w = \frac{1}{\sqrt{LC}}$$

(a) Find w when $L = 8 \times 10^{-3}$ and $C = 2 \times 10^{-9}$.
Give your answer in standard form.

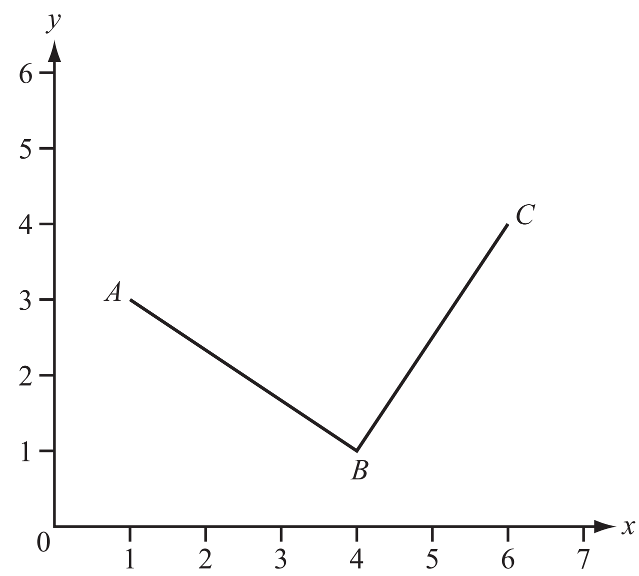
Answer(a) w = ... [3]

(b) Rearrange the formula to make C the subject.

Answer(b) C = ... [3]

Question 19 is printed on the next page.

19



$A(1, 3)$, $B(4, 1)$ and $C(6, 4)$ are shown on the diagram.

(a) **Using a straight edge and compasses only,** construct the angle bisector of angle ABC. [2]

(b) Work out the equation of the line BC.

Answer(b) .... [3]

(c) ABC forms a **right-angled isosceles** triangle of area $6.5\,\text{cm}^2$.

Calculate the length of AB.

Answer(c) AB = ... cm [2]

For Examiner's Use

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For Examiner's Use

1 Martha divides \$240 between spending and saving in the ratio

$$\text{spending} : \text{saving} = 7 : 8 .$$

Calculate the amount Martha has for spending.

Answer \$ .... [2]

---

2 210 211 212 213 214 215 216

From the list of numbers, find

(a) a prime number,

Answer(a) .... [1]

(b) a cube number.

Answer(b) .... [1]

---

3 Solve the simultaneous equations.

$$x + 5y = 22$$
$$x + 3y = 12$$

Answer $x =$ ....

$y =$ .... [2]

For Examiner's Use

4 Find the value of $\left(\frac{27}{8}\right)^{-\frac{4}{3}}$.

Give your answer as an exact fraction.

Answer .... [2]

---

5 The population of a city is 128 000, correct to the nearest thousand.

(a) Write 128 000 in standard form.

Answer(a) .... [1]

(b) Write down the upper bound of the population.

Answer(b) .... [1]

---

6 Pedro invested \$800 at a rate of 5% per year **compound** interest.
Calculate the **total** amount he has after 2 years.

Answer \$ .... [2]

---

7 Show that $3^{-2} + 2^{-2} = \frac{13}{36}$.

Write down all the steps of your working.

Answer

[2]

---

8 Find the value of $\dfrac{\sqrt[3]{17.1-1.89}}{10.4+\sqrt{8.36}}$.

Answer .... [2]

---

9 In Vienna, the mid-day temperatures, in °C, are recorded during a week in December.
This information is shown below.

$$-2 \quad 2 \quad 1 \quad -3 \quad -1 \quad -2 \quad 0$$

Calculate

(a) the difference between the highest temperature and the lowest temperature,

Answer(a) .... °C [1]

(b) the mean temperature.

Answer(b) .... °C [2]

---

10 Maria decides to increase her homework time of 8 hours per week by 15%.

Calculate her new homework time.
Give your answer in hours and minutes.

Answer .... h .... min [3]

For Examiner's Use

11 Factorise completely.

$$p^2x - 4q^2x$$

Answer .... [3]

---

12 Alberto changes 800 Argentine pesos (ARS) into dollars ($) when the rate is $1 = 3.8235 ARS.
He spends $150 and changes the remaining dollars back into pesos when the rate is
$1 = 3.8025 ARS.

Calculate the amount Alberto now has in pesos.

Answer .... ARS [3]

---

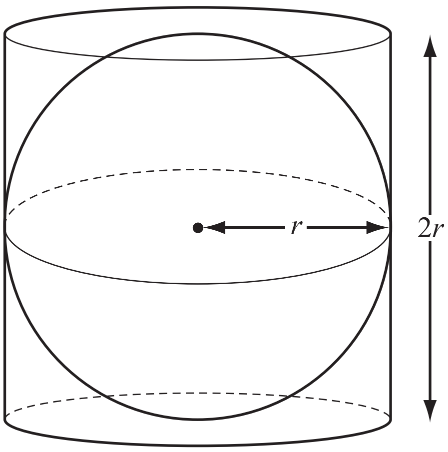
13 During a marathon race an athlete loses 2 % of his mass.
At the end of the race his mass is 67.13 kg.

Calculate his mass before the race.

Answer .... kg [3]

For Examiner's Use

14



The sphere of radius r fits exactly inside the cylinder of radius r and height $2r$.
Calculate the percentage of the cylinder occupied by the sphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer .... % [3]

---

15 $ap = px + c$

Write p in terms of a, c and x.

Answer p = ... [3]

---

16 The time, t, for a pendulum to swing varies directly as the **square root** of its length, l.
When $l = 9$, $t = 6$.

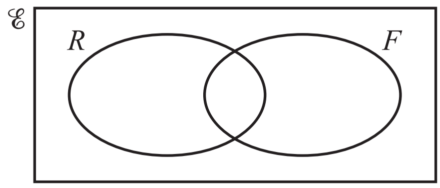
(a) Find a formula for t in terms of l.

Answer(a) $t =$ .... [2]

(b) Find t when $l = 2.25$.

Answer(b) $t =$ .... [1]

17



In the Venn diagram, ℰ = {students in a survey}, R = {students who like rugby} and F = {students who like football}.

n(ℰ) = 20 $n(R \cup F) = 17$ $n(R) = 13$ $n(F) = 11$

(a) Find

(i) $n(R \cap F)$,

Answer(a)(i) .... [1]

(ii) $n(R' \cap F)$.

Answer(a)(ii) .... [1]

(b) A student who likes rugby is chosen at random.

Find the probability that this student also likes football.

Answer(b) .... [1]

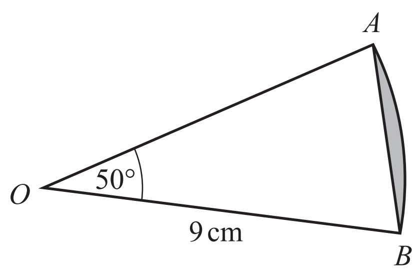
For Examiner's Use

18 Write as a single fraction, in its simplest form.

$$\frac{1-x}{x} - \frac{2+x}{1-2x}$$

Answer .... [4]

19



NOT TO SCALE

The diagram shows a sector *AOB* of a circle, centre *O*, radius 9 cm with angle *AOB* = 50°.

Calculate the area of the segment shaded in the diagram.

Answer .... cm^2 [4]

---

20 **(a)** $\mathbf{N} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$. The order of the matrix **N** is 2×1.

$\mathbf{P} = (1 \quad 3)$. The order of the matrix **P** is 1×2.

(i) Write down the order of the matrix **NP**.

Answer(a)(i) .... [1]

(ii) Calculate **PN**.

Answer(a)(ii) [1]

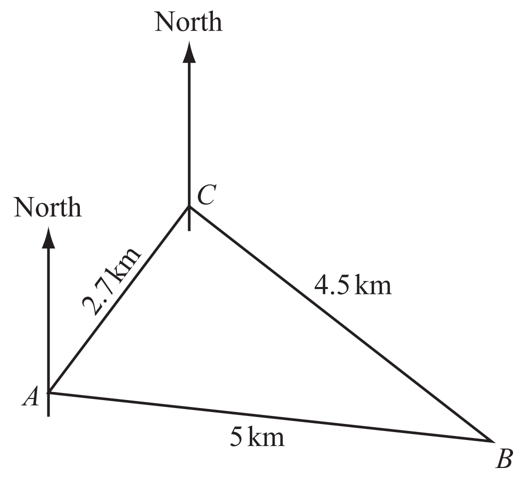
(b) $\mathbf{M} = \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}$.

Find $\mathbf{M}^{-1}$, the inverse of **M** .

Answer(b) $\mathbf{M}^{-1} =$ [2]

For Examiner's Use

21



The diagram shows 3 ships A, B and C at sea.

$AB = 5$ km, $BC = 4.5$ km and $AC = 2.7$ km.

(a) Calculate angle ACB.
Show all your working.

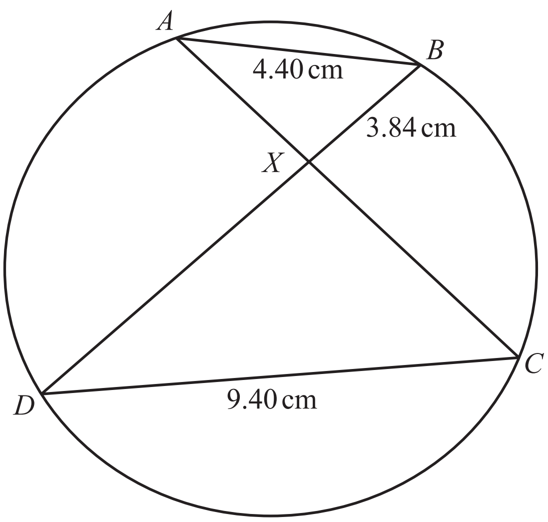
Answer(a) Angle ACB = ... [4]

(b) The bearing of A from C is 220°.

Calculate the bearing of B from C.

Answer(b) .... [1]

22



NOT TO SCALE

A, B, C and D lie on a circle.
AC and BD intersect at X.

(a) Give a reason why angle BAX is equal to angle CDX.

Answer(a) .... [1]

(b) $AB = 4.40$ cm, $CD = 9.40$ cm and $BX = 3.84$ cm.

(i) Calculate the length of CX.

Answer(b)(i) $CX =$ .... cm [2]

(ii) The area of triangle ABX is 5.41 cm^2.

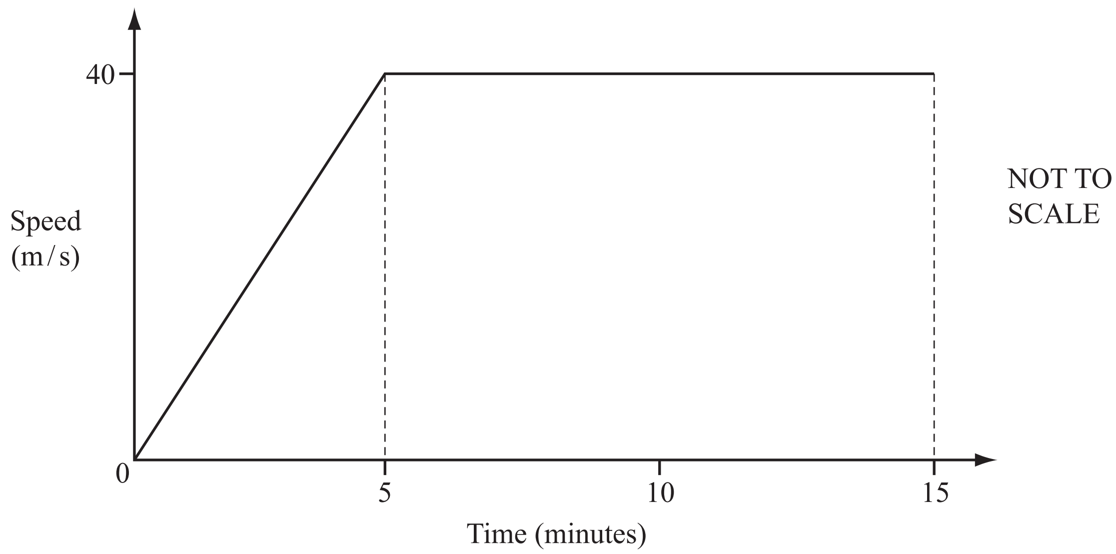
Calculate the area of triangle CDX.

Answer(b)(ii) .... cm^2 [2]

Question 23 is printed on the next page.

For Examiner's Use

23



The diagram shows the speed-time graph for the first 15 **minutes** of a train journey.
The train accelerates for 5 minutes and then continues at a constant speed of 40 metres/**second**.

(a) Calculate the acceleration of the train during the first 5 minutes.
Give your answer in m/s^2.

Answer(a) .... m/s^2 [2]

(b) Calculate the average speed for the first 15 minutes of the train journey.
Give your answer in m/s.

Answer(b) .... m/s [3]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME		
CENTRE NUMBER		CANDIDATE NUMBER

1019432694

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Mathematical tables (optional), Geometrical instruments, Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **16** printed pages.

For Examiner's Use

1 **(a)** Abdullah and Jasmine bought a car for \$9000.
Abdullah paid 45% of the \$9000 and Jasmine paid the rest.

(i) How much did Jasmine pay towards the cost of the car?

Answer(a)(i) \$ .... [2]

(ii) Write down the ratio of the payments Abdullah : Jasmine in its simplest form.

Answer(a)(ii) .... : .... [1]

(b) Last year it cost \$2256 to run the car.
Abdullah, Jasmine and their son Henri share this cost in the ratio 8 : 3 : 1.
Calculate the amount each paid to run the car.

Answer(b) Abdullah \$ ....

Jasmine \$ ....

Henri \$ .... [3]

(c) **(i)** A new truck costs \$15 000 and loses 23% of its value **each year**.
Calculate the value of the truck after three years.

Answer(c)(i) \$ .... [3]

(ii) Calculate the overall percentage loss of the truck's value after three years.

Answer(c)(ii) .... % [3]

For Examiner's Use

2 **(a)** Find the integer values for x which satisfy the inequality $-3 < 2x - 1 \leqslant 6$.

Answer(a) .... [3]

(b) Simplify $\dfrac{x^2 + 3x - 10}{x^2 - 25}$.

Answer(b) .... [4]

(c) **(i)** Show that $\dfrac{5}{x-3} + \dfrac{2}{x+1} = 3$ can be simplified to $3x^2 - 13x - 8 = 0$.

Answer(c)(i)

[3]

(ii) Solve the equation $3x^2 - 13x - 8 = 0$.

Show all your working and give your answers correct to two decimal places.

Answer(c)(ii) $x =$ .... or $x =$ .... [4]

For Examiner's Use

3 The table shows information about the heights of 120 girls in a swimming club.

Height (h metres)	Frequency
$1.3 < h \leqslant 1.4$	4
$1.4 < h \leqslant 1.5$	13
$1.5 < h \leqslant 1.6$	33
$1.6 < h \leqslant 1.7$	45
$1.7 < h \leqslant 1.8$	19
$1.8 < h \leqslant 1.9$	6

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

Answer(a)(i) .... m [1]

(ii) Calculate an estimate of the mean height. Show all of your working.

Answer(a)(ii) .... m [4]

(b) Girls from this swimming club are chosen at random to swim in a race.
Calculate the probability that

(i) the height of the first girl chosen is more than 1.8 metres,

Answer(b)(i) .... [1]

(ii) the heights of **both** the first and second girl chosen are 1.8 metres or less.

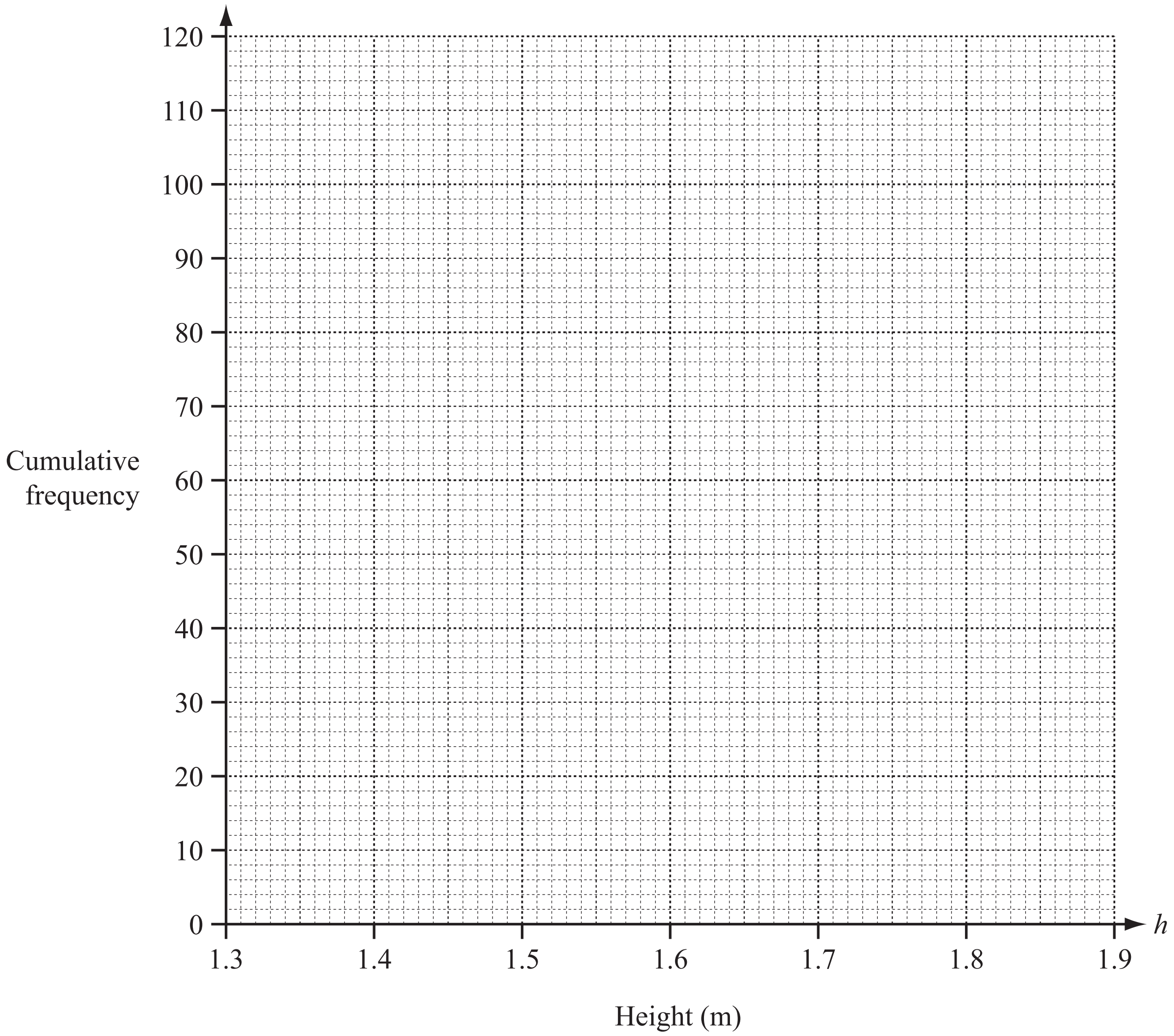
Answer(b)(ii) .... [3]

(c) (i) Complete the cumulative frequency table for the heights.

Height (h metres)	Cumulative frequency
$h \leqslant 1.3$	0
$h \leqslant 1.4$	4
$h \leqslant 1.5$	17
$h \leqslant 1.6$	50
$h \leqslant 1.7$	
$h \leqslant 1.8$	114
$h \leqslant 1.9$	

[1]

(ii) Draw the cumulative frequency graph on the grid.



[3]

(d) Use your graph to find

(i) the median height,

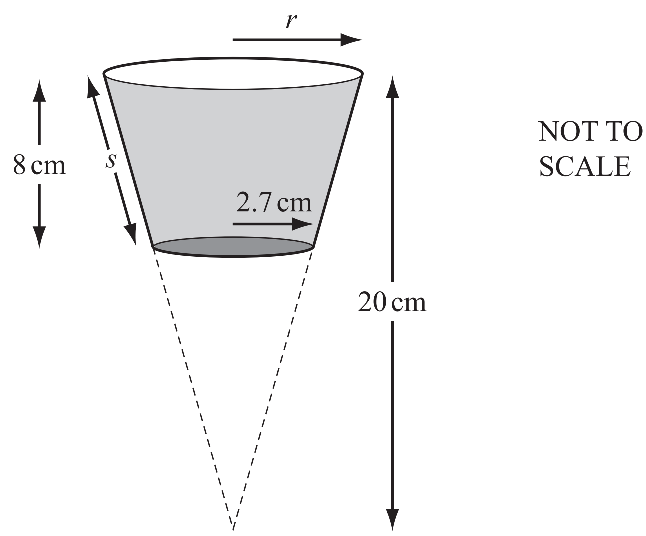
Answer(d)(i) .... m [1]

(ii) the 30th percentile.

Answer(d)(ii) .... m [1]

For Examiner's Use

4



The diagram shows a plastic cup in the shape of a cone with the end removed.
The vertical height of the cone in the diagram is 20 cm.
The height of the cup is 8 cm.
The base of the cup has radius 2.7 cm.

(a) **(i)** Show that the radius, r, of the circular top of the cup is 4.5 cm.

Answer(a)(i)

[2]

(ii) Calculate the volume of water in the cup when it is full.

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

Answer(a)(ii) .... cm^3 [4]

For Examiner's Use

(b) **(i)** Show that the slant height, s, of the cup is 8.2 cm.

Answer(b)(i)

[3]

(ii) Calculate the curved surface area of the outside of the cup.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Answer(b)(ii) .... cm^2 [5]

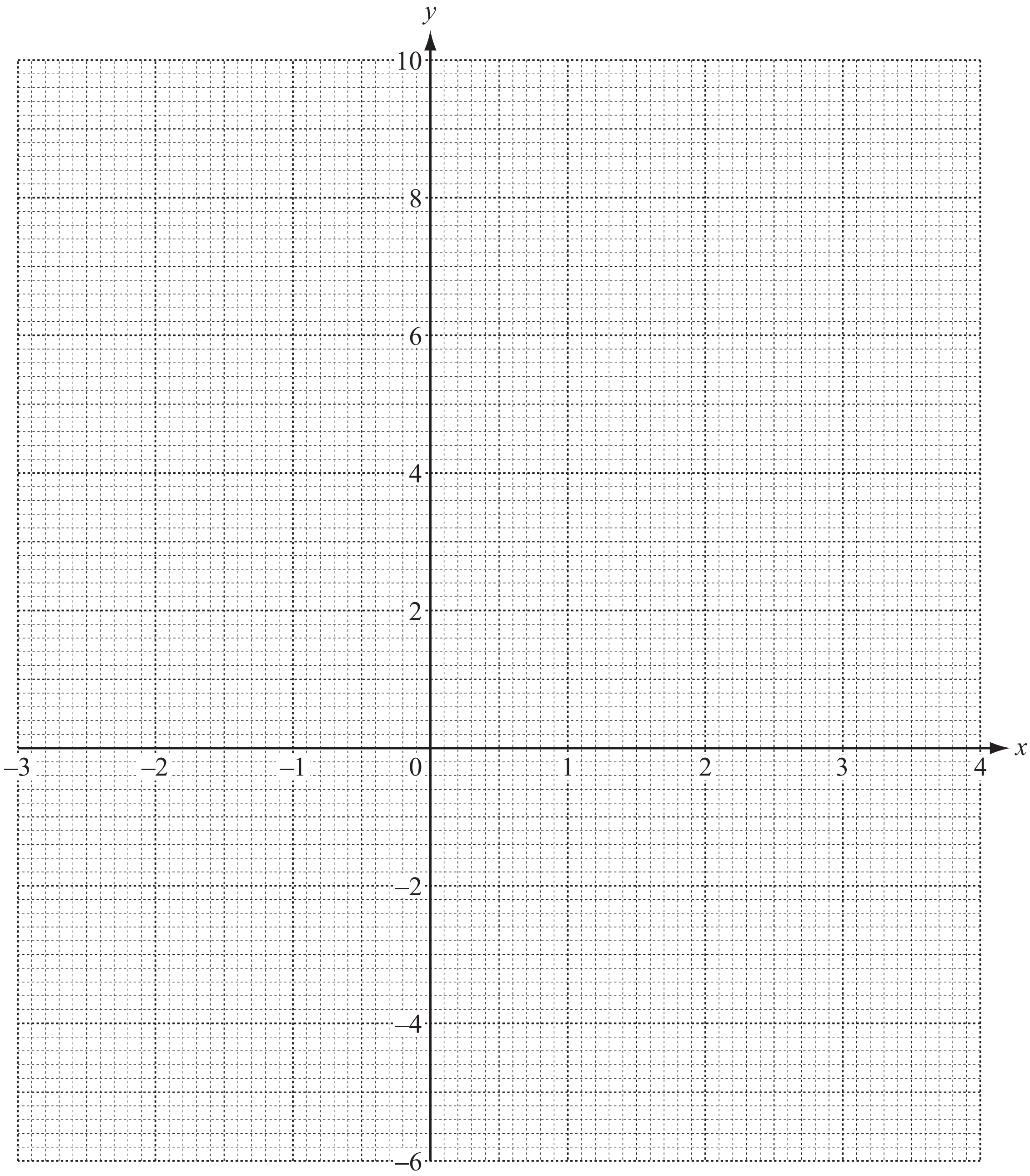
For Examiner's Use

5 **(a)** Complete the table for the function $f(x) = \frac{x^3}{2} - 3x - 1$.

x	–3	–2	–1.5	–1	0	1	1.5	2	3	3.5
$f(x)$	–5.5		1.8	1.5		–3.5	–3.8	–3		9.9

[3]

(b) On the grid draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant 3.5$.



[4]

For Examiner's Use

(c) Use your graph to

(i) solve $f(x) = 0.5$,

Answer(c)(i) $x =$ .... or $x =$ .... or $x =$ .... [3]

(ii) find the inequalities for k, so that $f(x) = k$ has only 1 answer.

Answer(c)(ii) $k <$ ....

$k >$ .... [2]

(d) **(i)** On the same grid, draw the graph of $y = 3x - 2$ for $-1 \leqslant x \leqslant 3.5$. [3]

(ii) The equation $\frac{x^3}{2} - 3x - 1 = 3x - 2$ can be written in the form $x^3 + ax + b = 0$.

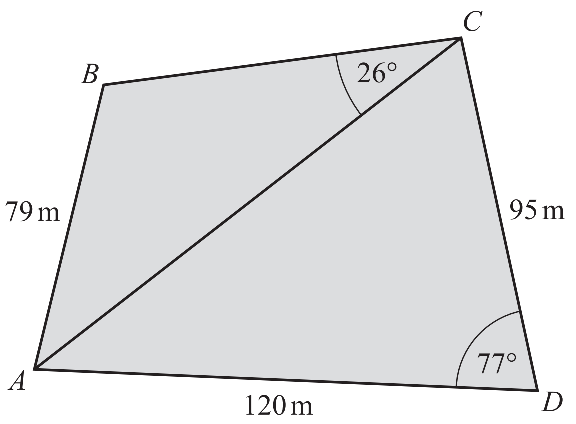
Find the values of a and b.

Answer(d)(ii) $a =$ .... and $b =$ .... [2]

(iii) Use your graph to find the **positive** answers to $\frac{x^3}{2} - 3x - 1 = 3x - 2$ for $-3 \leqslant x \leqslant 3.5$.

Answer(d)(iii) $x =$ .... or $x =$ .... [2]

6



The quadrilateral *ABCD* represents an area of land.
There is a straight road from *A* to *C*.
AB = 79 m, *AD* = 120 m and *CD* = 95 m.
Angle *BCA* = 26° and angle *CDA* = 77°.

(a) Show that the length of the road, *AC*, is 135 m correct to the nearest metre.

Answer(a)

[4]

(b) Calculate the size of the **obtuse** angle *ABC*.

Answer(b) Angle *ABC* = ... [4]

(c) A straight path is to be built from *B* to the nearest point on the road *AC*.

Calculate the length of this path.

For Examiner's Use

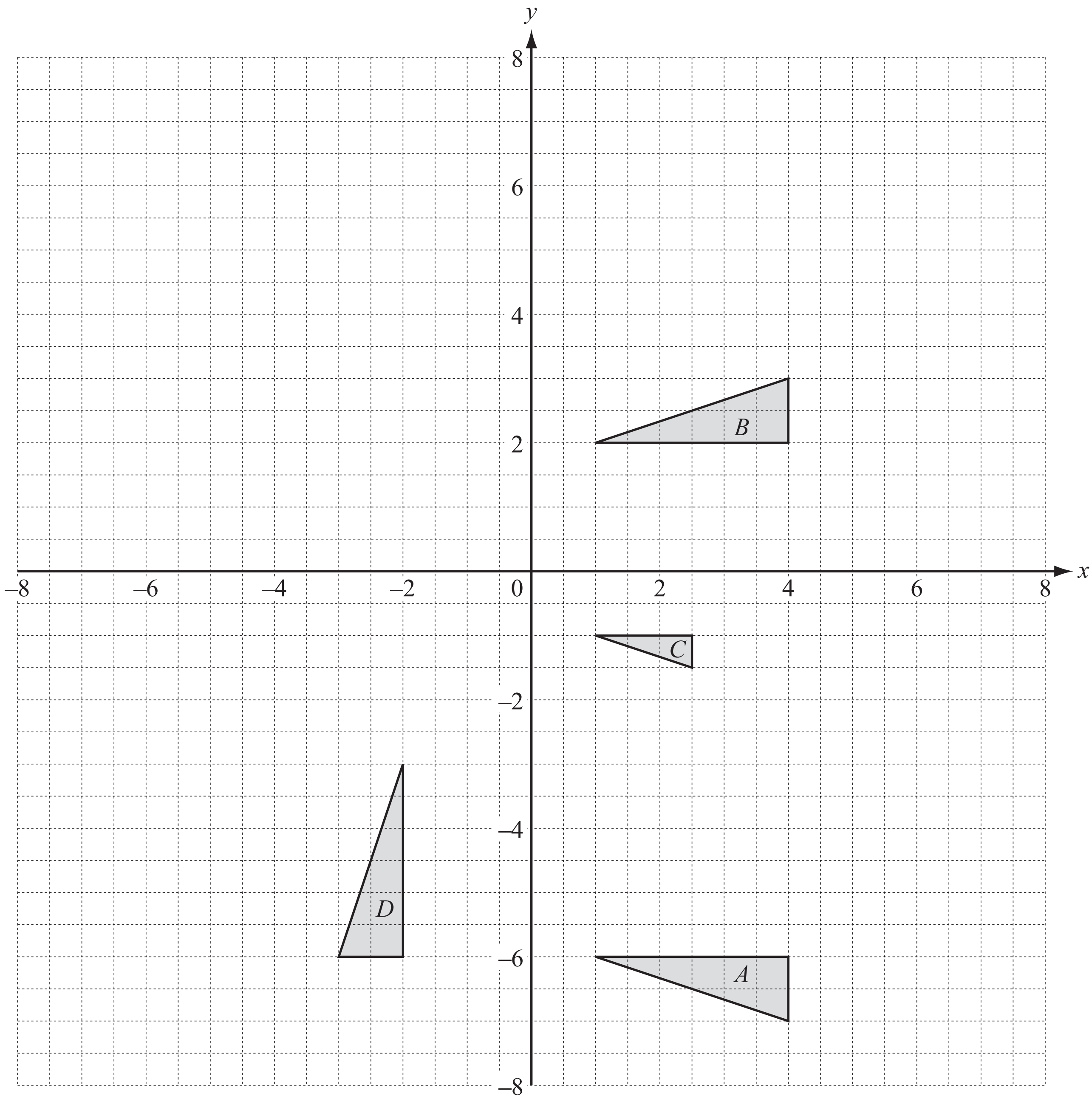
Answer(c) .... m [3]

(d) Houses are to be built on the land in triangle *ACD*.
Each house needs at least 180 m^2 of land.

Calculate the maximum number of houses which can be built.
Show all of your working.

Answer(d) .... [4]

7



(a) Describe fully the **single** transformation which maps

(i) triangle A onto triangle B,

Answer(a)(i) .... [2]

(ii) triangle A onto triangle C,

Answer(a)(ii) .... [3]

(iii) triangle A onto triangle D.

Answer(a)(iii) .... [3]

For Examiner's Use

(b) Draw the image of

(i) triangle B after a translation of $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$, [2]

(ii) triangle B after a transformation by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$. [3]

(c) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$.

Answer(c) ....

.... [3]

For Examiner's Use

8 Mr Chang hires x large coaches and y small coaches to take 300 students on a school trip.
Large coaches can carry 50 students and small coaches 30 students.
There is a maximum of 5 large coaches.

(a) Explain clearly how the following two inequalities satisfy these conditions.

(i) $x \leqslant 5$

Answer(a)(i) .... [1]

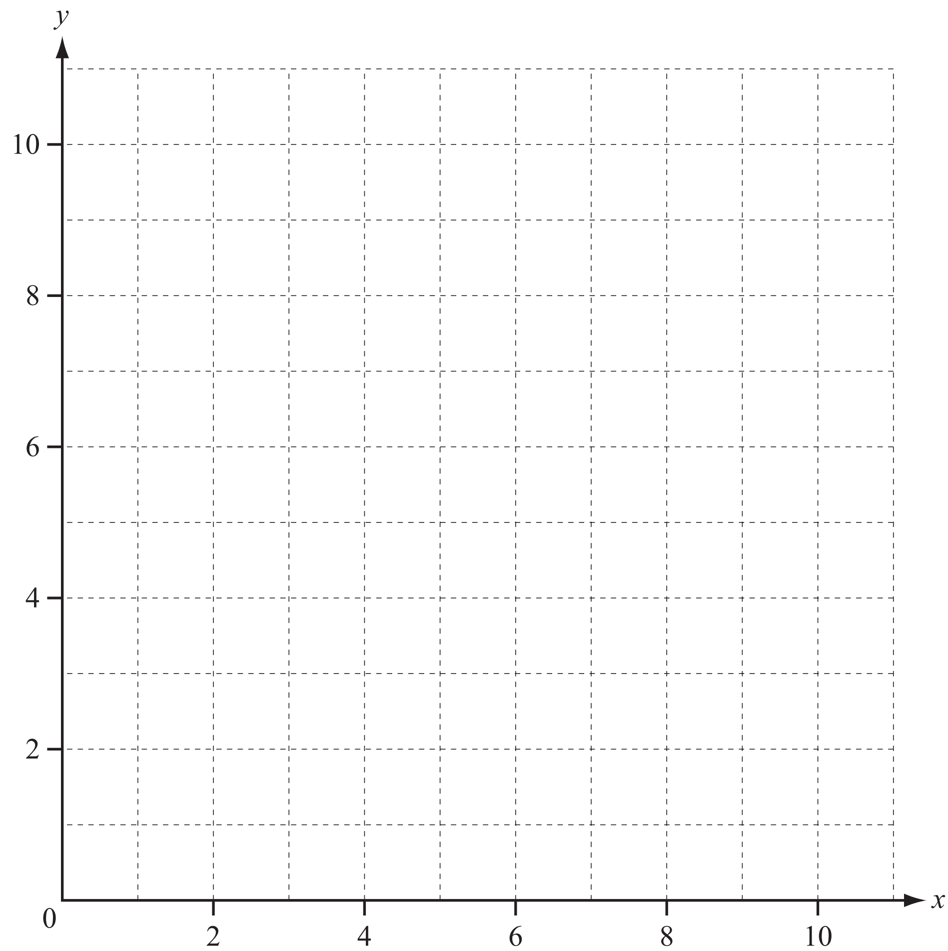
(ii) $5x + 3y \geqslant 30$

Answer(a)(ii) ....

.... [2]

Mr Chang also knows that $x + y \leqslant 10$.

(b) On the grid, show the information above by drawing three straight lines and shading the **unwanted** regions.



[5]

For Examiner's Use

(c) A large coach costs \$450 to hire and a small coach costs \$350.

(i) Find the number of large coaches and the number of small coaches that would give the minimum hire cost for this school trip.

Answer(c)(i) Large coaches ....

Small coaches .... [2]

(ii) Calculate this minimum cost.

Answer(c)(ii) \$ .... [1]

---

9 **(a)** 72 $= 2 \times 2 \times 2 \times 3 \times 3$ written as a product of prime factors.

(i) Write the number 126 as a product of prime factors.

Answer(a)(i) 126 = ... [2]

(ii) Find the value of the highest common factor of 72 and 126.

Answer(a)(ii) .... [1]

(iii) Find the value of the lowest common multiple of 72 and 126.

Answer(a)(iii) .... [2]

The rest of question 9 is printed on the next page.

For Examiner's Use

(b) John wants to estimate the value of π.
He measures the circumference of a circular pizza as 105 cm and its diameter as 34 cm, both correct to the nearest centimetre.

Calculate the lower bound of his estimate of the value of π.
Give your answer correct to 3 decimal places.

Answer(b) .... [4]

(c) The volume of a cylindrical can is 550 cm^3, correct to the nearest 10 cm^3.
The height of the can is 12 cm correct to the nearest centimetre.

Calculate the upper bound of the radius of the can.
Give your answer correct to 3 decimal places.

Answer(c) .... cm [5]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

1108636051

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
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Do not use staples, paper clips, highlighters, glue or correction fluid.
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For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

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

IB11 11_0580_42/5RP

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 Children go to camp on holiday.

(a) Fatima buys bananas and apples for the camp.

(i) Bananas cost \$0.85 per kilogram.

Fatima buys 20kg of bananas and receives a discount of 14%.

How much does she spend on bananas?

Answer(a)(i) \$ .... [3]

(ii) Fatima spends \$16.40 on apples after a discount of 18%.

Calculate the original price of the apples.

Answer(a)(ii) \$ .... [3]

(iii) The ratio number of bananas : number of apples = 4 : 5.

There are 108 bananas.

Calculate the number of apples.

Answer(a)(iii) .... [2]

For Examiner's Use

(b) The cost to hire a tent consists of two parts.

$\$c$	+	$\$d$ per day

The total cost for 4 days is \$27.10 and for 7 days is \$34.30.

Write down two equations in c and d and solve them.

Answer(b) $c =$ ....

$d =$ .... [4]

(c) The children travel 270 km to the camp, leaving at 07 43 and arriving at 15 13.

Calculate their average speed in km/h.

Answer(c) .... km/h [3]

(d) Two years ago \$540 was put in a savings account to pay for the holiday.

The account paid **compound** interest at a rate of 6% per year.

How much is in the account now?

Answer(d) \$ .... [2]

2

For Examiner's Use

$$f(x) = 4x - 2$$

$$g(x) = \frac{2}{x} + 1$$

$$h(x) = x^2 + 3$$

(a) **(i)** Find the value of hf(2).

Answer(a)(i) .... [2]

(ii) Write fg(x) in its simplest form.

Answer(a)(ii) fg(x) = ... [2]

(b) Solve g(x) = 0.2.

Answer(b) x = ... [2]

(c) Find the value of gg(3).

Answer(c) .... [2]

For Examiner's Use

(d) **(i)** Show that $f(x) = g(x)$ can be written as $4x^2 - 3x - 2 = 0$.

Answer (d)(i)

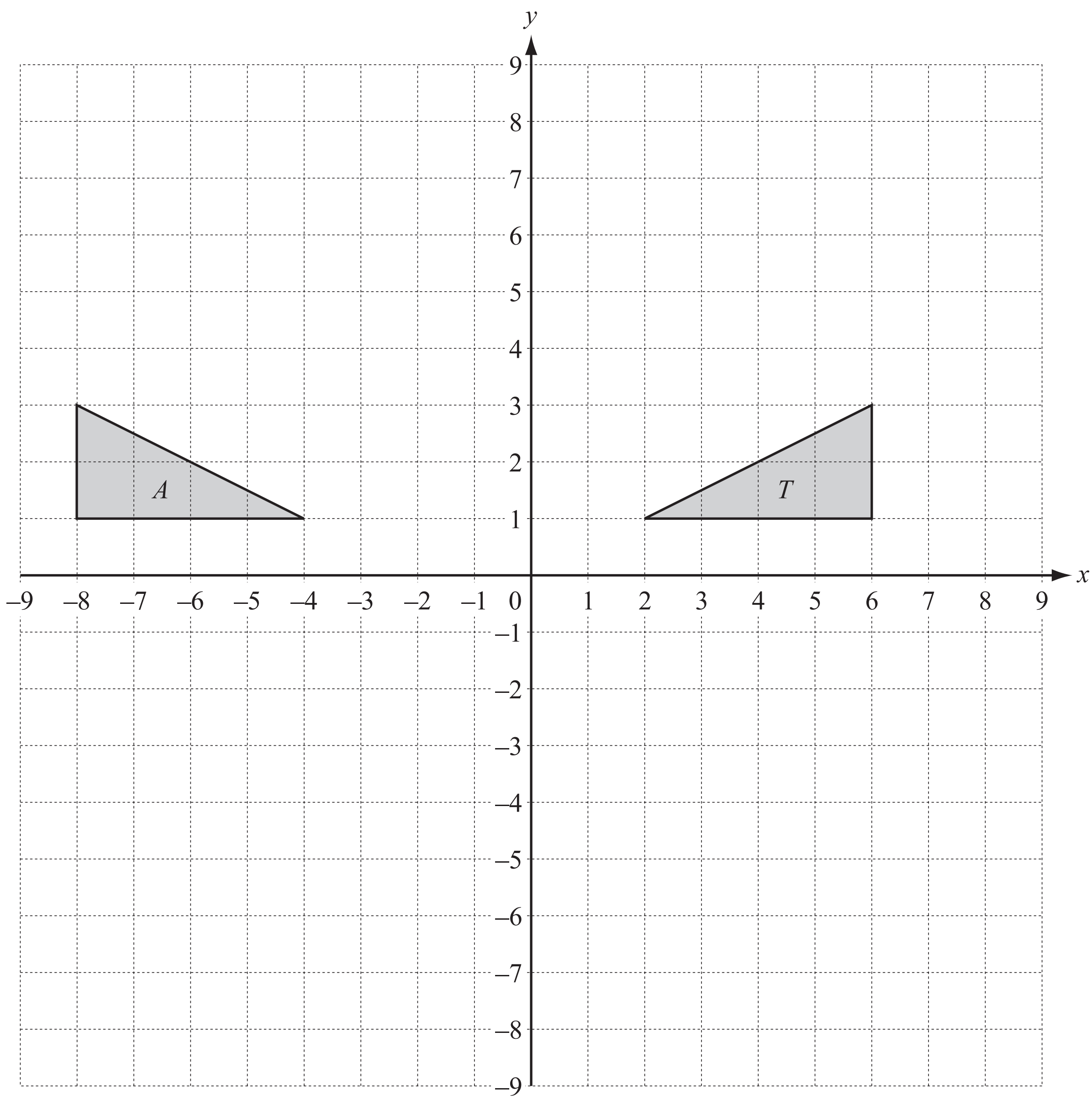
[1]

(ii) Solve the equation $4x^2 - 3x - 2 = 0$.

Show all your working and give your answers correct to 2 decimal places.

Answer(d)(ii) x = ... or x = ... [4]

3



Triangles T and A are drawn on the grid above.

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

Answer(a) .... [2]

(b) **(i)** Draw the image of triangle T after a rotation of 90° anticlockwise about the point (0,0).

Label the image B. [2]

(ii) Draw the image of triangle T after a reflection in the line $x + y = 0$.

Label the image C. [2]

(iii) Draw the image of triangle T after an enlargement with centre (4, 5) and scale factor 1.5.

Label the image D. [2]

For Examiner's Use

(c) **(i)** Triangle T has its vertices at co-ordinates (2, 1), (6, 1) and (6, 3).

Transform triangle T by the matrix $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.

Draw this image on the grid and label it E.

[3]

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

Answer(c)(ii) .... [3]

(d) Write down the matrix that transforms triangle B onto triangle T.

Answer(d) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

For Examiner's Use

4 Boris has a recipe which makes 16 biscuits.

The ingredients are

160 g flour,

160 g sugar,

240 g butter,

200 g oatmeal.

(a) Boris has only 350 grams of oatmeal but plenty of the other ingredients.

(i) How many biscuits can he make?

Answer(a)(i) .... [2]

(ii) How many grams of butter does he need to make this number of biscuits?

Answer(a)(ii) .... g [2]

(b) The ingredients are mixed together to make dough.

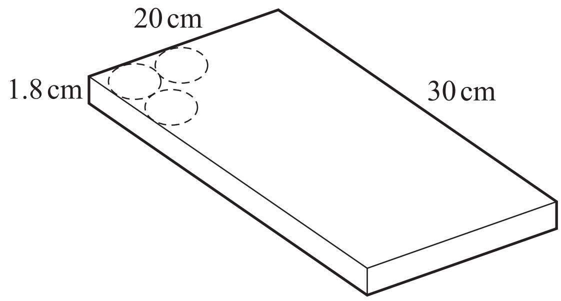
This dough is made into a sphere of volume 1080 cm^3.

Calculate the radius of this sphere.

[The volume, V, of a sphere of radius r is $V = \frac{4}{3}\pi r^3$.]

Answer(b) .... cm [3]

(c)



The $1080\,\text{cm}^3$ of dough is then rolled out to form a cuboid $20\,\text{cm} \times 30\,\text{cm} \times 1.8\,\text{cm}$.

Boris cuts out circular biscuits of diameter 5 cm.

(i) How many whole biscuits can he cut from this cuboid?

Answer(c)(i) .... [1]

(ii) Calculate the volume of dough left over.

Answer(c)(ii) .... cm^3 [3]

For Examiner's Use

For Examiner's Use

5 **(a)** The times, t seconds, for 200 people to solve a problem are shown in the table.

Time (t seconds)	Frequency
$0 < t \leqslant 20$	6
$20 < t \leqslant 40$	12
$40 < t \leqslant 50$	20
$50 < t \leqslant 60$	37
$60 < t \leqslant 70$	42
$70 < t \leqslant 80$	50
$80 < t \leqslant 90$	28
$90 < t \leqslant 100$	5

Calculate an estimate of the mean time.

Answer(a) .... s [4]

(b) **(i)** Complete the cumulative frequency table for this data.

Time (t seconds)	$t \leqslant 20$	$t \leqslant 40$	$t \leqslant 50$	$t \leqslant 60$	$t \leqslant 70$	$t \leqslant 80$	$t \leqslant 90$	$t \leqslant 100$
Cumulative Frequency	6	18	38			167		

[2]

(ii) Draw the cumulative frequency graph on the grid opposite to show this data. [4]

(c) Use your cumulative frequency graph to find

(i) the median time,

Answer(c)(i) .... s [1]

(ii) the lower quartile,

Answer(c)(ii) .... s [1]

(iii) the inter-quartile range,

Answer(c)(iii) .... s [1]

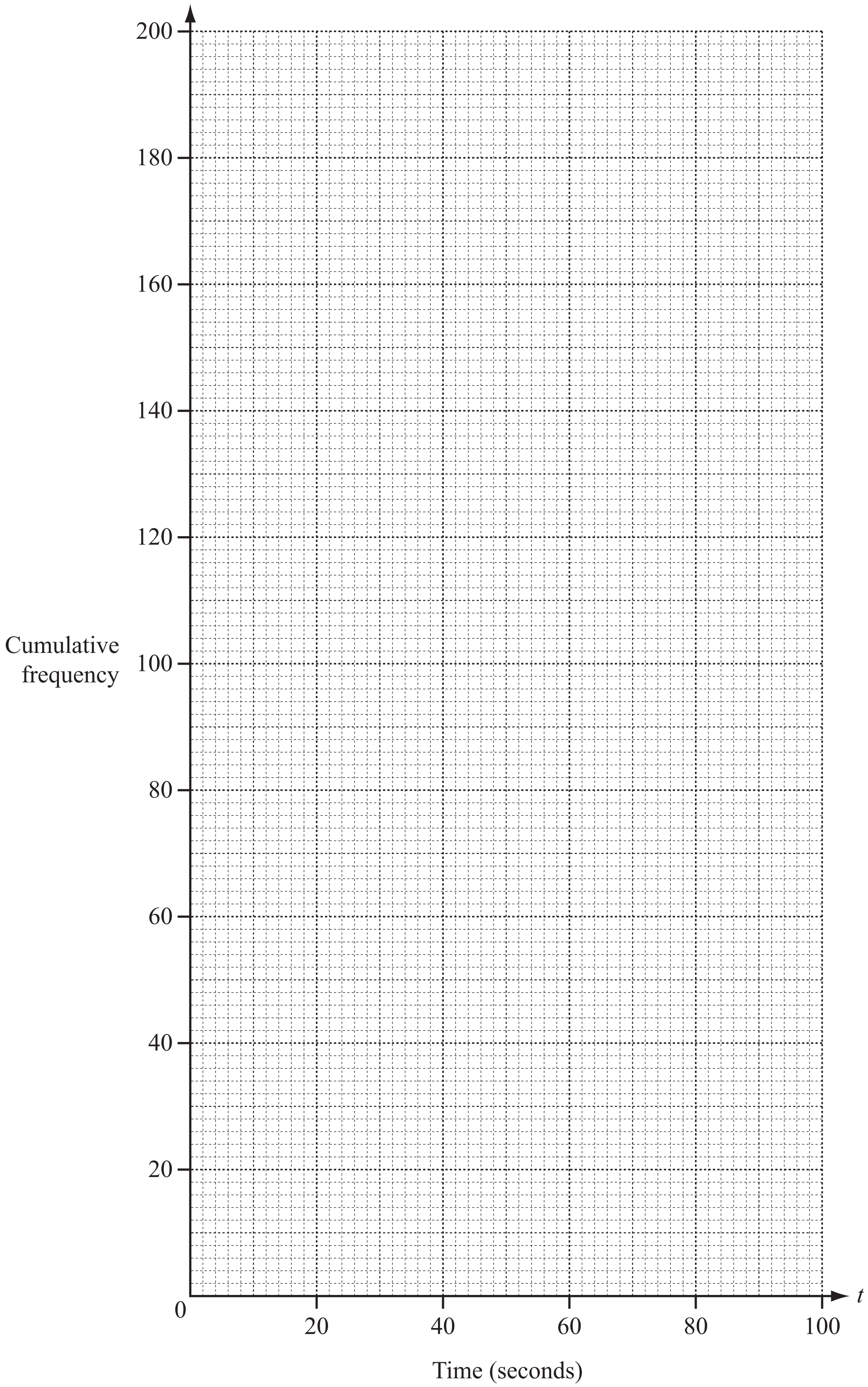
(iv) how many people took between 65 and 75 seconds to solve the problem,

Answer(c)(iv) .... [1]

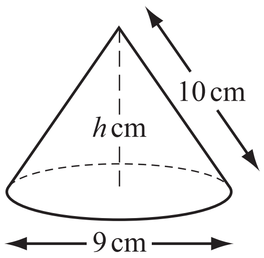
(v) how many people took longer than 45 seconds to solve the problem.

Answer(c)(v) .... [2]

For Examiner's Use



6



A solid cone has diameter 9 cm, slant height 10 cm and vertical height h cm.

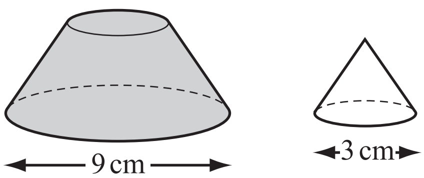
(a) **(i)** Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone, radius r and slant height l is $A = \pi rl$.]

Answer(a)(i) .... cm^2 [2]

(ii) Calculate the value of h, the vertical height of the cone.

Answer(a)(ii) h = ... [3]

(b)



Sasha cuts off the top of the cone, making a smaller cone with diameter 3 cm.
This cone is **similar** to the original cone.

(i) Calculate the **vertical** height of this small cone.

Answer(b)(i) .... cm [2]

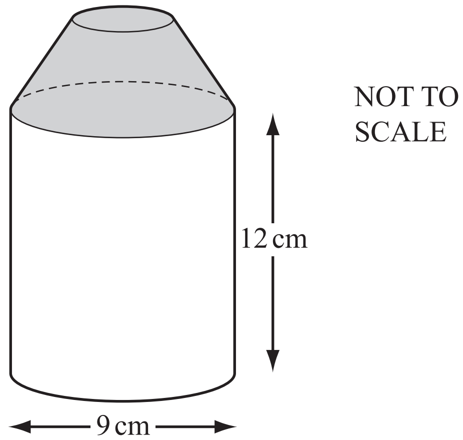
For Examiner's Use

(ii) Calculate the curved surface area of this small cone.

For Examiner's Use

Answer(b)(ii) .... cm^2 [2]

(c)

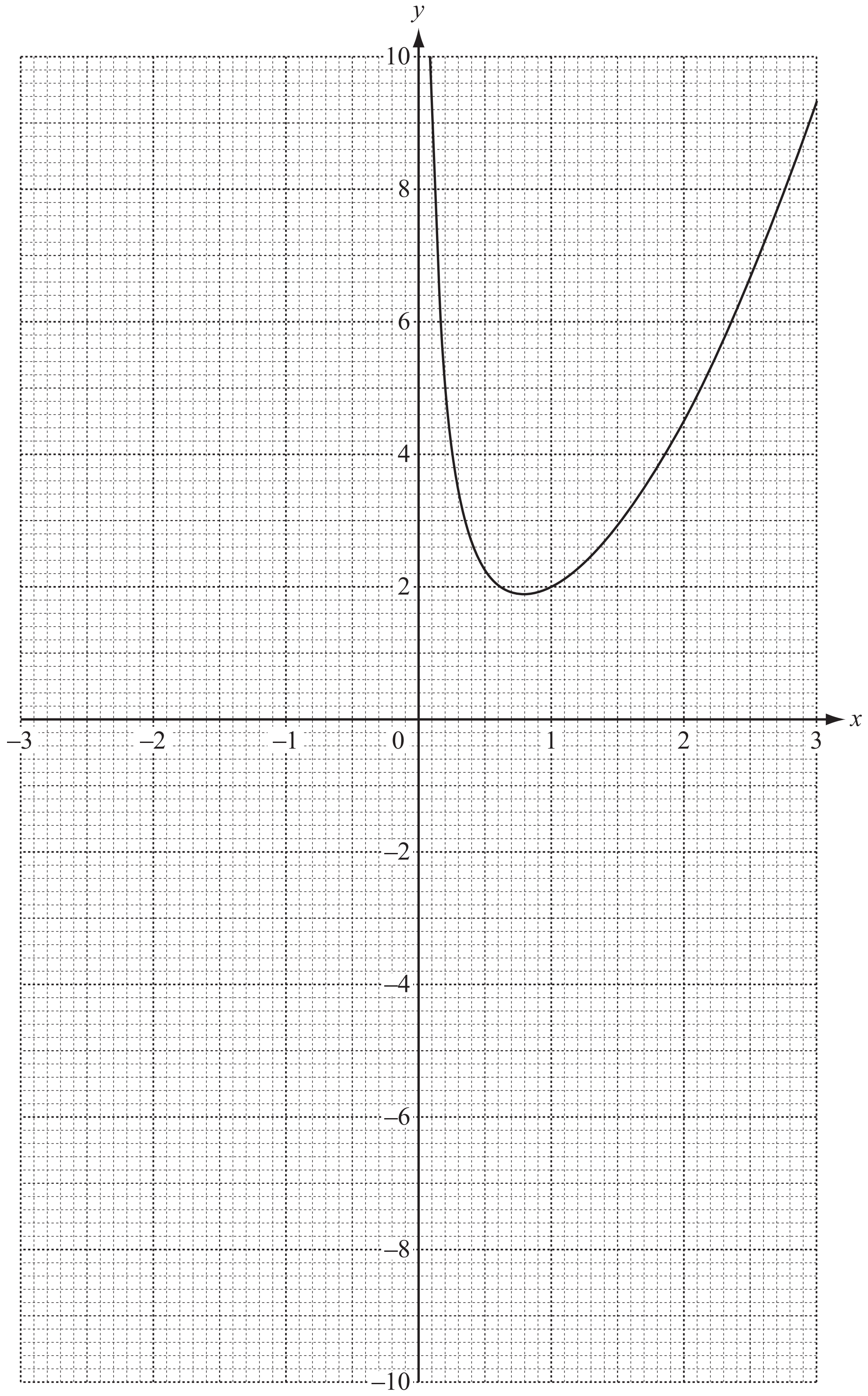


The shaded solid from **part (b)** is joined to a solid cylinder with diameter 9 cm and height 12 cm.
Calculate the **total** surface area of the whole solid.

Answer(c) .... cm^2 [5]

7 The diagram shows the accurate graph of $y = f(x)$ where $f(x) = \frac{1}{x} + x^2$ for $0 < x \leqslant 3$.

For Examiner's Use



For Examiner's Use

(a) Complete the table for $f(x) = \frac{1}{x} + x^2$.

x	-3	-2	-1	-0.5	-0.3	-0.1
$f(x)$		3.5	0	-1.8		

[3]

(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leqslant x < 0$. [3]

(c) By drawing a tangent, work out an estimate of the gradient of the graph where $x = 2$.

Answer(c) .... [3]

(d) Write down the inequality satisfied by k when $f(x) = k$ has three answers.

Answer(d) .... [1]

(e) **(i)** Draw the line $y = 1 - x$ on the grid for $-3 \leqslant x \leqslant 3$. [2]

(ii) Use your graphs to solve the equation $1 - x = \frac{1}{x} + x^2$.

Answer(e)(ii) $x =$ .... [1]

(f) **(i)** Rearrange $x^3 - x^2 - 2x + 1 = 0$ into the form $\frac{1}{x} + x^2 = ax + b$, where a and b are integers.

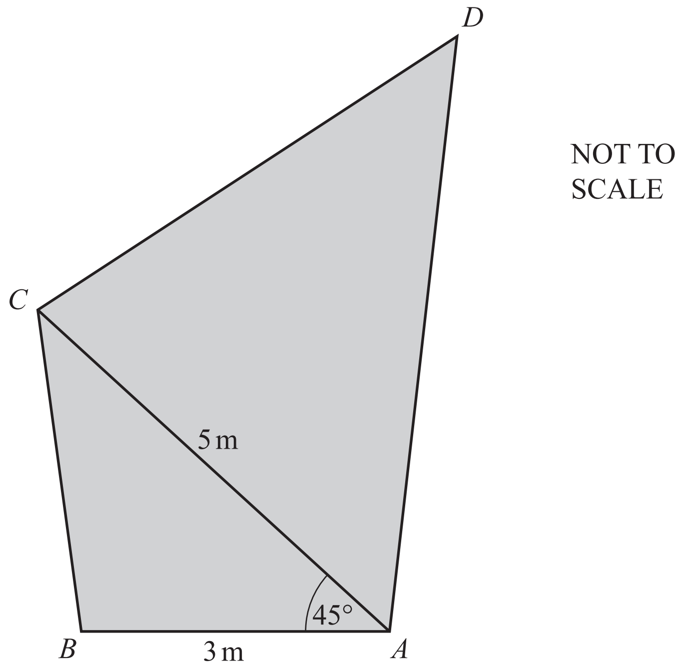
Answer(f)(i)

[2]

(ii) Write down the equation of the line that could be drawn on the graph to solve $x^3 - x^2 - 2x + 1 = 0$.

Answer(f)(ii) $y =$ .... [1]

8



Parvatti has a piece of canvas *ABCD* in the shape of an irregular quadrilateral.

AB = 3 m, *AC* = 5 m and angle *BAC* = 45°.

(a) **(i)** Calculate the length of *BC* and show that it rounds to 3.58 m, correct to 2 decimal places.

You must show all your working.

Answer(a)(i)

[4]

(ii) Calculate angle *BCA*.

Answer(a)(ii) Angle *BCA* = ... [3]

For Examiner's Use

(b) $AC = CD$ and angle $CDA = 52°$.

(i) Find angle DCA.

Answer(b)(i) Angle DCA = ... [1]

(ii) Calculate the area of the canvas.

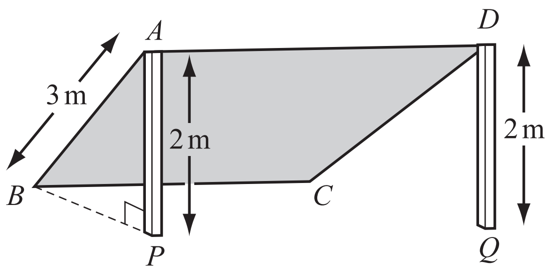
Answer(b)(ii) .... m^2 [3]

(c) Parvatti uses the canvas to give some shade.

She attaches corners A and D to the top of vertical poles, AP and DQ, each of height 2 m.

Corners B and C are pegged to the horizontal ground.

AB is a straight line and angle $BPA = 90°$.



NOT TO SCALE

Calculate angle PAB.

Answer(c) Angle PAB = ... [2]

[Turn over

For Examiner's Use

9 **(a)** Emile lost 2 blue buttons from his shirt.

A bag of spare buttons contains 6 white buttons and 2 blue buttons.

Emile takes 3 buttons out of the bag at random **without replacement**.

Calculate the probability that

(i) all 3 buttons are white,

Answer(a)(i) .... [3]

(ii) exactly one of the 3 buttons is blue.

Answer(a)(ii) .... [3]

For Examiner's Use

(b) There are 25 buttons in another bag.

This bag contains x blue buttons.

Two buttons are taken at random **without replacement**.
The probability that they are both blue is $\frac{7}{100}$.

(i) Show that $x^2 - x - 42 = 0$.

Answer (b)(i)

[4]

(ii) Factorise $x^2 - x - 42$.

Answer(b)(ii) .... [2]

(iii) Solve the equation $x^2 - x - 42 = 0$.

Answer(b)(iii) $x =$ .... or $x =$ .... [1]

(iv) Write down the number of buttons in the bag which are **not** blue.

Answer(b)(iv) .... [1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME							
CENTRE NUMBER						CANDIDATE NUMBER	

8178142556

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Mathematical tables (optional), Geometrical instruments, Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **20** printed pages.

IB11 11_0580_43/4RP

UNIVERSITY *of* CAMBRIDGE International Examinations

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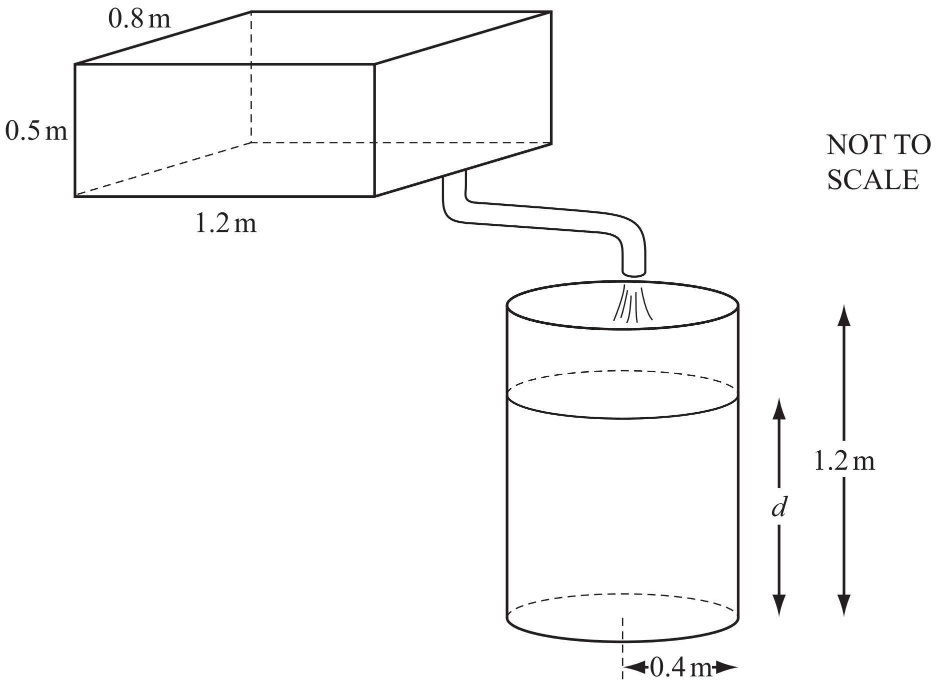
For Examiner's Use

1



A rectangular tank measures 1.2 m by 0.8 m by 0.5 m.

(a) Water flows from the full tank into a cylinder at a rate of $0.3\,m^3/min$.

Calculate the time it takes for the full tank to empty.
Give your answer in minutes and seconds.

Answer(a) .... min .... s [3]

For Examiner's Use

(b) The radius of the cylinder is 0.4 m.

Calculate the depth of water, d, when all the water from the rectangular tank is in the cylinder.

Answer(b) d = ... m [3]

(c) The cylinder has a height of 1.2 m and is open at the top.
The inside surface is painted at a cost of \$2.30 per m^2.

Calculate the cost of painting the inside surface.

Answer(c) \$ .... [4]

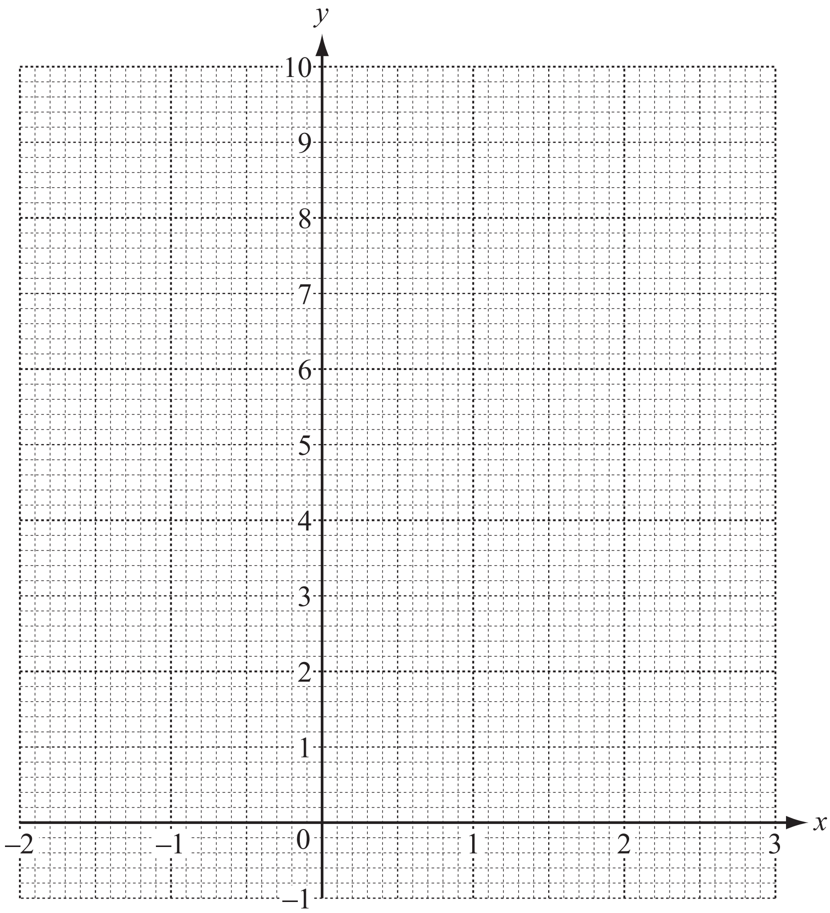
For Examiner's Use

2 **(a)** Complete the table of values for $y = 2^x$.

x	–2	–1	0	1	2	3
y	0.25		1	2		8

[2]

(b) On the grid, draw the graph of $y = 2^x$ for $-2 \leqslant x \leqslant 3$.



[3]

For Examiner's Use

(c) **(i)** On the grid, draw the straight line which passes through the points (0, 2) and (3, 8). [1]

(ii) The equation of this line is $y = mx + 2$.

Show that the value of m is 2.

Answer(c)(ii)

[1]

(iii) One answer to the equation $2^x = 2x + 2$ is $x = 3$.

Use your graph to find the other answer.

Answer(c)(iii) $x =$ .... [1]

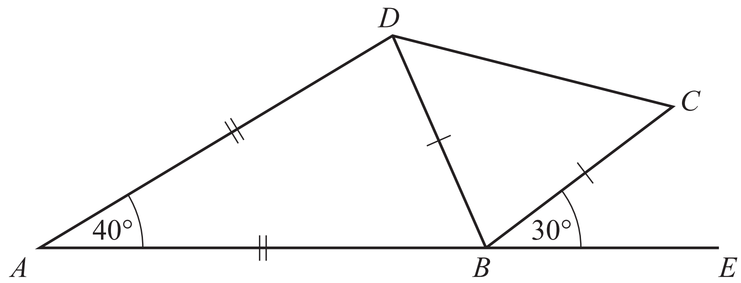
(d) Draw the tangent to the curve at the point where $x = 1$.

Use this tangent to calculate an estimate of the gradient of $y = 2^x$ when $x = 1$.

Answer(d) .... [3]

For Examiner's Use

3 **(a)**



NOT TO SCALE

ABCD is a quadrilateral with angle *BAD* = 40°.
AB is extended to *E* and angle *EBC* = 30°.
AB = *AD* and *BD* = *BC*.

(i) Calculate angle *BCD*.

Answer(a)(i) Angle *BCD* = ... [3]

(ii) Give a reason why *DC* is not parallel to *AE*.

Answer(a)(ii) .... [1]

(b) A regular polygon has *n* sides.

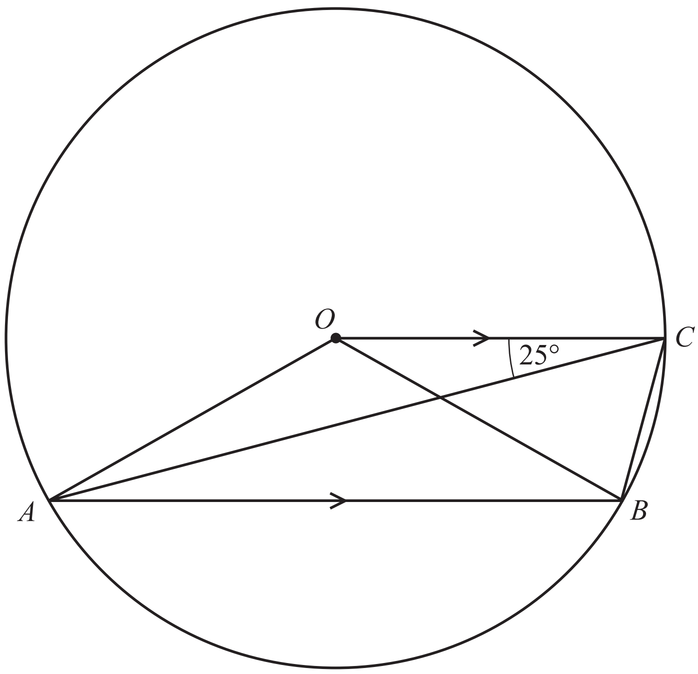
Each exterior angle is $\frac{5n}{2}$ degrees.

Find the value of *n*.

Answer(b) *n* = ... [3]

For Examiner's Use

(c)



NOT TO SCALE

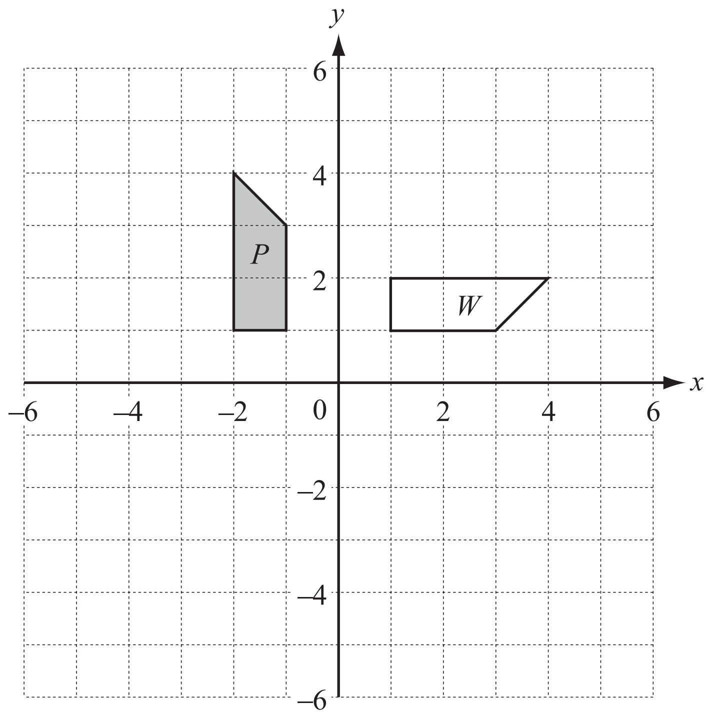
The diagram shows a circle centre *O*.
A, *B* and *C* are points on the circumference.
OC is parallel to *AB*.
Angle *OCA* = 25°.

Calculate angle *OBC*.

*Answer(c)*Angle *OBC* = ... [3]

For Examiner's Use

4



(a) Draw the reflection of shape P in the line $y = x$. [2]

(b) Draw the translation of shape P by the vector $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$. [2]

(c) **(i)** Describe fully the **single** transformation that maps shape P onto shape W.

Answer(c)(i) .... [3]

(ii) Find the 2 by 2 matrix which represents this transformation.

Answer(c)(ii) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

(d) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$.

Answer(d) .... [3]

5 **(a)** The cost of a bottle of juice is 5 cents more than the cost of a bottle of water.
Mohini buys 3 bottles of water and 6 bottles of juice.
The total cost is \$5.25.

Find the cost of a bottle of water.
Give your answer in cents.

Answer(a) .... cents [4]

(b) The cost of a biscuit is x cents.
The cost of a cake is $(x + 3)$ cents.
The number of biscuits Roshni can buy for 72 cents is 2 more than the number of cakes she can buy for 72 cents.

(i) Show that $x^2 + 3x - 108 = 0$.

Answer(b)(i)

[3]

(ii) Solve the equation $x^2 + 3x - 108 = 0$.

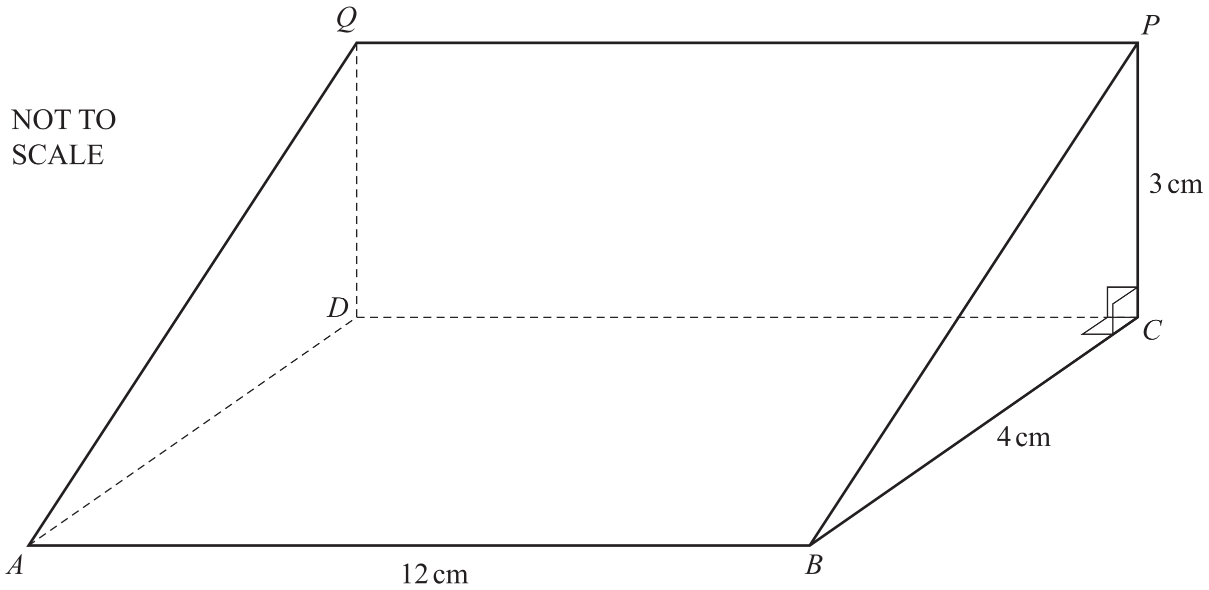
Answer(b)(ii) $x =$ .... or $x =$ .... [3]

(iii) Find the total cost of 2 biscuits and 1 cake.

Answer(b)(iii) .... cents [1]

For Examiner's Use

6



The diagram shows a triangular prism of length 12 cm.

The rectangle *ABCD* is horizontal and the rectangle *DCPQ* is vertical.

The cross-section is triangle *PBC* in which angle *BCP* = 90°, *BC* = 4 cm and *CP* = 3 cm.

(a) **(i)** Calculate the length of *AP*.

Answer(a)(i) *AP* = ... cm [3]

(ii) Calculate the angle of elevation of *P* from *A*.

Answer(a)(ii) .... [2]

For Examiner's Use

(b) **(i)** Calculate angle *PBC*.

Answer(b)(i) Angle *PBC* = ... [2]

(ii) *X* is on *BP* so that angle *BXC* = 120°.

Calculate the length of *XC*.

Answer(b)(ii) *XC* = ... cm [3]

7 The times, t minutes, taken for 200 students to cycle one kilometre are shown in the table.

For Examiner's Use

Time (t minutes)	$0 < t \leqslant 2$	$2 < t \leqslant 3$	$3 < t \leqslant 4$	$4 < t \leqslant 8$
Frequency	24	68	72	36

(a) Write down the class interval that contains the median.

Answer(a) .... [1]

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

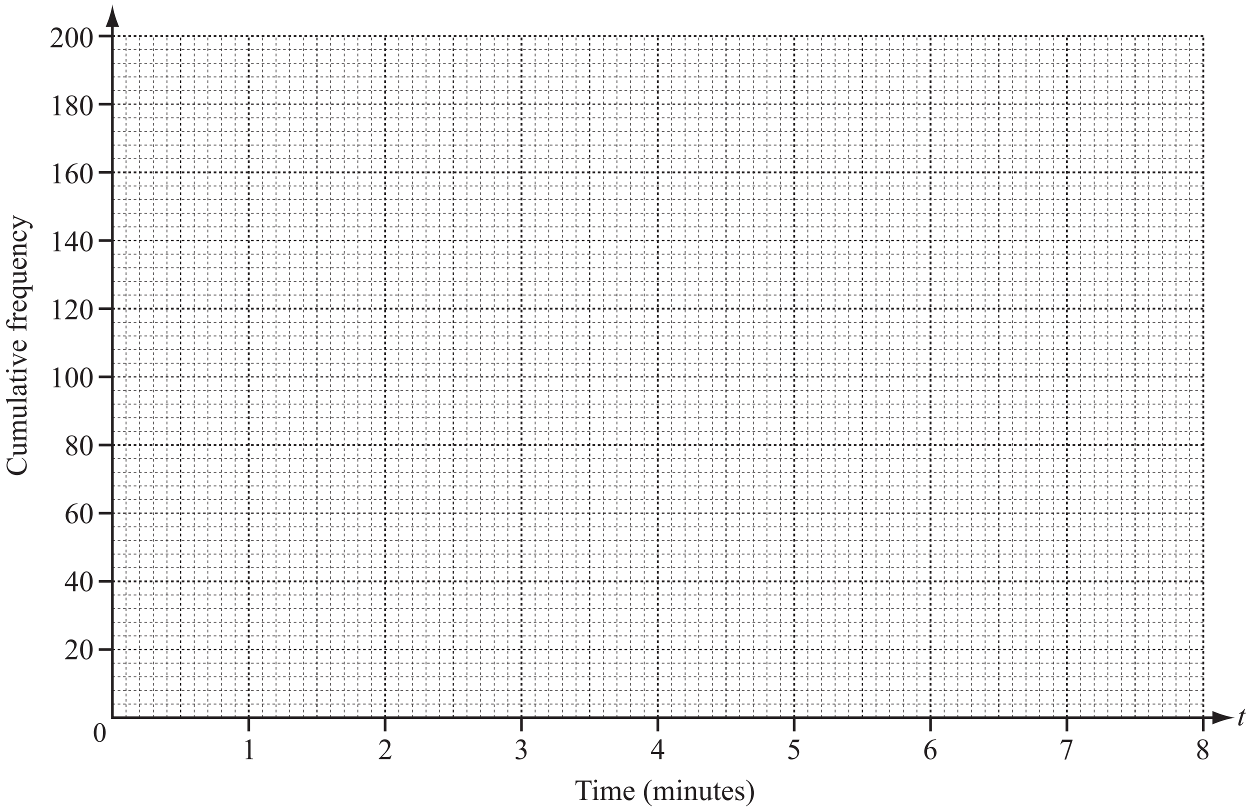
Answer(b) .... min [4]

(c) (i) Use the information in the table opposite to complete the cumulative frequency table.

Time (t minutes)	$t \leqslant 2$	$t \leqslant 3$	$t \leqslant 4$	$t \leqslant 8$
Cumulative frequency	24			200

[1]

(ii) On the grid, draw a cumulative frequency diagram.



[3]

(iii) Use your diagram to find the median, the lower quartile and the inter-quartile range.

Answer(c)(iii) Median = ... min

Lower quartile = ... min

Inter-quartile range = ... min [3]

For Examiner's Use

For Examiner's Use

8 $f(x) = x^2 + x - 1$ $g(x) = 1 - 2x$ $h(x) = 3^x$

(a) Find the value of hg(–2).

Answer(a) .... [2]

(b) Find $g^{-1}(x)$.

Answer(b) $g^{-1}(x) =$ .... [2]

(c) Solve the equation $f(x) = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer(c) $x =$ .... or $x =$ .... [4]

(d) Find fg(x).
Give your answer in its simplest form.

Answer(d) fg(x) = ... [3]

(e) Solve the equation $h^{-1}(x) = 2$.

Answer(e) $x =$ .... [1]

9

Set A S U M S

Set B M I N U S

The diagram shows two sets of cards.

(a) One card is chosen at random from Set A and replaced.

(i) Write down the probability that the card chosen shows the letter M.

Answer(a)(i) .... [1]

(ii) If this is carried out 100 times, write down the expected number of times the card chosen shows the letter M.

Answer(a)(ii) .... [1]

(b) Two cards are chosen at random, **without** replacement, from Set A.

Find the probability that both cards show the letter S.

Answer(b) .... [2]

(c) One card is chosen at random from Set A and one card is chosen at random from Set B.

Find the probability that exactly one of the two cards shows the letter U.

Answer(c) .... [3]

(d) A card is chosen at random, **without** replacement, from Set B until the letter shown is either I or U.

Find the probability that this does not happen until the 4th card is chosen.

Answer(d) .... [2]

For Examiner's Use

10 Hassan stores books in large boxes and small boxes.
Each large box holds 20 books and each small box holds 10 books.
He has x large boxes and y small boxes.

(a) Hassan must store at least 200 books.

Show that $2x + y \geqslant 20$.

Answer(a)

[1]

(b) Hassan must not use more than 15 boxes.
He must use at least 3 small boxes.
The number of small boxes must be less than or equal to the number of large boxes.

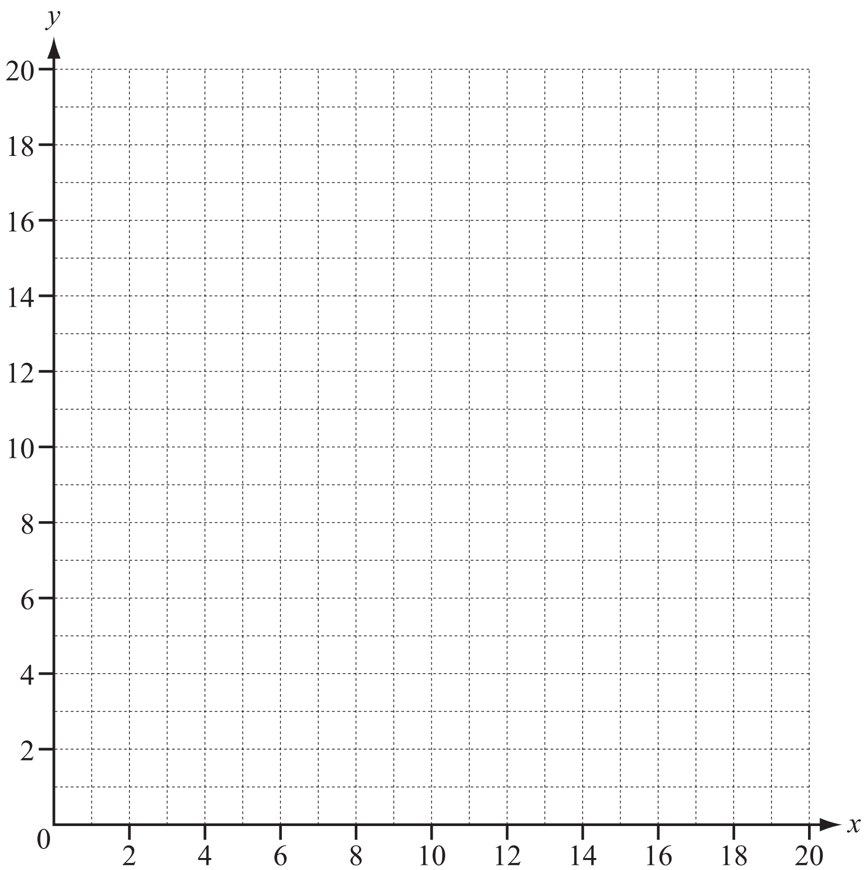
Write down three inequalities to show this information.

Answer(b) ....

....

.... [3]

(c) On the grid, show the information in **part (a)** and **part (b)** by drawing four straight lines and shading the **unwanted** regions.



[6]

For Examiner's Use

(d) A large box costs \$5 and a small box costs \$2.

(i) Find the least possible total cost of the boxes.

Answer(d)(i) \$ .... [1]

(ii) Find the number of large boxes and the number of small boxes which give this least possible cost.

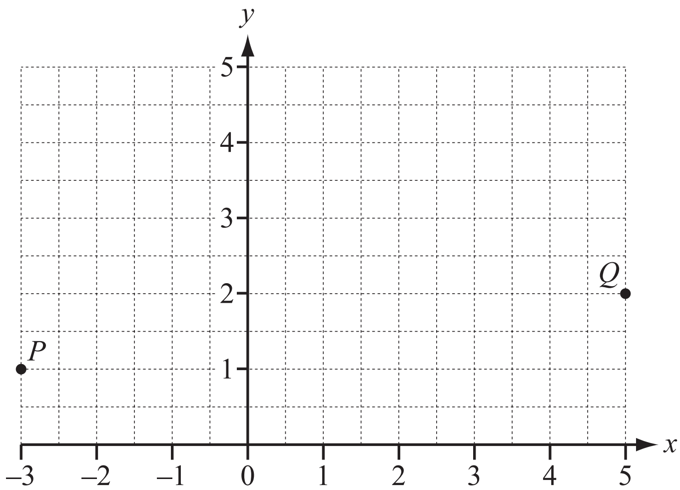
Answer(d)(ii) Number of large boxes = ...

Number of small boxes = ... [2]

Question 11 is printed on the next page.

For Examiner's Use

11 (a)



The points P and Q have co-ordinates (–3, 1) and (5, 2).

(i) Write $\overrightarrow{PQ}$ as a column vector.

Answer(a)(i) $\overrightarrow{PQ} = \begin{pmatrix} \\ \\ \end{pmatrix}$ [1]

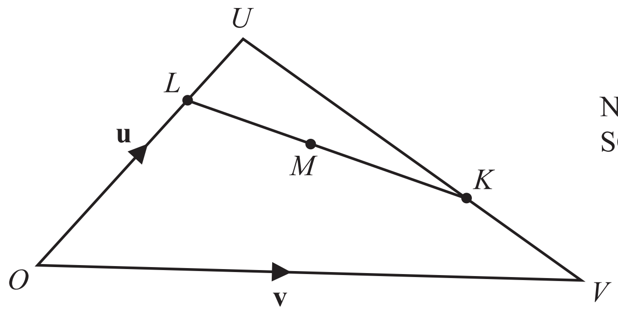
(ii) $\overrightarrow{QR} = 2\begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Mark the point R on the grid. [1]

(iii) Write down the position vector of the point P.

Answer(a)(iii) $\begin{pmatrix} \\ \\ \end{pmatrix}$ [1]

(b)



In the diagram, $\overrightarrow{OU} = \mathbf{u}$ and $\overrightarrow{OV} = \mathbf{v}$.

K is on UV so that $\overrightarrow{UK} = \frac{2}{3}\overrightarrow{UV}$ and L is on OU so that $\overrightarrow{OL} = \frac{3}{4}\overrightarrow{OU}$.

M is the midpoint of KL.

Find the following in terms of **u** and **v**, giving your answers in their simplest form.

(i) $\overrightarrow{LK}$

Answer(b)(i) $\overrightarrow{LK} =$ .... [4]

(ii) $\overrightarrow{OM}$

Answer(b)(ii) $\overrightarrow{OM} =$ .... [2]

Question 12 is printed on the next page.

12 (a) The *n*th term of a sequence is $n(n+1)$.

(i) Write the two missing terms in the spaces. 2, 6, ... , 20, ... [2]

(ii) Write down an expression in terms of n for the $(n + 1)$th term.

Answer(a)(ii) .... [1]

(iii) The difference between the nth term and the $(n + 1)$th term is $pn + q$.

Find the values of p and q.

Answer(a)(iii) p = ...

q = ... [2]

(iv) Find the positions of the two consecutive terms which have a difference of 140.

Answer(a)(iv) .... and .... [2]

(b) A sequence u_1, u_2, u_3, u_4, ... is given by the following rules.

$u_1 = 2$, $u_2 = 3$ and $u_n = 2u_{n-2} + u_{n-1}$ for $n \geqslant 3$.

For example, the third term is u_3 and $u_3 = 2u_1 + u_2 = 2 \times 2 + 3 = 7$.
So, the sequence is 2, 3, 7, u_4, u_5, ...

(i) Show that $u_4 = 13$.

Answer(b)(i) .... [1]

(ii) Find the value of u_5 .

Answer(b)(ii) u_5 = ... [1]

(iii) Two consecutive terms of the sequence are 3413 and 6827 .

Find the term before and the term after these two given terms.

Answer(b)(iii) .... , 3413, 6827, ... [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

9523289317

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 70.

UNIVERSITY of CAMBRIDGE
International Examinations

For Examiner's Use

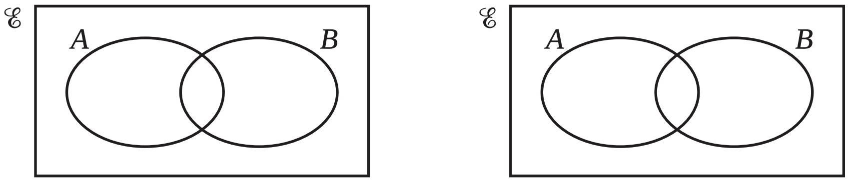
1 A concert hall has 1540 seats.

Calculate the number of people in the hall when 55% of the seats are occupied.

Answer .... [1]

---

2 Shade the required region on each Venn diagram.



$A \cup B'$ $(A \cap B)'$

[2]

---

3 Calculate $81^{0.25} \div 4^{-2}$.

Answer .... [2]

---

4 **(a)** Find m when $4^m \times 4^2 = 4^{12}$.

Answer(a) $m =$ .... [1]

(b) Find p when $6^p \div 6^5 = \sqrt{6}$.

Answer(b) $p =$ .... [1]

---

5 A hummingbird beats its wings 24 times per second.

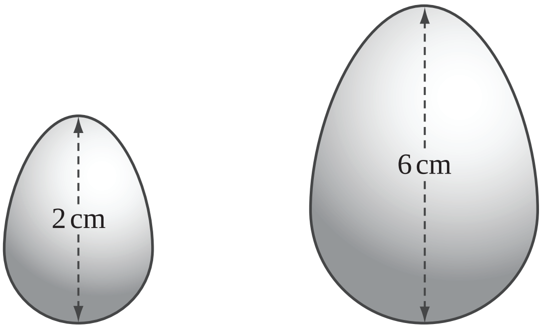
(a) Calculate the number of times the hummingbird beats its wings in one hour.

Answer(a) .... [1]

(b) Write your answer to **part (a)** in standard form.

Answer(b) .... [1]

6



A company makes solid chocolate eggs and their shapes are mathematically similar.
The diagram shows eggs of height 2 cm and 6 cm.
The mass of the small egg is 4 g.

Calculate the mass of the large egg.

Answer .... g [2]

---

7 Find the length of the straight line from Q (–8, 1) to R (4 , 6).

Answer QR = ... [3]

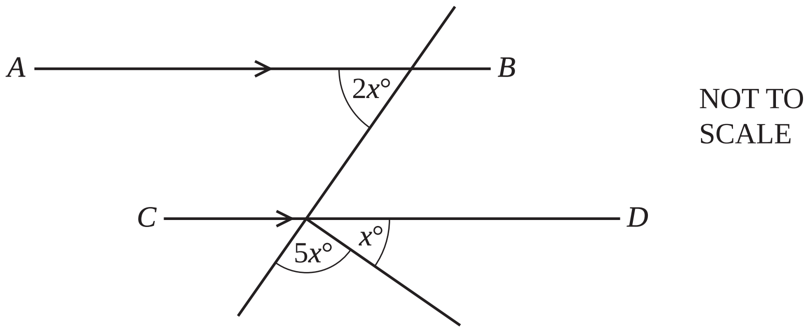
---

8 Calculate the radius of a sphere with volume $1260\,\text{cm}^3$.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer .... cm [3]

9



AB is parallel to *CD*.
Calculate the value of x.

Answer x = ... [3]

---

10 Solve the simultaneous equations.

$$3x + y = 30$$
$$2x - 3y = 53$$

Answer x = ...

y = ... [3]

---

11 A rectangular photograph measures 23.3 cm by 19.7 cm, each correct to 1 decimal place.
Calculate the lower bound for

(a) the perimeter,

Answer(a) .... cm [2]

(b) the area.

Answer(b) .... cm^2 [1]

---

12 A train leaves Barcelona at 21 28 and takes 10 hours and 33 minutes to reach Paris.

(a) Calculate the time the next day when the train arrives in Paris.

Answer(a) .... [1]

(b) The distance from Barcelona to Paris is 827 km.

Calculate the average speed of the train in kilometres per hour.

Answer(b) .... km/h [3]

For Examiner's Use

13 The scale on a map is 1: 20 000.

(a) Calculate the actual distance between two points which are 2.7 cm apart on the map.
Give your answer in kilometres.

Answer(a) .... km [2]

(b) A field has an area of 64 400 m^2.
Calculate the area of the field on the map in cm^2.

Answer(b) .... cm^2 [2]

---

14 Solve the equation $2x^2 + 3x - 6 = 0$.
Show all your working and give your answers correct to 2 decimal places.

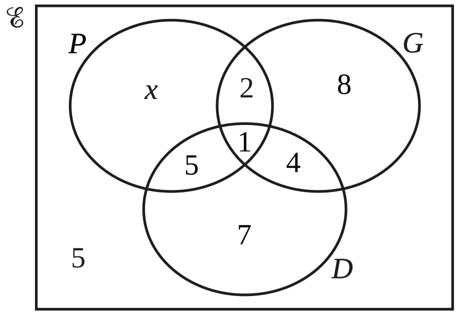
Answer x = ... or x = ... [4]

---

15 A teacher asks 36 students which musical instruments they play.

P = {students who play the piano}
G = {students who play the guitar}
D = {students who play the drums}

The Venn diagram shows the results.



(a) Find the value of x.

Answer(a) x = ... [1]

(b) A student is chosen at random.

Find the probability that this student

(i) plays the drums but **not** the guitar,

Answer(b)(i) .... [1]

(ii) plays only 2 different instruments.

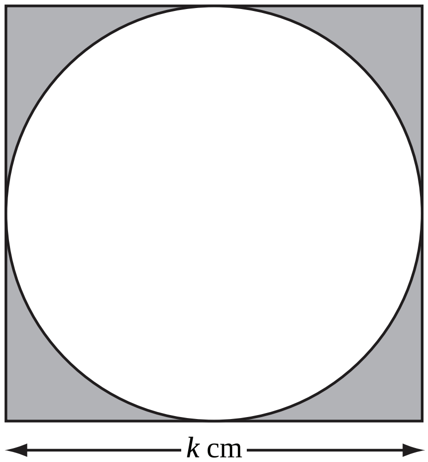
Answer(b)(ii) .... [1]

(c) A student is chosen at random from those who play the guitar.

Find the probability that this student plays no other instrument.

Answer(c) .... [1]

16



The diagram shows a square of side k cm.

The circle inside the square touches all four sides of the square.

(a) The shaded area is A cm^2.

Show that $4A = 4k^2 - \pi k^2$.

Answer (a)

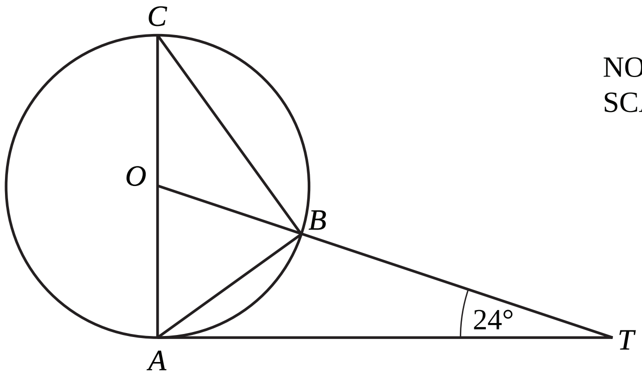
[2]

(b) Make k the subject of the formula $4A = 4k^2 - \pi k^2$.

Answer(b) k = ... [3]

For Examiner's Use

17



A, B and C are points on a circle, centre O.
TA is a tangent to the circle at A and OBT is a straight line.
AC is a diameter and angle $OTA = 24°$.

Calculate

(a) angle AOT,

Answer(a) Angle AOT = ... [2]

(b) angle ACB,

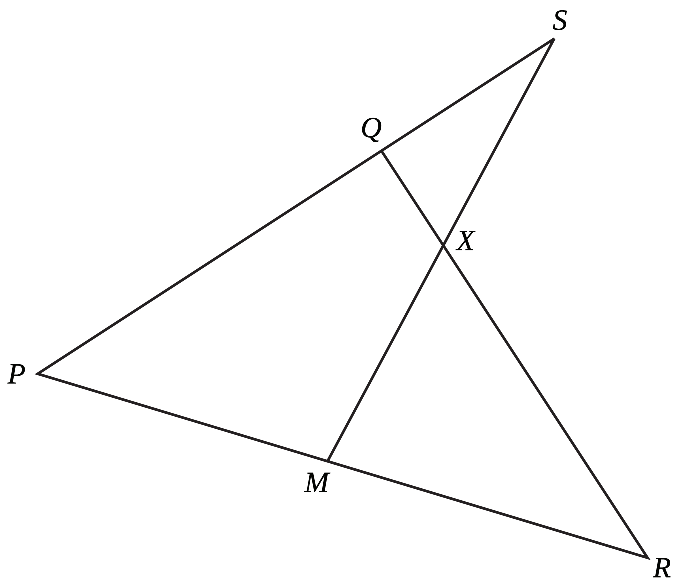
Answer(b) Angle ACB = ... [1]

(c) angle ABT.

Answer(c) Angle ABT = ... [2]

For Examiner's Use

18



In the diagram, PQS, PMR, MXS and QXR are straight lines.

$PQ = 2\,QS$.
M is the midpoint of PR.
$QX : XR = 1 : 3$.

$\overrightarrow{PQ} = \mathbf{q}$ and $\overrightarrow{PR} = \mathbf{r}$.

(a) Find, in terms of **q** and **r**,

(i) $\overrightarrow{RQ}$,

Answer(a)(i) $\overrightarrow{RQ}$ = ... [1]

(ii) $\overrightarrow{MS}$.

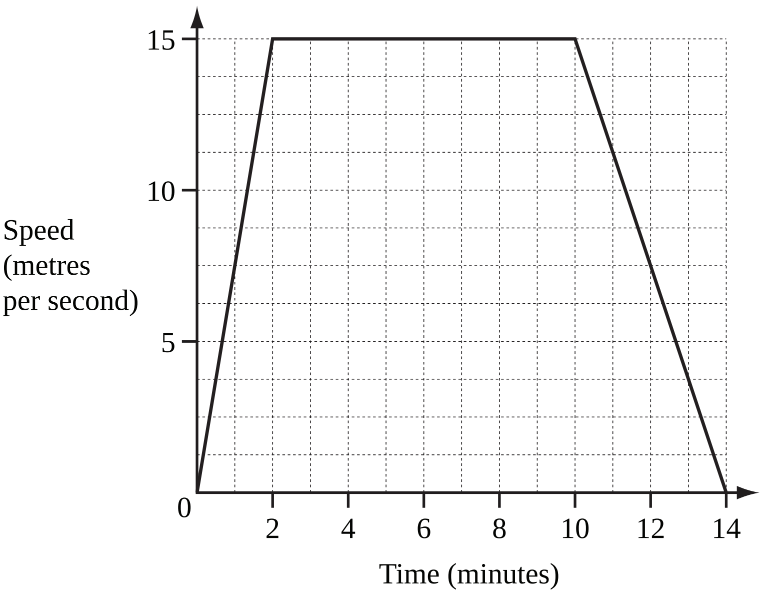
Answer(a)(ii) $\overrightarrow{MS}$ = ... [1]

(b) By finding $\overrightarrow{MX}$, show that X is the midpoint of MS.

Answer (b)

[3]

19



The diagram shows the speed-time graph of a train journey between two stations.
The train accelerates for two minutes, travels at a constant maximum speed, then slows to a stop.

(a) Write down the number of **seconds** that the train travels at its constant maximum speed.

Answer(a) .... s [1]

(b) Calculate the distance between the two stations **in metres**.

Answer(b) .... m [3]

(c) Find the acceleration of the train in the **first two minutes**.
Give your answer in m/s^2.

Answer(c) .... m/s^2 [2]

For Examiner's Use

Question 20 is printed on the next page.

20 $f(x) = x^3$ $g(x) = 2x - 3$

(a) Find

(i) $g(6)$,

Answer(a)(i) .... [1]

(ii) $f(2x)$.

Answer(a)(ii) .... [1]

(b) Solve $fg(x) = 125$.

Answer(b) $x =$ .... [3]

(c) Find the inverse function $g^{-1}(x)$.

Answer(c) $g^{-1}(x) =$ .... [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4065843724

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 70.

This document consists of **12** printed pages.

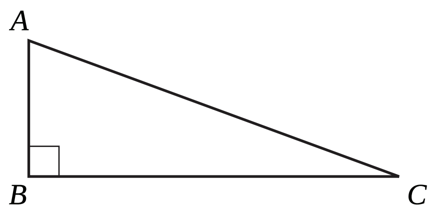
IB11 06_0580_22/8RP

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

For Examiner's Use

1 In the right-angled triangle ABC, $\cos C = \frac{4}{5}$. Find angle A.



Answer Angle A = ... [2]

---

2 Which of the following numbers are irrational?

$\frac{2}{3}$ $\sqrt{36}$ $\sqrt{3} + \sqrt{6}$ π 0.75 48% $8^{\frac{1}{3}}$

Answer .... [2]

---

3 Show that $1\frac{5}{9} \div 1\frac{7}{9} = \frac{7}{8}$.

Write down all the steps in your working.

Answer

[2]

For Examiner's Use

4 $$\frac{3}{5} < p < \frac{2}{3}$$

Which of the following could be a value of p?

$$\frac{16}{27} \qquad 0.67 \qquad 60\% \qquad (0.8)^2 \qquad \sqrt{\frac{4}{9}}$$

Answer .... [2]

---

5 A meal on a boat costs 6 euros (€) or 11.5 Brunei dollars ($).

In which currency does the meal cost less, on a day when the exchange rate is €1 = $1.9037?
Write down all the steps in your working.

Answer .... [2]

---

6 Use your calculator to find the value of $2^{\sqrt{3}}$.

Give your answer correct to 4 significant figures.

Answer .... [2]

For Examiner's Use

7 Solve the equation $4x + 6 \times 10^3 = 8 \times 10^4$.

Give your answer in standard form.

Answer x = ... [3]

---

8 p varies directly as the square root of q.
$p = 8$ when $q = 25$.

Find p when $q = 100$.

Answer p = ... [3]

---

9 Ashraf takes 1500 steps to walk d **metres** from his home to the station.
Each step is 90 centimetres correct to the nearest 10 cm.

Find the lower bound and the upper bound for d.

Answer .... $\leqslant d <$ .... [3]

---

10 The table shows the opening and closing times of a café.

For Examiner's Use

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Opening time	0600	0600	0600	0600	0600	(a)	0800
Closing time	2200	2200	2200	2200	2200	2200	1300

(a) The café is open for a total of 100 hours each week.
Work out the opening time on Saturday.

Answer(a) .... [2]

(b) The owner decides to close the café at a later time on Sunday. This increases the **total** number of hours the café is open by 4%.
Work out the new closing time on Sunday.

Answer(b) .... [1]

---

11 Rearrange the formula $c = \dfrac{4}{a - b}$ to make a the subject.

Answer a = ... [3]

For Examiner's Use

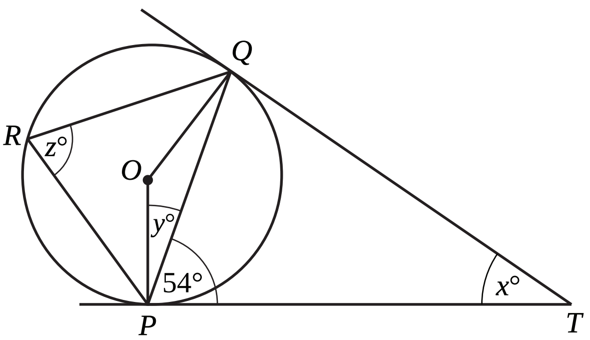
12 Solve the simultaneous equations.

$$x - 5y = 0$$
$$15x + 10y = 17$$

Answer x = ...

y = ... [3]

13



NOT TO SCALE

The points *P*, *Q* and *R* lie on a circle, centre *O*.
TP and *TQ* are tangents to the circle.
Angle *TPQ* = 54°.

Calculate the value of

(a) *x*,

Answer(a) x = ... [1]

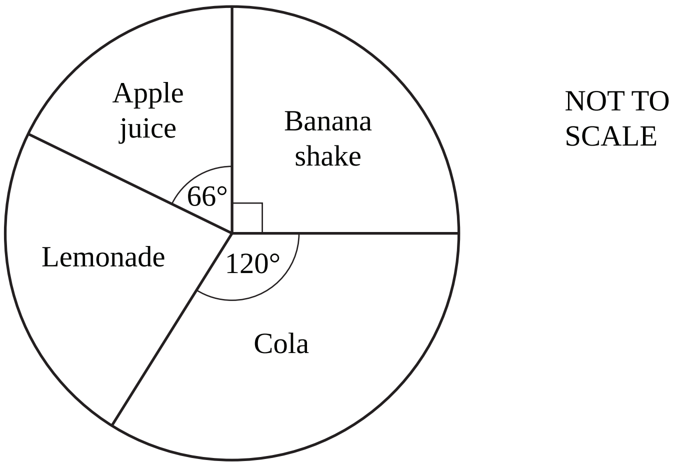
(b) *y*,

Answer(b) y = ... [1]

(c) *z*.

Answer(c) z = ... [2]

14 60 students recorded their favourite drink.
The results are shown in the pie chart.



(a) **Calculate** the angle for the sector labelled Lemonade.

Answer(a) .... [1]

(b) Calculate the number of students who chose Banana shake.

Answer(b) .... [1]

(c) The pie chart has a radius of 3 cm.
Calculate the arc length of the sector representing Cola.

Answer(c) .... cm [2]

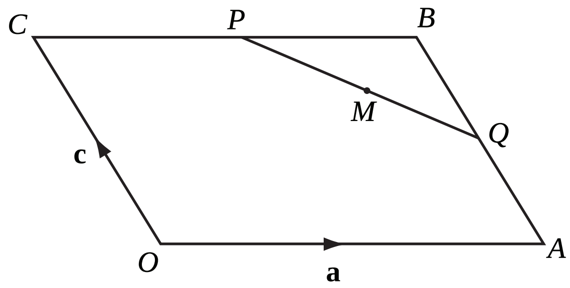
For Examiner's Use

15 Write the following as a single fraction in its simplest form.

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

Answer .... [4]

16



NOT TO SCALE

O is the origin and *OABC* is a parallelogram.
CP = *PB* and *AQ* = *QB*.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
Find in terms of **a** and **c**, in their simplest form,

(a) $\overrightarrow{PQ}$,

Answer(a) $\overrightarrow{PQ}$ = ... [2]

(b) the position vector of *M*, where *M* is the midpoint of *PQ*.

Answer(b) .... [2]

---

17 Simplify

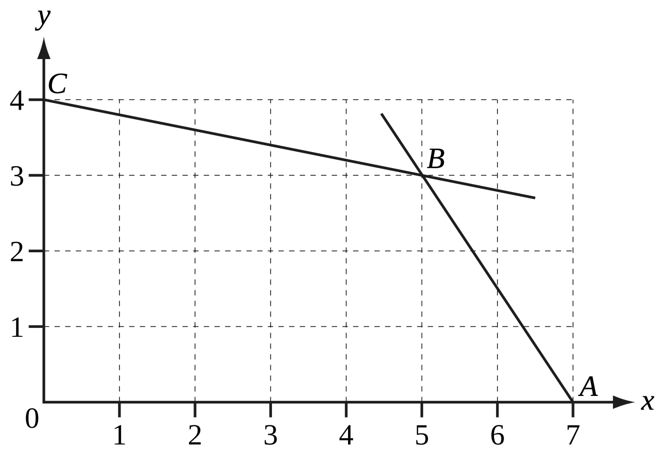
(a) $32x^8 \div 8x^{32}$,

Answer(a) .... [2]

(b) $\left(\dfrac{x^3}{64}\right)^{\frac{2}{3}}$.

Answer(b) .... [2]

18



The lines *AB* and *CB* intersect at *B*.

(a) Find the co-ordinates of the midpoint of *AB*.

Answer(a) (.......... , ...) [1]

(b) Find the equation of the line *CB*.

Answer(b) .... [3]

For Examiner's Use

19 $f(x) = x^2$ $g(x) = 2^x$ $h(x) = 2x - 3$

(a) Find g(3).

Answer(a) .... [1]

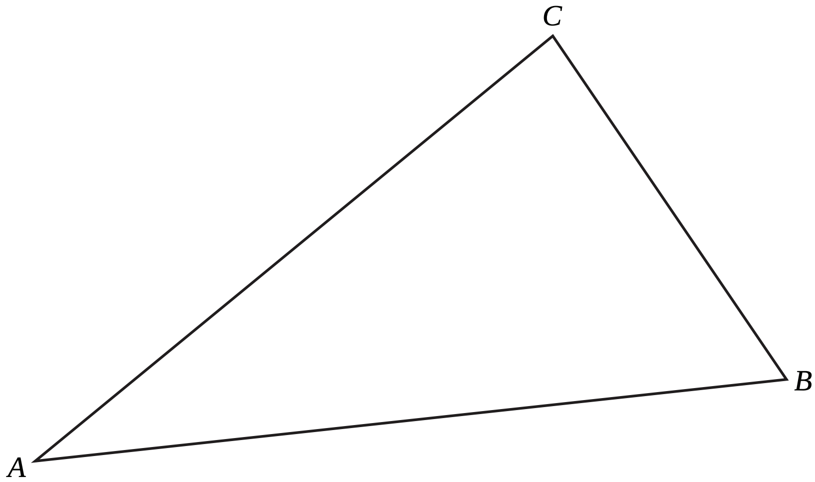
(b) Find hh(x) in its simplest form.

Answer(b) .... [2]

(c) Find fg(x + 1) in its simplest form.

Answer(c) .... [2]

20



(a) On the diagram above, **using a straight edge and compasses only**, construct

(i) the bisector of angle *ABC*, [2]

(ii) the locus of points which are equidistant from *A* and from *B*. [2]

(b) Shade the region inside the triangle which is nearer to *A* than to *B* **and** nearer to *AB* than to *BC*. [1]

Question 21 is printed on the next page.

21 (a)

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

(i) Work out **AB**.

Answer(a)(i) [2]

(ii) Work out **BA**.

Answer(a)(ii) [2]

(b) $\mathbf{C} = \begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$

Find $\mathbf{C}^{-1}$, the inverse of **C**.

Answer(b) [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

4967052731

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Mathematical tables (optional), Geometrical instruments, Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

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For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 70.

This document consists of **12** printed pages.

IB11 06_0580_23/5RP

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

1 Factorise completely.

$$2xy - 4yz$$

Answer .... [2]

For Examiner's Use

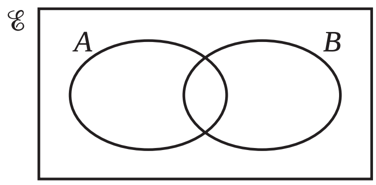
---

2 Make x the subject of the formula. $y = \frac{x}{3} + 5$

Answer x = ... [2]

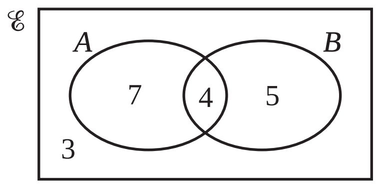
---

3 **(a)**



Shade the region A ∩ B′. [1]

(b)



This Venn diagram shows the number of elements in each region.

Write down the value of n ($A \cup B'$).

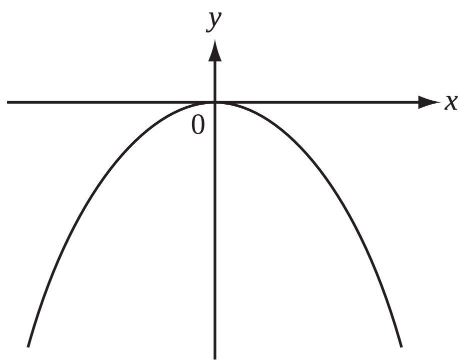
Answer(b) n ($A \cup B'$) = ... [1]

---

4 Helen measures a rectangular sheet of paper as 197 mm by 210 mm, each correct to the nearest millimetre.
Calculate the upper bound for the perimeter of the sheet of paper.

Answer .... mm [2]

5



NOT TO SCALE

The sketch shows the graph of $y = ax^n$ where a and n are integers.

Write down a possible value for a and a possible value for n.

Answer a = ...

n = ... [2]

---

6 **(a)** Write 16 460 000 in standard form.

Answer(a) .... [1]

(b) Calculate $7.85 \div (2.366 \times 10^2)$, giving your answer in standard form.

Answer(b) .... [2]

For Examiner's Use

7 **(a)** Find the value of x when $\frac{18}{24} = \frac{27}{x}$.

Answer(a) x = ... [1]

(b) Show that $\frac{2}{3} \div 1\frac{1}{6} = \frac{4}{7}$.

Write down all the steps in your working.

Answer(b)

[2]

---

8 Solve the simultaneous equations.

$$x + 2y = 3$$
$$2x - 3y = 13$$

Answer x = ...

y = ... [3]

---

9 Eva invests \$120 at a rate of 3% per year **compound interest**.

Calculate the total amount Eva has after 2 years.
Give your answer correct to 2 decimal places.

Answer \$ .... [3]

---

10 The cost of a cup of tea is t cents.

The cost of a cup of coffee is $(t + 5)$ cents.

The total cost of 7 cups of tea and 11 cups of coffee is 2215 cents.

Find the cost of one cup of tea.

Answer .... cents [3]

---

11 The volume of a solid varies directly as the **cube** of its length.
When the length is 3 cm, the volume is 108 cm^3.

Find the volume when the length is 5 cm.

Answer .... cm^3 [3]

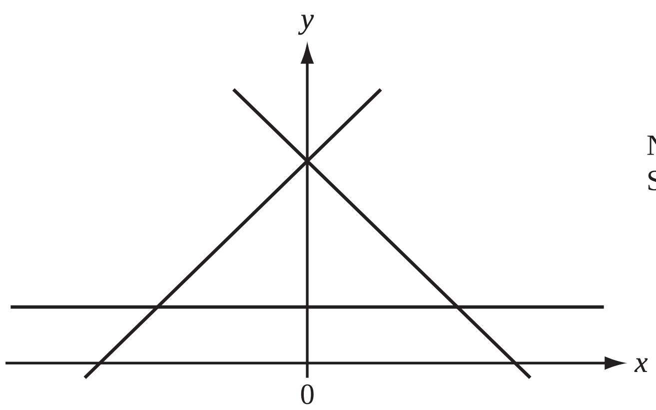
---

12 Federico changed 400 euros (€) into New Zealand dollars (NZ$) at a rate of €1 = NZ$ 2.1 .
He spent x New Zealand dollars and changed the rest back into euros at a rate of €1 = NZ$ d.

Find an expression, in terms of x and d, for the number of euros Federico received.

Answer € .... [3]

13



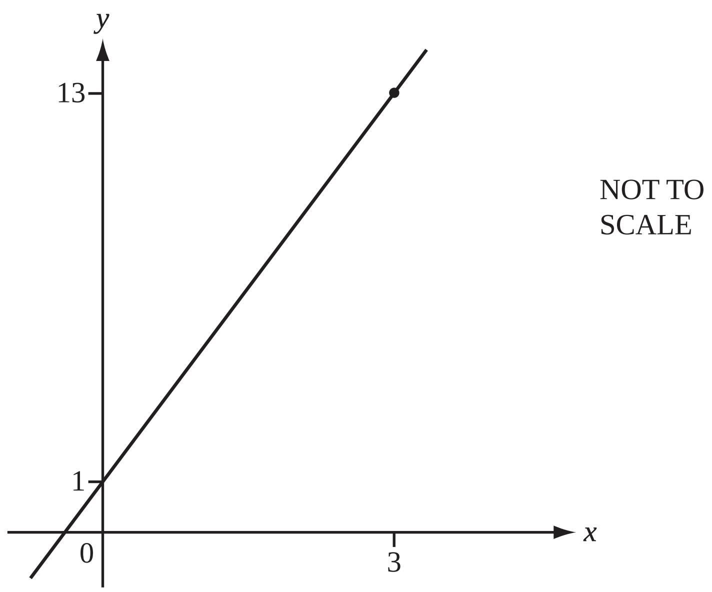
NOT TO SCALE

The diagram shows the lines $y = 1$, $y = x + 4$ and $y = 4 - x$.

On the diagram, **label the region R** where $y \geqslant 1$, $y \geqslant x + 4$ and $y \leqslant 4 - x$. [3]

For Examiner's Use

14



The diagram shows the straight line which passes through the points (0, 1) and (3, 13).

Find the equation of the straight line.

Answer .... [3]

---

15 A cylinder has a height of 12 cm and a volume of 920 cm^3.

Calculate the radius of the base of the cylinder.

Answer .... cm [3]

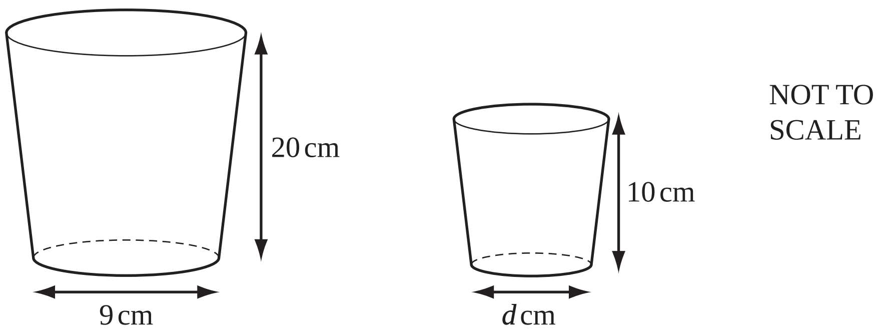
---

16 Write $\dfrac{2}{x-2}+\dfrac{3}{x+2}$ as a single fraction.

Give your answer in its simplest form.

Answer .... [3]

17



The diagrams show two mathematically similar containers.
The larger container has a base with diameter 9 cm and a height 20 cm.
The smaller container has a base with diameter d cm and a height 10 cm.

(a) Find the value of d.

Answer(a) d = ... [1]

(b) The larger container has a capacity of 1600 ml.

Calculate the capacity of the smaller container.

Answer(b) .... ml [2]

For Examiner's Use

18 Simplify the following.

(a) $(3x^3)^3$

Answer(a) .... [2]

(b) $(125x^6)^{\frac{2}{3}}$

Answer(b) .... [2]

---

19 The scale of a map is 1 : 250 000.

(a) The actual distance between two cities is 80 km.

Calculate this distance on the map. Give your answer in centimetres.

Answer(a) .... cm [2]

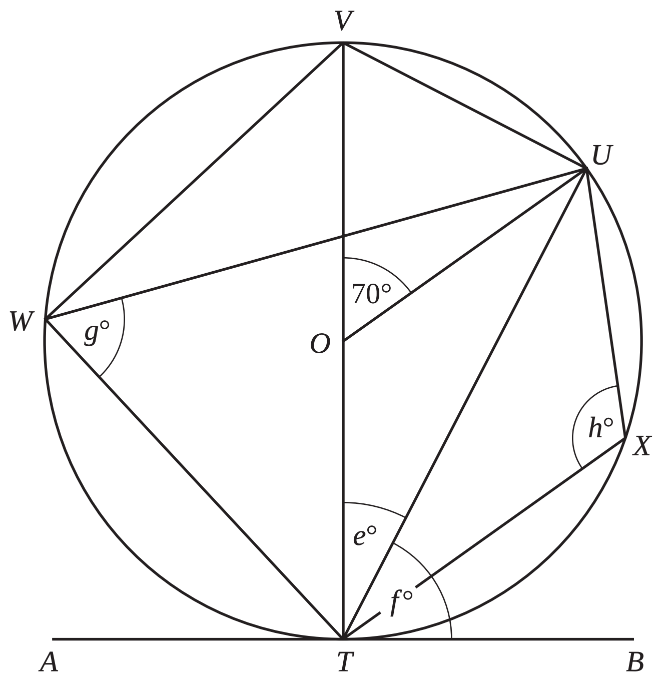
(b) On the map a large forest has an area of 6 cm^2.

Calculate the actual area of the forest. Give your answer in square kilometres.

Answer(b) .... km^2 [2]

For Examiner's Use

20



NOT TO SCALE

The diagram shows a circle, centre O.
VT is a diameter and ATB is a tangent to the circle at T.
U, V, W and X lie on the circle and angle $VOU = 70°$.

Calculate the value of

(a) e,

Answer(a) $e =$ .... [1]

(b) f,

Answer(b) $f =$ .... [1]

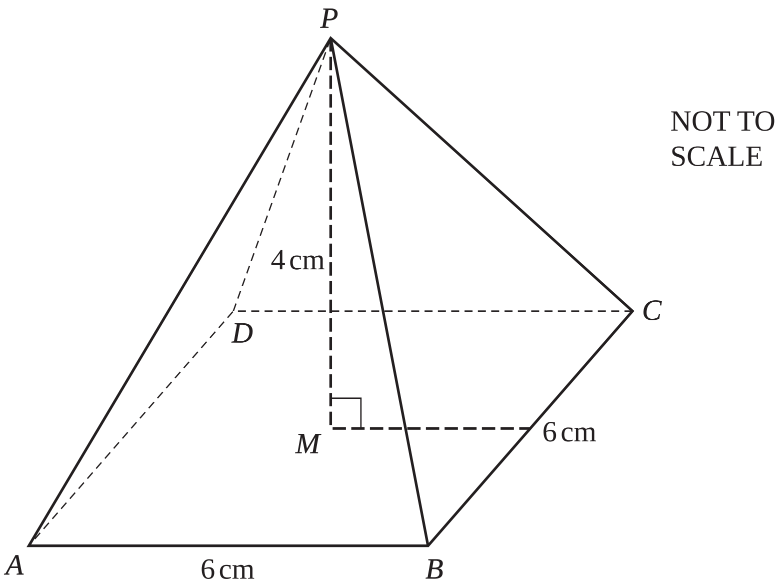
(c) g,

Answer(c) $g =$ .... [1]

(d) h.

Answer(d) $h =$ .... [1]

21



The diagram shows a pyramid with a square base *ABCD* of side 6 cm.

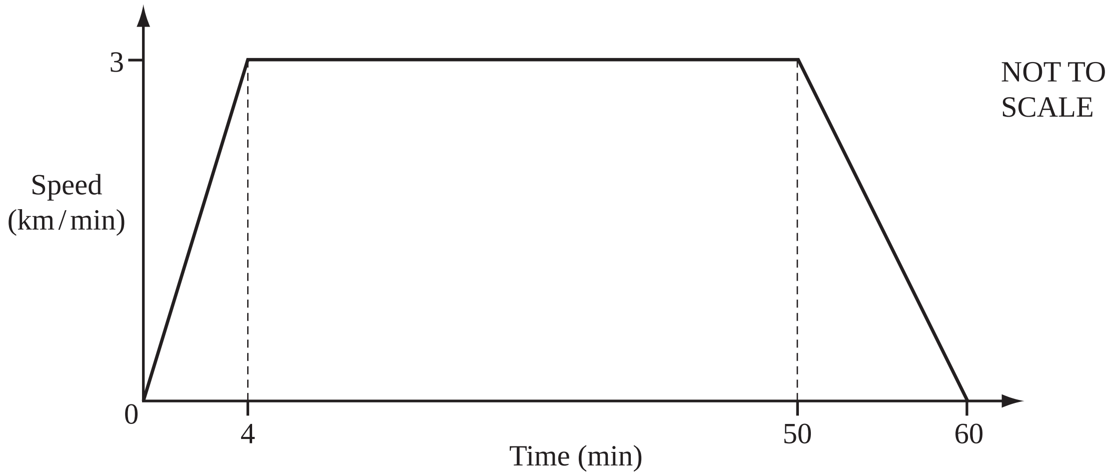
The height of the pyramid, *PM*, is 4 cm, where *M* is the centre of the base.

Calculate the total surface area of the pyramid.

Answer .... cm^2 [5]

Question 22 is printed on the next page.

22



A train journey takes one hour.
The diagram shows the speed-time graph for this journey.

(a) Calculate the total distance of the journey.

Give your answer in kilometres.

Answer(a) .... km [3]

(b) **(i)** Convert 3 kilometres / minute into metres / second.

Answer(b)(i) .... m/s [2]

(ii) Calculate the acceleration of the train during the first 4 minutes.

Give your answer in metres / second^2.

Answer(b)(ii) .... m/s^2 [2]

For Examiner's Use

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

4338708562

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **16** printed pages.

IB11 06_0580_41/6RP

UNIVERSITY of CAMBRIDGE International Examinations

1 A school has a sponsored swim in summer and a sponsored walk in winter.
In 2010, the school raised a total of \$1380.
The ratio of the money raised in summer : winter = 62 : 53.

(a) **(i)** Show clearly that \$744 was raised by the swim in **summer**.

Answer (a)(i)

[1]

(ii) Alesha's swim raised \$54.10. Write this as a percentage of \$744.

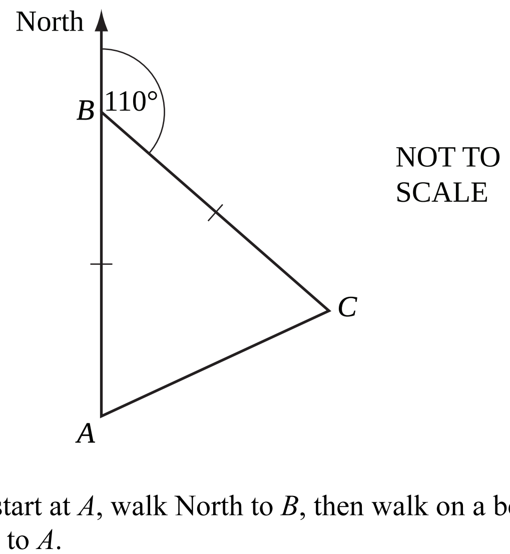
Answer(a)(ii) .... % [1]

(iii) Bryan's swim raised \$31.50.
He received 75 cents for each length of the pool which he swam.

Calculate the number of lengths Bryan swam.

Answer(a)(iii) .... [2]

(b) The route for the **sponsored walk in winter** is triangular.



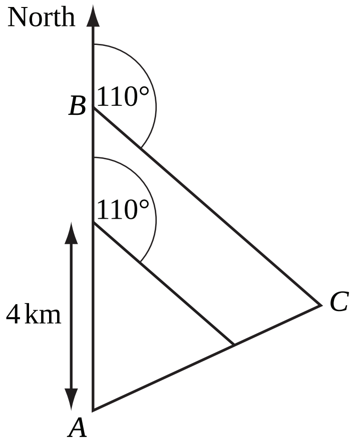
(i) Senior students start at *A*, walk North to *B*, then walk on a bearing 110° to *C*.
They then return to *A*.
AB = *BC*.

Calculate the bearing of *A* from *C*.

Answer(b)(i) .... [3]

For Examiner's Use

(ii)



$AB = BC = 6$ km.
Junior students follow a **similar** path but they only walk 4 km North from A, then 4 km on a bearing 110° before returning to A.

Senior students walk a total of 18.9 km.

Calculate the distance walked by junior students.

Answer(b)(ii) .... km [3]

(c) The total amount, \$1380, raised in 2010 was 8% **less** than the total amount raised in 2009.

Calculate the total amount raised in 2009.

Answer(c) \$ .... [3]

2 **In this question give all your answers as fractions.**

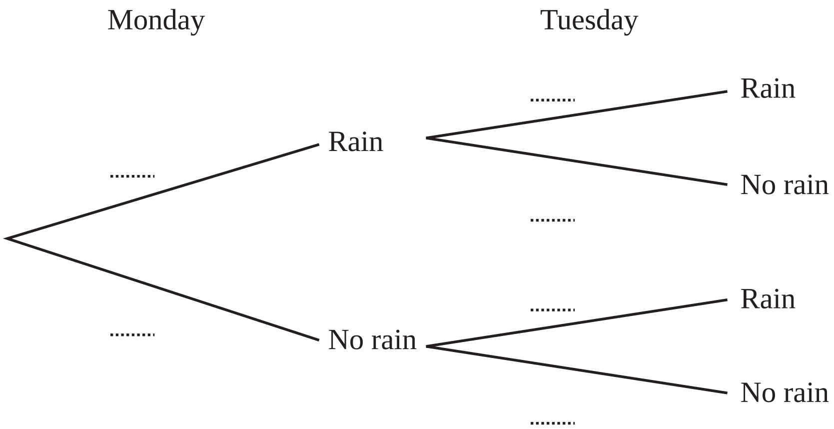
For Examiner's Use

The probability that it rains on Monday is $\frac{3}{5}$.

If it rains on Monday, the probability that it rains on Tuesday is $\frac{4}{7}$.

If it does not rain on Monday, the probability that it rains on Tuesday is $\frac{5}{7}$.

(a) Complete the tree diagram.



[3]

(b) Find the probability that it rains

(i) on **both** days,

Answer(b)(i) .... [2]

(ii) on Monday but not on Tuesday,

Answer(b)(ii) .... [2]

(iii) on **only one** of the two days.

Answer(b)(iii) .... [2]

(c) If it does **not** rain on Monday and it does **not** rain on Tuesday, the probability that it does **not** rain on Wednesday is $\frac{1}{4}$.

Calculate the probability that it rains on **at least one** of the three days.

Answer(c) .... [3]

For Examiner's Use

3 **(a)** p varies **inversely** as $(m + 1)$.

When $p = 4$, $m = 8$.

Find the value of p when $m = 11$.

Answer(a) p = ... [3]

(b) **(i)** Factorise $x^2 - 25$.

Answer(b)(i) .... [1]

(ii) Simplify $\dfrac{2x^2 + 11x + 5}{x^2 - 25}$.

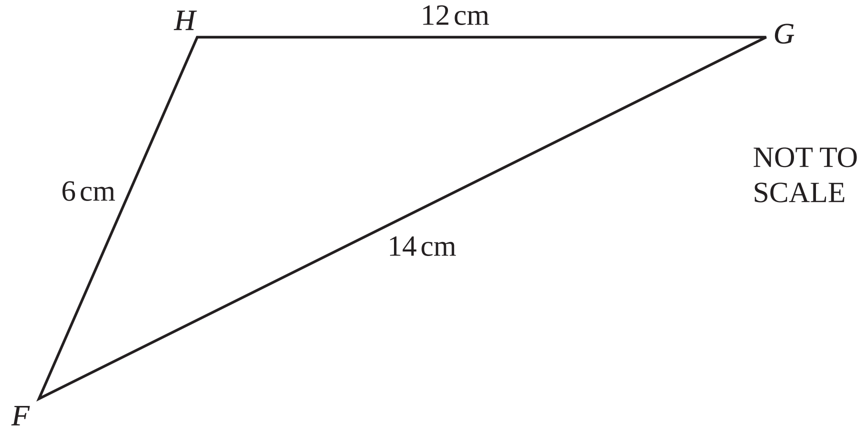
Answer(b)(ii) .... [3]

(c) Solve the inequality $5(x - 4) < 3(12 - x)$.

Answer(c) .... [3]

For Examiner's Use

4 (a)



The diagram shows triangle *FGH*, with *FG* = 14 cm, *GH* = 12 cm and *FH* = 6 cm.

(i) Calculate the size of angle *HFG*.

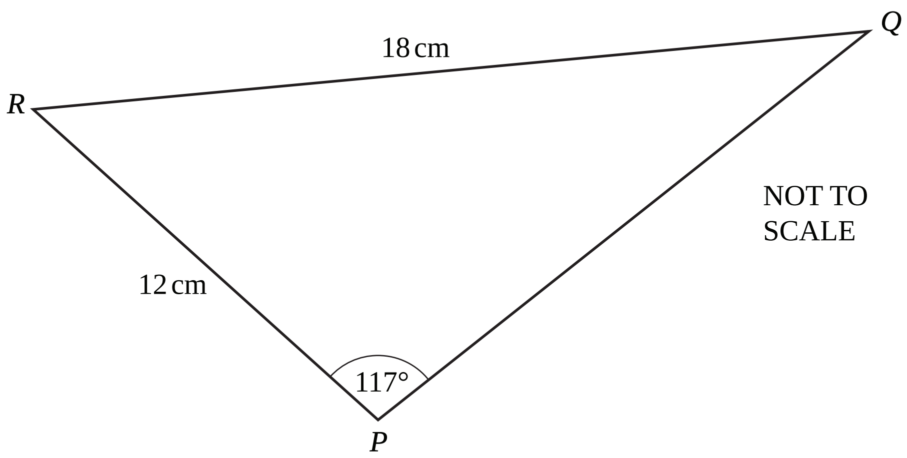
Answer(a)(i) Angle *HFG* = ... [4]

(ii) Calculate the area of triangle *FGH*.

Answer(a)(ii) .... cm^2 [2]

For Examiner's Use

(b)

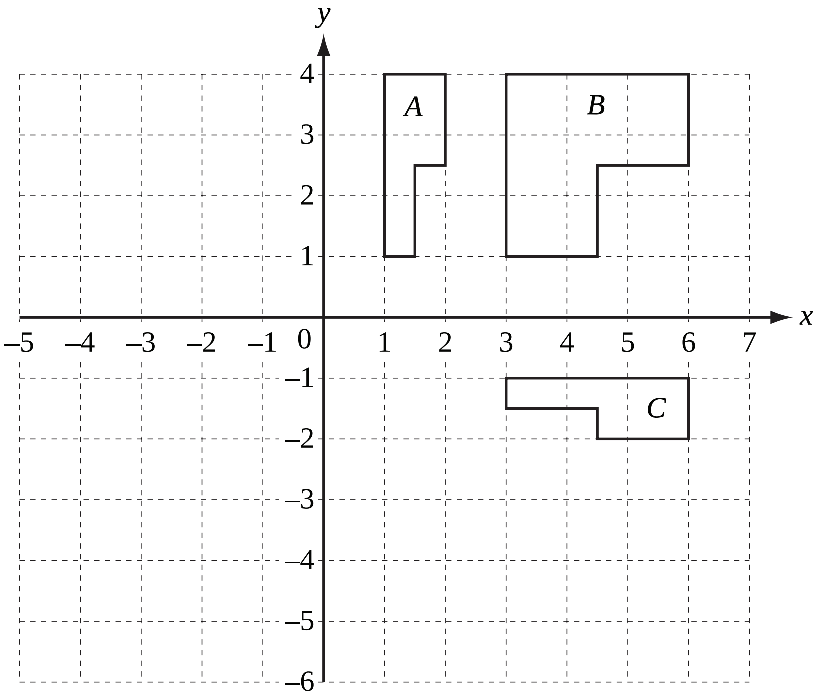


The diagram shows triangle PQR, with $RP = 12$ cm, $RQ = 18$ cm and angle $RPQ = 117°$.

Calculate the size of angle RQP.

Answer(b) Angle RQP = ... [3]

5



(a) On the grid above, draw the image of

(i) shape A after translation by the vector $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$, [2]

(ii) shape A after reflection in the line $x = -1$. [2]

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

(i) shape A onto shape B,

Answer(b)(i) .... [3]

(ii) shape A onto shape C.

Answer(b)(ii) .... [3]

(c) Find the matrix representing the transformation which maps shape A onto shape B.

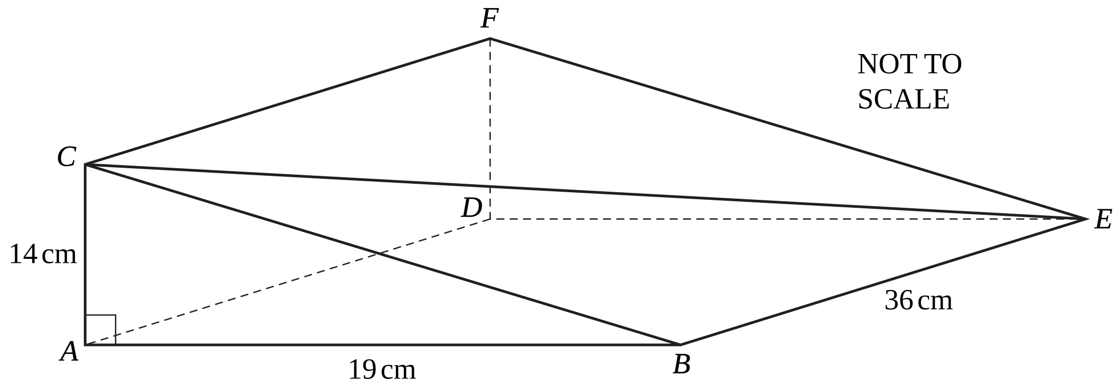
Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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

Answer(d) .... [3]

For Examiner's Use

6



In the diagram, *ABCDEF* is a prism of length 36 cm.
The cross-section *ABC* is a right-angled triangle.
AB = 19 cm and *AC* = 14 cm.

Calculate

(a) the length *BC*,

Answer(a) BC = ... cm [2]

(b) the total surface area of the prism,

Answer(b) .... cm^2 [4]

(c) the volume of the prism,

Answer(c) .... cm^3 [2]

(d) the length *CE*,

Answer(d) CE = ... cm [2]

(e) the angle between the line *CE* and the base *ABED*.

Answer(e) .... [3]

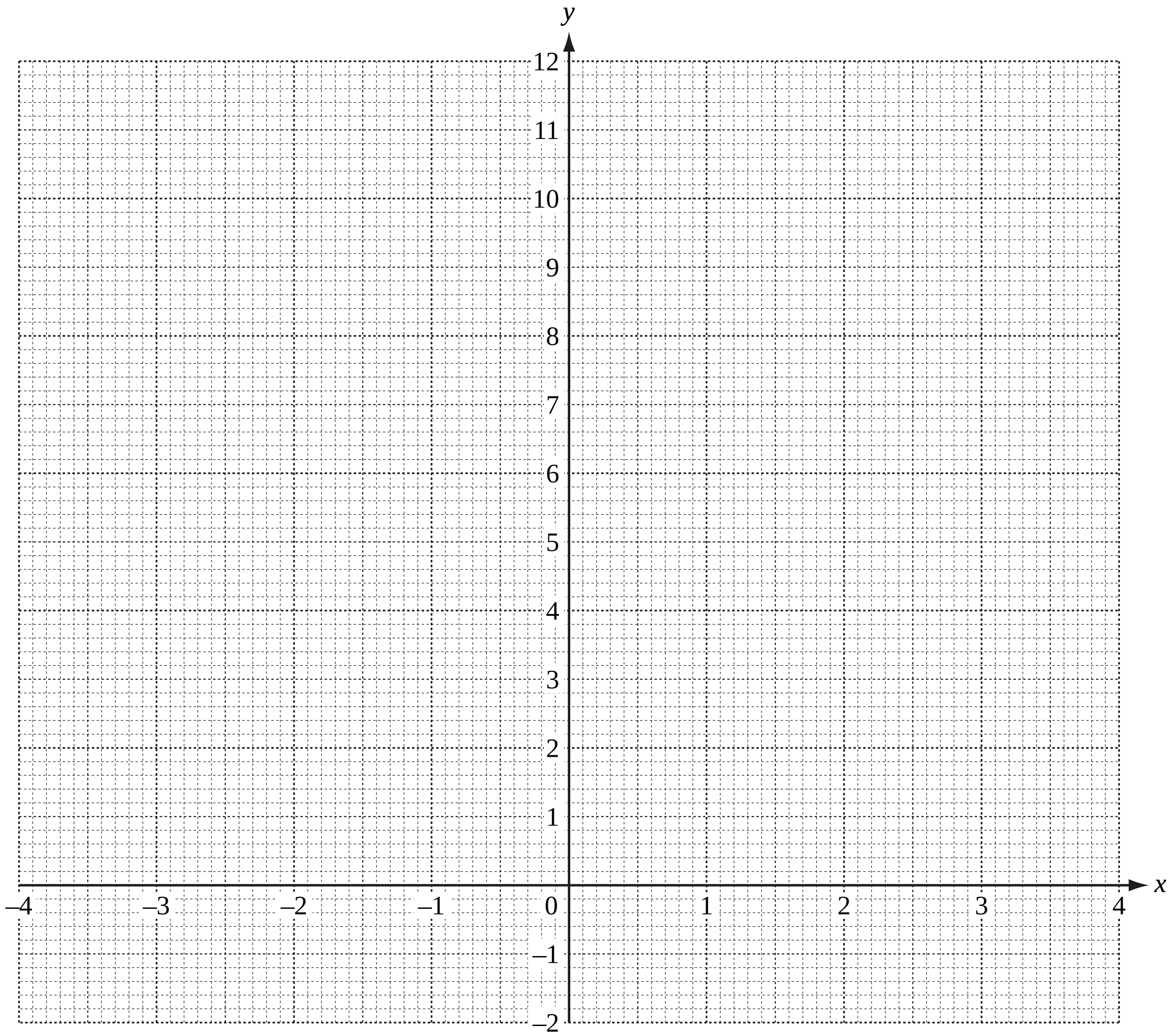
For Examiner's Use

7 **(a)** Complete the table of values for the equation $y = \frac{4}{x^2}$, $x \neq 0$.

x	-4	-3	-2	-1	-0.6		0.6	1	2	3	4
y	0.25	0.44			11.11			4.00		0.44	

[3]

(b) On the grid, draw the graph of $y = \frac{4}{x^2}$ for $-4 \leqslant x \leqslant -0.6$ and $0.6 \leqslant x \leqslant 4$.



[5]

For Examiner's Use

(c) Use your graph to solve the equation $\dfrac{4}{x^2} = 6$.

Answer(c)x = ... or $x =$ .... [2]

(d) By drawing a suitable tangent, estimate the gradient of the graph where $x = 1.5$.

Answer(d) .... [3]

(e) **(i)** The equation $\dfrac{4}{x^2} - x + 2 = 0$ can be solved by finding the intersection of the graph of $y = \dfrac{4}{x^2}$ and a straight line.

Write down the equation of this straight line.

Answer(e)(i) .... [1]

(ii) On the grid, draw the straight line from your answer to **part (e)(i)**. [2]

(iii) Use your graphs to solve the equation $\dfrac{4}{x^2} - x + 2 = 0$.

Answer(e)(iii) $x =$ .... [1]

8 The table below shows the marks scored by a group of students in a test.

Mark	11	12	13	14	15	16	17	18
Frequency	10	8	16	11	7	8	6	9

(a) Find the mean, median and mode.

Answer(a) mean = ...

median = ...

mode = ... [6]

(b) The table below shows the time (t minutes) taken by the students to complete the test.

Time (t)	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 50$	$50 < t \leqslant 60$
Frequency	2	19	16	14	15	9

(i) Cara rearranges this information into a new table.

Complete her table.

Time (t)	$0 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 50$	$50 < t \leqslant 60$
Frequency				9

[2]

(ii) Cara wants to draw a histogram to show the information in **part (b)(i)**.

Complete the table below to show the interval widths and the frequency densities.

	$0 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 50$	$50 < t \leqslant 60$
Interval width				10
Frequency density				0.9

[3]

For Examiner's Use

(c) **Some** of the students were asked how much time they spent revising for the test.

10 students revised for 2.5 hours, 12 students revised for 3 hours and n students revised for 4 hours.

The mean time that **these** students spent revising was 3.1 hours.

Find n.

Show all your working.

Answer(c) n = ... [4]

9 Peter wants to plant x plum trees and y apple trees.

He wants at least 3 plum trees and at least 2 apple trees.

(a) Write down one inequality in x and one inequality in y to represent these conditions.

Answer(a) .... , ... [2]

(b) There is space on his land for no more than 9 trees.

Write down an inequality in x and y to represent this condition.

Answer(b) .... [1]

(c) Plum trees cost \$6 and apple trees cost \$14.

Peter wants to spend no more than \$84.

Write down an inequality in x and y, and show that it simplifies to $3x + 7y \leqslant 42$.

Answer(c)

[1]

(d) On the grid, draw four lines to show the four inequalities and shade the **unwanted** regions.

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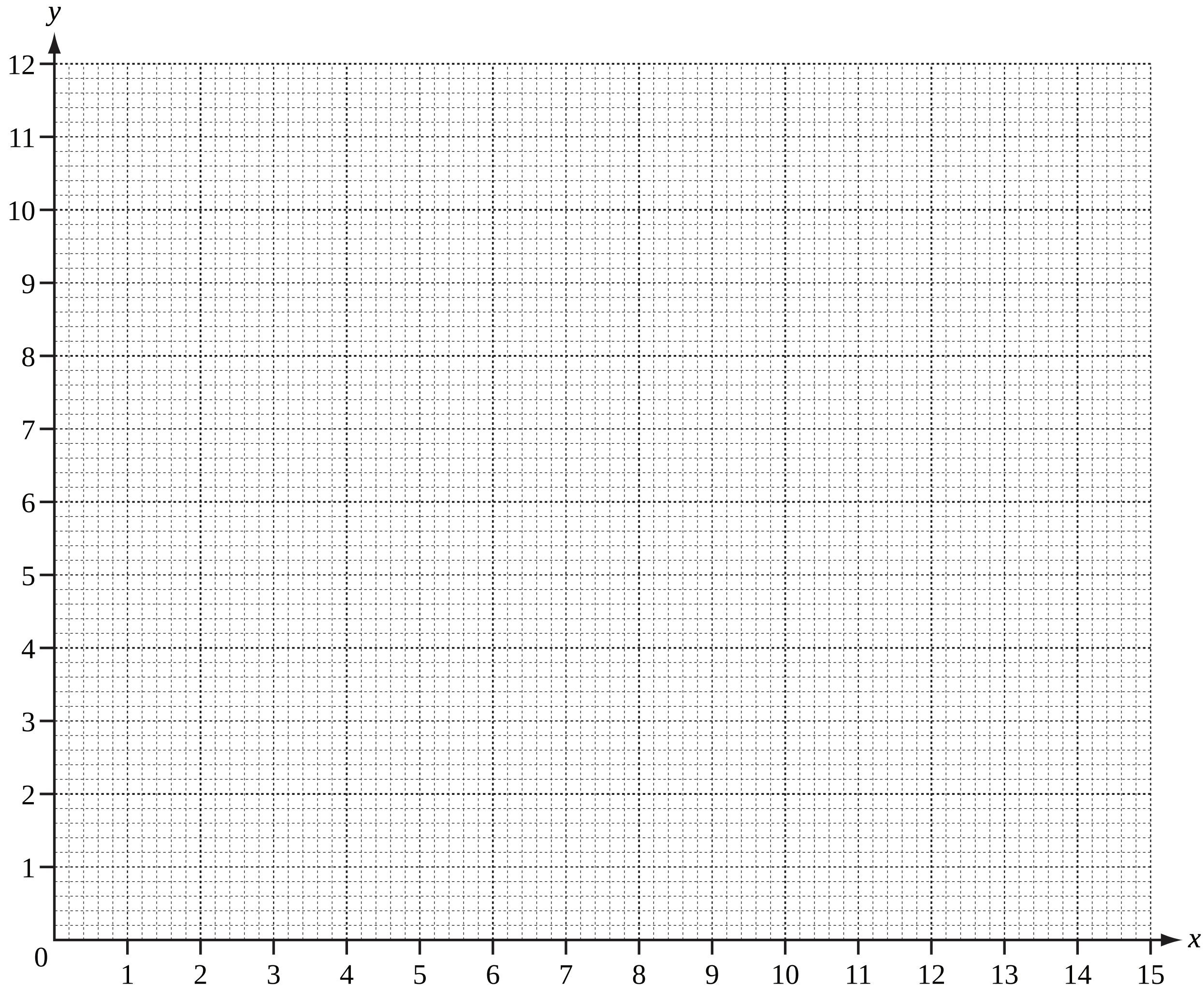


[7]

(e) Calculate the smallest cost when Peter buys a total of 9 trees.

Answer(e) $ .... [2]

Question 10 is printed on the next page.

10 The first and the nth terms of sequences A, B and C are shown in the table below.

(a) Complete the table for each sequence.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence A	1					n^3
Sequence B	4					$4n$
Sequence C	4					$(n + 1)^2$

[5]

(b) Find

(i) the 8th term of sequence A,

Answer(b)(i) .... [1]

(ii) the 12th term of sequence C.

Answer(b)(ii) .... [1]

(c) **(i)** Which term in sequence A is equal to 15 625?

Answer(c)(i) .... [1]

(ii) Which term in sequence C is equal to 10 000?

Answer(c)(ii) .... [1]

(d) The first four terms of sequences D and E are shown in the table below.

Use the results from **part (a)** to find the 5th and the nth terms of the sequences D and E.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence D	5	16	39	80		
Sequence E	0	1	4	9		

[4]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9387816354

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator; Geometrical instruments; Mathematical tables (optional); Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **15** printed pages and **1** blank page.

IB11 06_0580_42/6RP

UNIVERSITY *of* CAMBRIDGE International Examinations

For Examiner's Use

1 **(a)** Work out the following.

(i) $\dfrac{1}{0.2^2}$

Answer(a)(i) .... [1]

(ii) $\sqrt{5.1^2 + 4 \times 7.3^2}$

Answer(a)(ii) .... [1]

(iii) $25^{\frac{1}{2}} \times 1000^{-\frac{2}{3}}$

Answer(a)(iii) .... [2]

(b) Mia invests \$7500 at 3.5% per year **simple** interest.
Calculate the total amount she has after 5 years.

Answer(b) \$ .... [3]

(c) Written as the product of prime factors $48 = 2^4 \times 3$.

(i) Write 60 as the product of prime factors.

Answer(c)(i) .... [2]

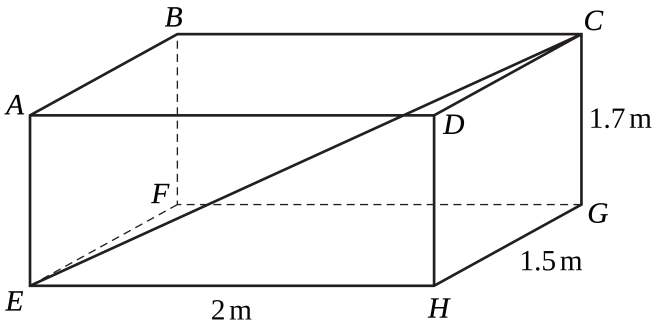
(ii) Work out the highest common factor (HCF) of 48 and 60.

Answer(c)(ii) .... [2]

(iii) Work out the lowest common multiple (LCM) of 48 and 60.

Answer(c)(iii) .... [2]

2



NOT TO SCALE

The diagram shows a box *ABCDEFGH* in the shape of a cuboid measuring 2 m by 1.5 m by 1.7 m.

(a) Calculate the length of the diagonal *EC*.

Answer(a) EC = ... m [4]

(b) Calculate the angle between *EC* and the base *EFGH*.

Answer(b) .... [3]

(c) **(i)** A rod has length 2.9 m, correct to 1 decimal place.

What is the upper bound for the length of the rod?

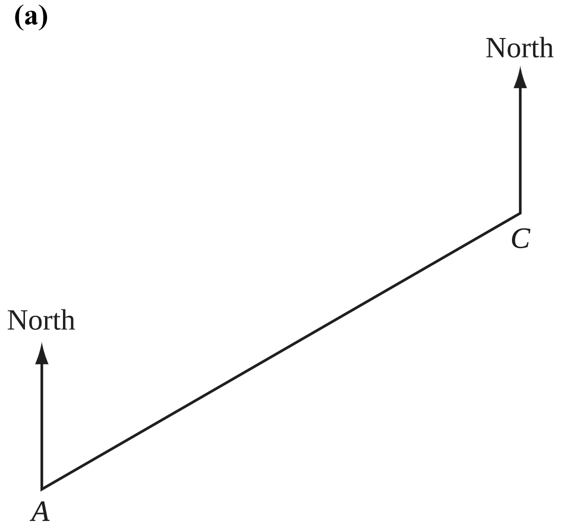
Answer(c)(i) .... m [1]

(ii) Will the rod fit completely in the box?

Give a reason for your answer.

Answer(c)(ii) .... [1]

3 **(a)**



The scale drawing shows the positions of two towns A and C on a map.
On the map, 1 centimetre represents 20 kilometres.

(i) Find the distance in kilometres from town A to town C.

Answer(a)(i) .... km [2]

(ii) Measure and write down the bearing of town C from town A.

Answer(a)(ii) .... [1]

(iii) Town B is 140 km from town C on a bearing of 150°.

Mark accurately the position of town B on the scale drawing. [2]

(iv) Find the bearing of town C from town B.

Answer(a)(iv) .... [1]

(v) A lake on the map has an area of 0.15 cm^2.

Work out the actual area of the lake.

Answer(a)(v) .... km^2 [2]

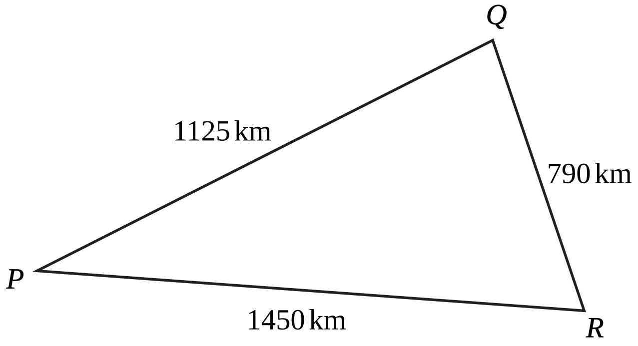
For Examiner's Use

(b) A plane leaves town C at 11 57 and flies 1500 km to another town, landing at 14 12.

Calculate the average speed of the plane.

Answer(b) .... km/h [3]

(c)



The diagram shows the distances between three towns P, Q and R.

Calculate angle PQR.

Answer(c) Angle PQR = ... [4]

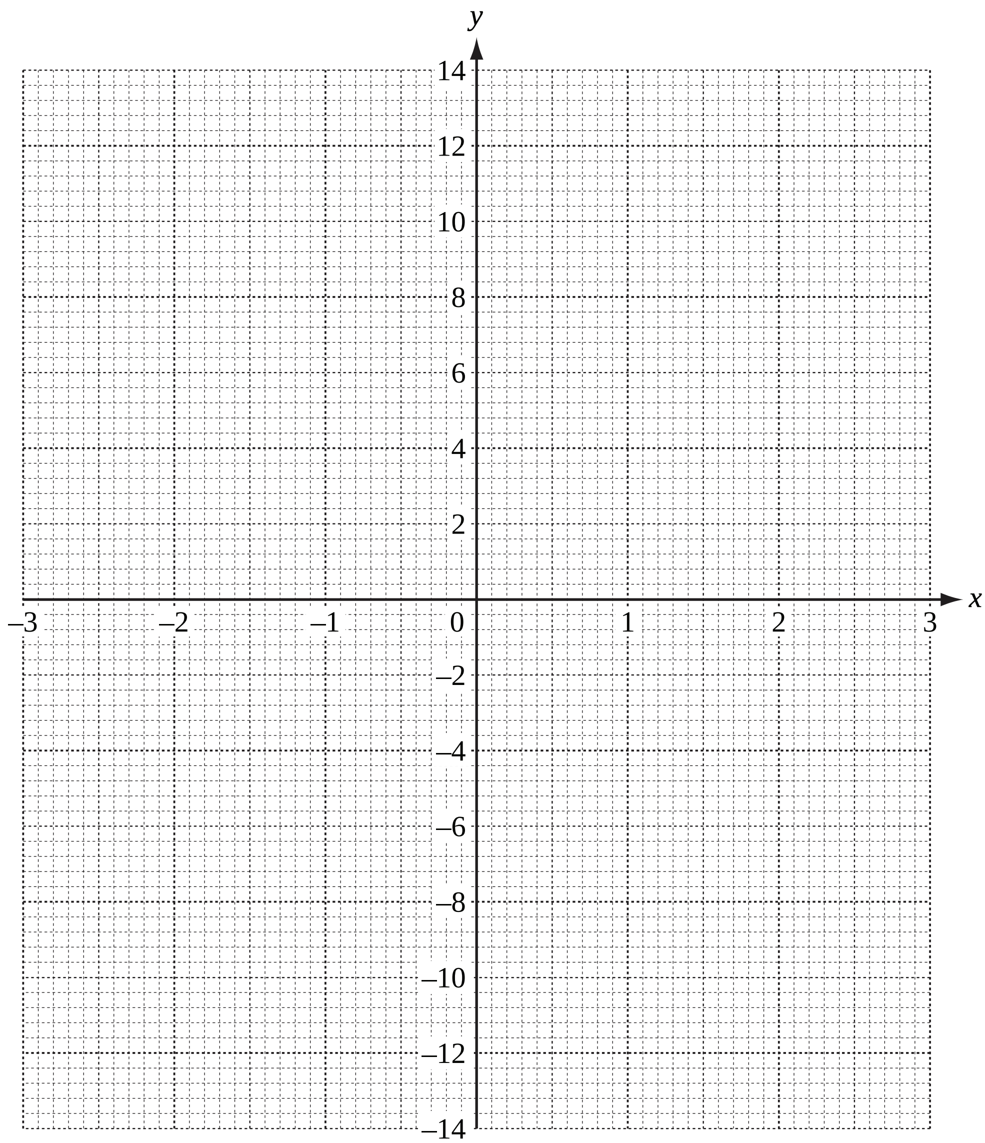
For Examiner's Use

4 **(a)** Complete the table of values for the function $y = x^2 - \frac{3}{x}$, $x \neq 0$.

x	-3	-2	-1	-0.5	-0.25		0.25	0.5	1	2	3
y	10	5.5		6.3	12.1		-11.9			2.5	8

[3]

(b) Draw the graph of $y = x^2 - \frac{3}{x}$ for $-3 \leqslant x \leqslant -0.25$ and $0.25 \leqslant x \leqslant 3$.



[5]

For Examiner's Use

(c) Use your graph to solve $x^2 - \frac{3}{x} = 7$.

Answer(c) $x =$ .... or $x =$ .... or $x =$ .... [3]

(d) Draw the tangent to the curve where $x = -2$.
Use the tangent to calculate an estimate of the gradient of the curve where $x = -2$.

Answer(d) .... [3]

For Examiner's Use

5 **(a)** Solve $9 < 3n + 6 \leqslant 21$ for integer values of n.

Answer(a) .... [3]

(b) Factorise completely.

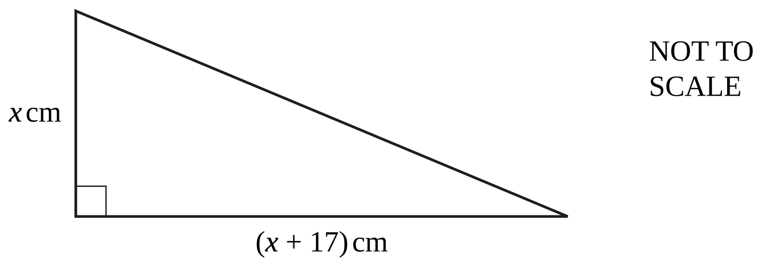
(i) $2x^2 + 10xy$

Answer(b)(i) .... [2]

(ii) $3a^2 - 12b^2$

Answer(b)(ii) .... [3]

(c)



The area of this triangle is $84\,\text{cm}^2$.

(i) Show that $x^2 + 17x - 168 = 0$.

Answer (c)(i)

[2]

(ii) Factorise $x^2 + 17x - 168$.

Answer(c)(ii) .... [2]

(iii) Solve $x^2 + 17x - 168 = 0$.

Answer(c)(iii) $x =$ .... or $x =$ .... [1]

(d) Solve

$$\frac{15 - x}{2} = 3 - 2x.$$

Answer(d) x = ... [3]

(e) Solve $2x^2 - 5x - 6 = 0$.

Show all your working and give your answers correct to 2 decimal places.

Answer(e) x = ... or $x =$ .... [4]

6

Time (t mins)	$0 < t \leqslant 20$	$20 < t \leqslant 35$	$35 < t \leqslant 45$	$45 < t \leqslant 55$	$55 < t \leqslant 70$	$70 < t \leqslant 80$
Frequency	6	15	19	37	53	20

The table shows the times taken, in minutes, by 150 students to complete their homework on one day.

(a) **(i)** In which interval is the median time?

Answer(a)(i) .... [1]

(ii) Using the mid-interval values 10, 27.5, ……..calculate an estimate of the mean time.

Answer(a)(ii) .... min [3]

(b) **(i)** Complete the table of cumulative frequencies.

Time (t mins)	$t \leqslant 20$	$t \leqslant 35$	$t \leqslant 45$	$t \leqslant 55$	$t \leqslant 70$	$t \leqslant 80$
Cumulative frequency	6	21				

[2]

(ii) On the grid, label the horizontal axis from 0 to 80, using the scale 1 cm represents 5 minutes and the vertical axis from 0 to 150, using the scale 1 cm represents 10 students.

Draw a cumulative frequency diagram to show this information. [5]

For Examiner's Use

(c) Use your graph to estimate

(i) the median time, *Answer(c)*(i) .... min [1]

(ii) the inter-quartile range,

Answer(c)(ii) .... min [2]

(iii) the number of students whose time was in the range $50 < t \leqslant 60$,

Answer(c)(iii) .... [1]

(iv) the probability, as a fraction, that a student, chosen at random, took longer than 50 minutes,

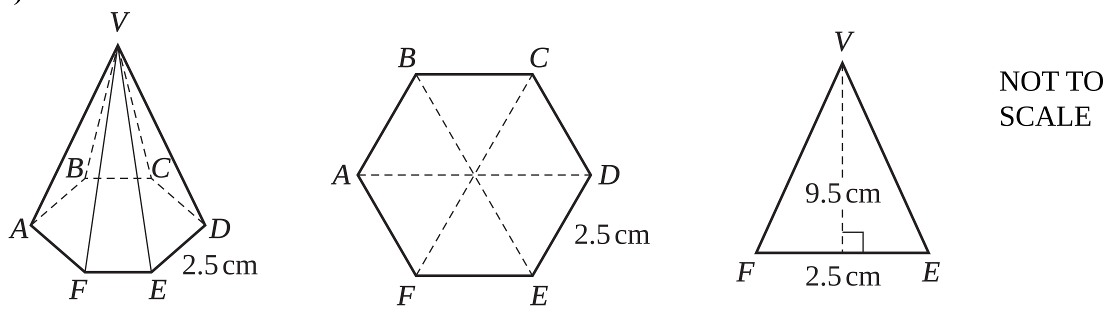
Answer(c)(iv) .... [2]

(v) the probability, as a fraction, that two students, chosen at random, both took longer than 50 minutes.

Answer(c)(v) .... [2]

For Examiner's Use

7 **(a)**

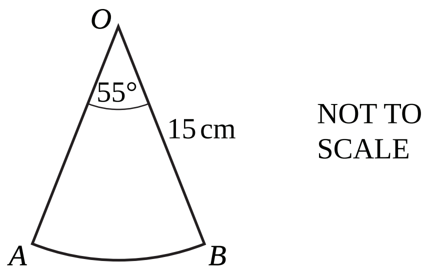


A solid pyramid has a **regular hexagon** of side 2.5 cm as its base.
Each sloping face is an isosceles triangle with base 2.5 cm and height 9.5 cm.

Calculate the **total** surface area of the pyramid.

Answer(a) .... cm^2 [4]

(b)



A sector *OAB* has an angle of 55° and a radius of 15 cm.

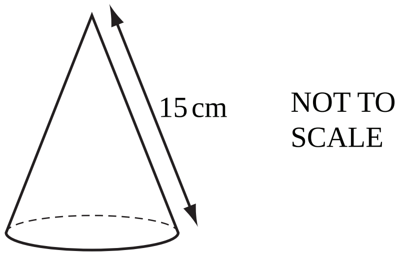
Calculate the area of the sector and show that it rounds to 108 cm^2, correct to 3 significant figures.

Answer (b)

[3]

For Examiner's Use

(c)



The sector radii *OA* and *OB* in **part (b)** are joined to form a cone.

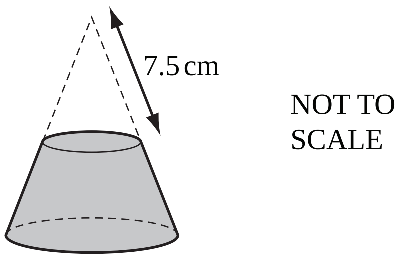
(i) Calculate the base radius of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Answer(c)(i) .... cm [2]

(ii) Calculate the perpendicular height of the cone.

Answer(c)(ii) .... cm [3]

(d)



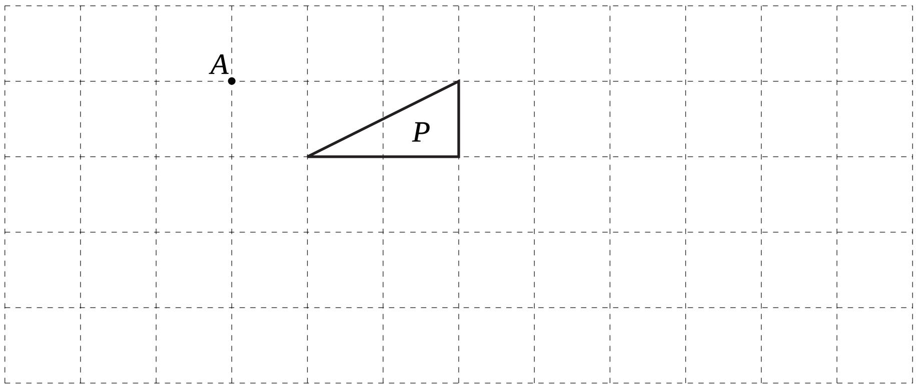
A solid cone has the same dimensions as the cone in **part (c)**.
A small cone with slant height 7.5 cm is removed by cutting parallel to the base.

Calculate the volume of the remaining solid.

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

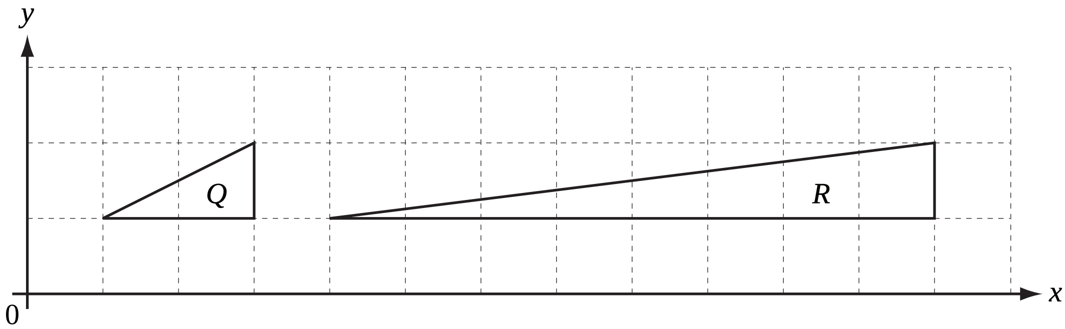
Answer(d) .... cm^3 [3]

8 **(a)**



Draw the enlargement of triangle P with centre A and scale factor 2. [2]

(b)



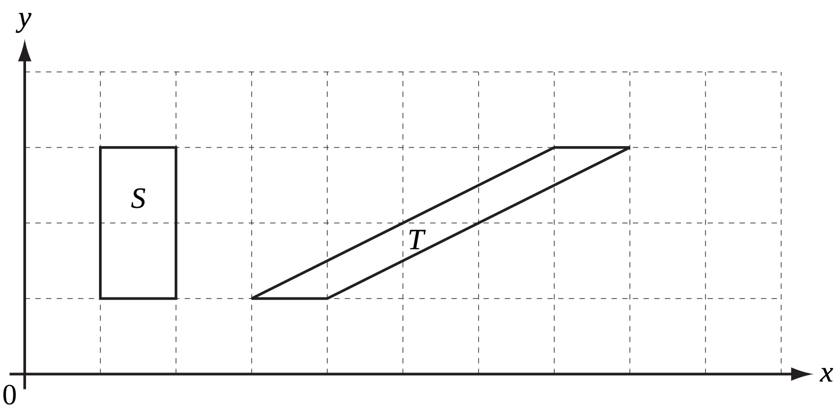
(i) Describe fully the **single** transformation which maps shape Q onto shape R.

Answer(b)(i) .... [3]

(ii) Find the matrix which represents this transformation.

Answer(b)(ii) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

(c)



Describe fully the **single** transformation which maps shape S onto shape T.

Answer(c) .... [3]

For Examiner's Use

9 **(a)** **(i)** Work out the first 3 terms of the sequence whose nth term is $n(n + 2)$.

Answer(a)(i) .... , ... , ... [2]

(ii) Which term in this sequence is equal to 168?

Answer(a)(ii) .... [3]

(b) Find a formula for the nth term of the following sequences.

(i) 5 8 11 14 17 ……

Answer(b)(i) .... [2]

(ii) 1 2 4 8 16 ……

Answer(b)(ii) .... [2]

(c)

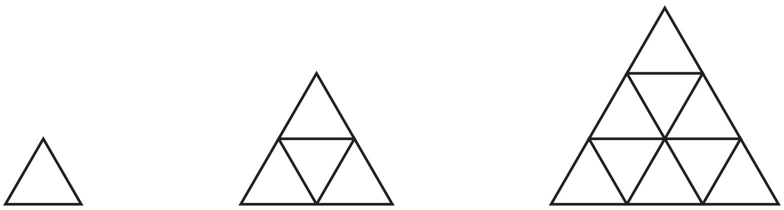


Diagram 1 Diagram 2 Diagram 3

A sequence of diagrams is formed by drawing equilateral triangles each of side one centimetre.
Diagram 1 has 3 one centimetre lines.
Diagram 2 has 9 one centimetre lines.

The formula for the **total** number of one centimetre lines needed to draw **all of the first *n* diagrams** is

$$an^3 + bn^2 + n.$$

Find the values of a and b.

Answer(c) a = ...

b = ... [6]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

8044643715

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

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

IB11 06_0580_43/4RP

UNIVERSITY of CAMBRIDGE International Examinations

1 Lucy works in a clothes shop.

(a) In one week she earned $277.20.

(i) She spent $\frac{1}{8}$ of this on food.
Calculate how much she spent on food.

Answer(a)(i) $ .... [1]

(ii) She paid 15% of the $277.20 in taxes.
Calculate how much she paid in taxes.

Answer(a)(ii) $ .... [2]

(iii) The $277.20 was 5% more than Lucy earned in the previous week.
Calculate how much Lucy earned in the previous week.

Answer(a)(iii) $ .... [3]

(b) The shop sells clothes for men, women and children.

(i) In one day Lucy sold clothes with a total value of $2200 in the ratio

men : women : children = 2 : 5 : 4.

Calculate the value of the women's clothes she sold.

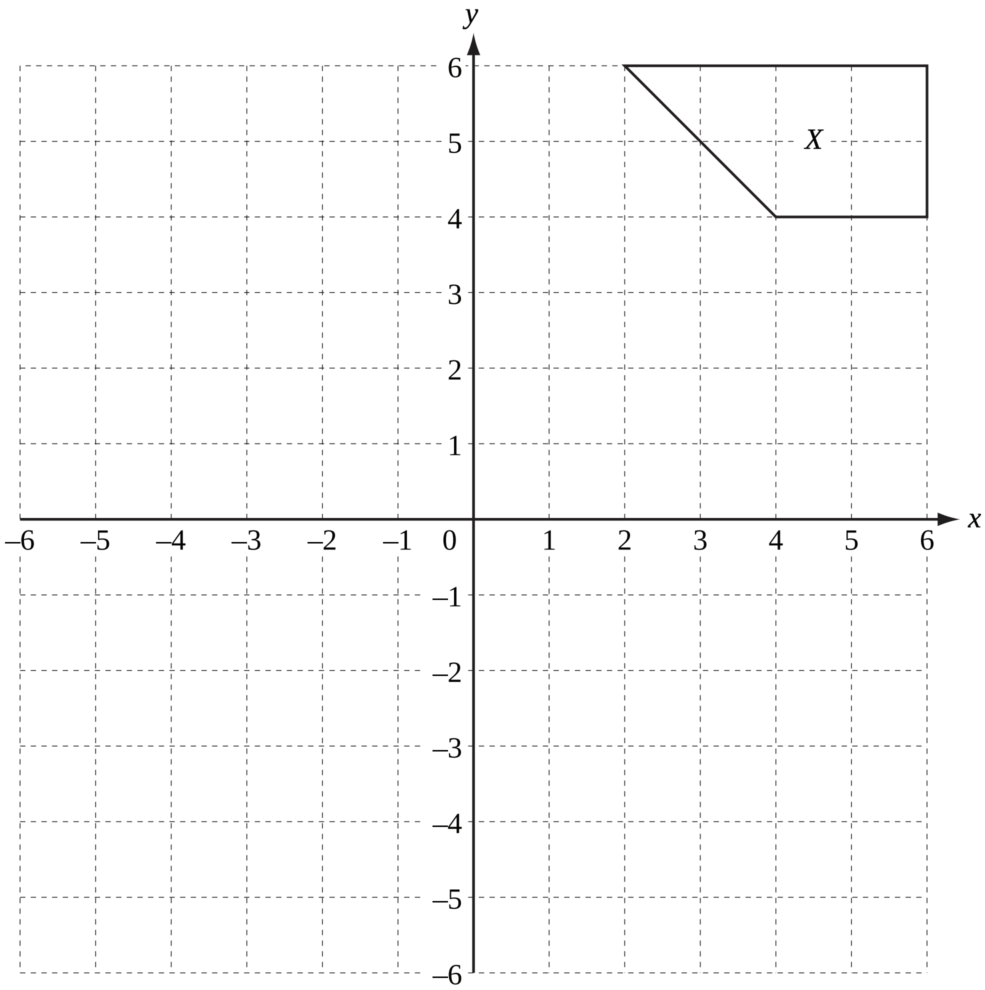
Answer(b)(i) $ .... [2]

(ii) The $2200 was $\frac{44}{73}$ of the total value of the clothes sold in the shop on this day.
Calculate the total value of the clothes sold in the shop on this day.

Answer(b)(ii) $ .... [2]

For Examiner's Use

2



(a) **(i)** Draw the reflection of shape X in the x-axis. Label the image Y. [2]

(ii) Draw the rotation of **shape *Y***, 90° clockwise about (0, 0). Label the image Z. [2]

(iii) Describe fully the **single** transformation that maps shape Z onto shape X.

Answer(a)(iii) .... [2]

(b) **(i)** Draw the enlargement of shape X, centre (0, 0), scale factor $\frac{1}{2}$. [2]

(ii) Find the matrix which represents an enlargement, centre (0, 0), scale factor $\frac{1}{2}$.

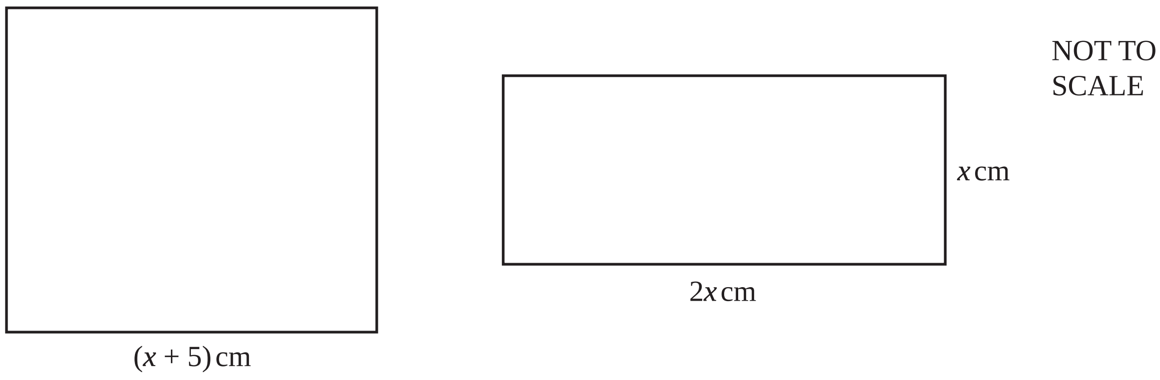
Answer(b)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) **(i)** Draw the shear of **shape *X*** with the x-axis invariant and shear factor –1. [2]

(ii) Find the matrix which represents a shear with the x-axis invariant and shear factor –1.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

3



For Examiner's Use

The diagram shows a square of side $(x + 5)$ cm and a rectangle which measures $2x$ cm by x cm.

The area of the square is $1\ \text{cm}^2$ more than the area of the rectangle.

(a) Show that $x^2 - 10x - 24 = 0$.

Answer(a)

[3]

For Examiner's Use

(b) Find the value of x.

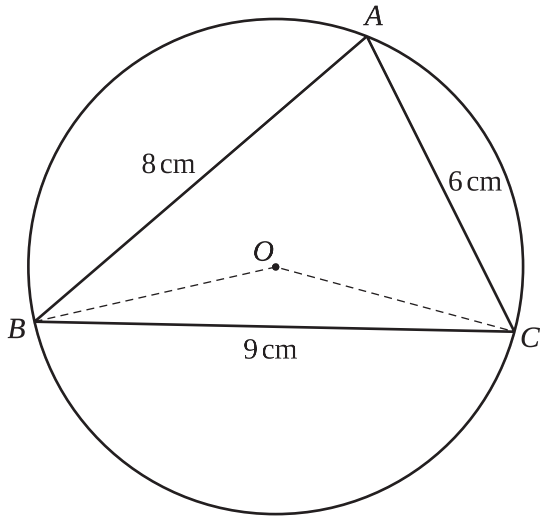
Answer(b) x = ... [3]

(c) Calculate the acute angle between the diagonals of the rectangle.

Answer(c) .... [3]

4

For Examiner's Use



NOT TO SCALE

The circle, centre *O*, passes through the points *A*, *B* and *C*.

In the triangle *ABC*, *AB* = 8 cm, *BC* = 9 cm and *CA* = 6 cm.

(a) Calculate angle *BAC* and show that it rounds to 78.6°, correct to 1 decimal place.

Answer(a)

[4]

(b) *M* is the midpoint of *BC*.

(i) Find angle *BOM*.

Answer(b)(i) Angle *BOM* = ... [1]

For Examiner's Use

(ii) Calculate the radius of the circle and show that it rounds to 4.59 cm, correct to 3 significant figures.

Answer(b)(ii)

[3]

(c) Calculate the area of the triangle *ABC* as a percentage of the area of the circle.

Answer(c) .... % [4]

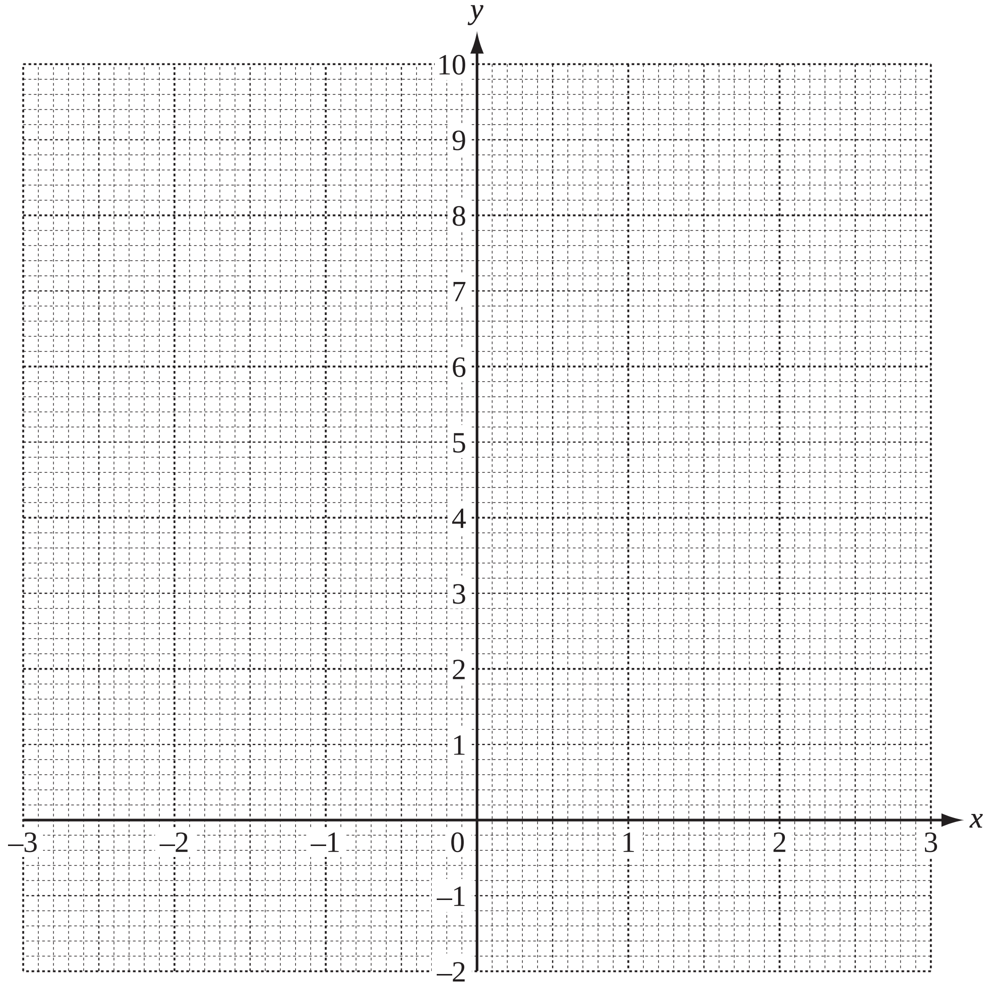
For Examiner's Use

5 **(a)** Complete the table of values for the function f(x), where $f(x) = x^2 + \frac{1}{x^2}$, $x \neq 0$.

x	-3	-2.5	-2	-1.5	-1	-0.5		0.5	1	1.5	2	2.5	3
f(x)		6.41		2.69		4.25		4.25		2.69		6.41	

[3]

(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant -0.5$ and $0.5 \leqslant x \leqslant 3$.



[5]

For Examiner's Use

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

Answer(c)(i) .... [1]

(ii) Draw the tangent to the graph of $y = f(x)$ where $x = -1.5$.
Use the tangent to estimate the gradient of the graph of $y = f(x)$ where $x = -1.5$.

Answer(c)(ii) .... [3]

(iii) Use your graph to solve the equation $x^2 + \frac{1}{x^2} = 3$.

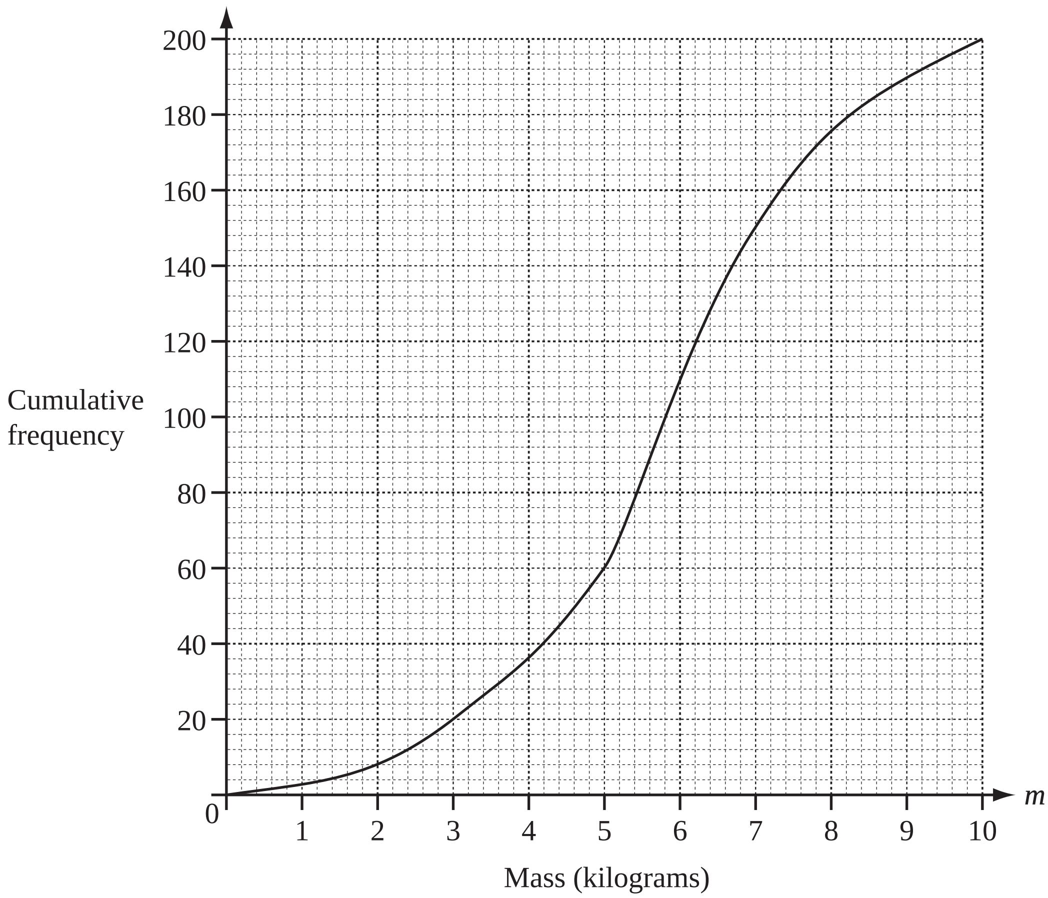
Answer(c)(iii) $x =$ .... or $x =$ .... or $x =$ .... or $x =$ .... [2]

(iv) Draw a suitable line on the grid and use your graphs to solve the equation $x^2 + \frac{1}{x^2} = 2x$.

Answer(c)(iv) $x =$ .... or $x =$ .... [3]

6

For Examiner's Use



The masses of 200 parcels are recorded.

The results are shown in the cumulative frequency diagram above.

(a) Find

(i) the median,

Answer(a)(i) .... kg [1]

(ii) the lower quartile,

Answer(a)(ii) .... kg [1]

(iii) the inter-quartile range,

Answer(a)(iii) .... kg [1]

(iv) the number of parcels with a mass greater than 3.5 kg.

Answer(a)(iv) .... [2]

(b) **(i)** Use the information from the cumulative frequency diagram to complete the grouped frequency table.

Mass (m) kg	$0 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 7$	$7 < m \leqslant 10$
Frequency	36			50

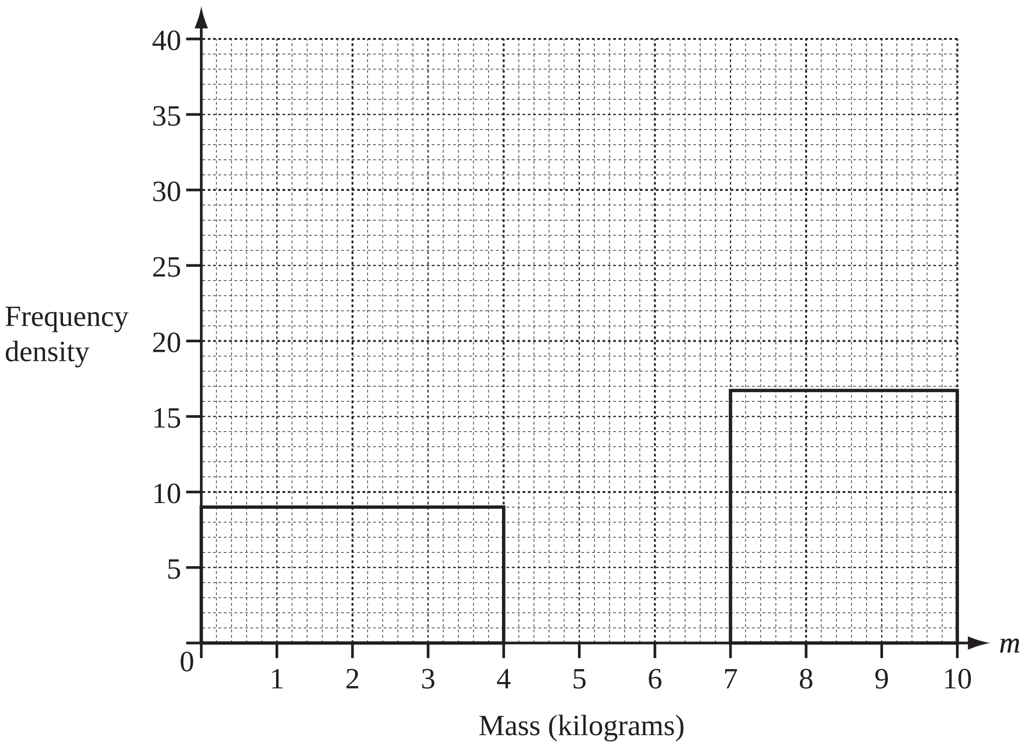
[2]

(ii) Use the grouped frequency table to calculate an estimate of the mean.

Answer(b)(ii) .... kg [4]

(iii) Complete the frequency density table and use it to complete the histogram.

Mass (m) kg	$0 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 7$	$7 < m \leqslant 10$
Frequency density	9			16.7



[4]

For Examiner's Use

7 Katrina puts some plants in her garden.

The probability that a plant will produce a flower is $\frac{7}{10}$.

If there is a flower, it can only be red, yellow or orange.

When there is a flower, the probability it is red is $\frac{2}{3}$ and the probability it is yellow is $\frac{1}{4}$.

(a) Draw a tree diagram to show **all** this information.

Label the diagram and write the probabilities on each branch.

Answer(a)

[5]

(b) A plant is chosen at random.

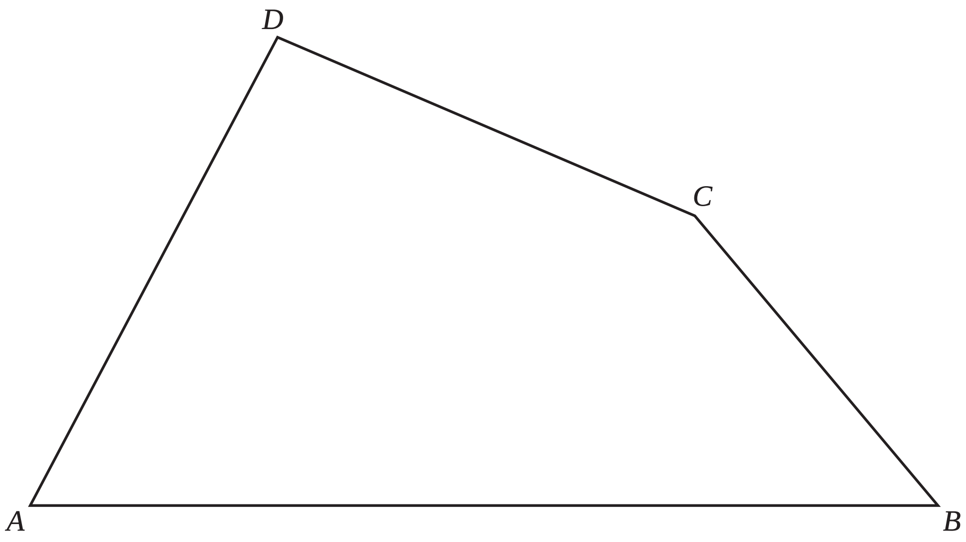
Find the probability that it will **not** produce a yellow flower.

Answer(b) .... [3]

(c) If Katrina puts 120 plants in her garden, how many orange flowers would she expect?

Answer(c) .... [2]

8



(a) Draw accurately the locus of points, inside the quadrilateral *ABCD*, which are 6 cm from the point *D*. [1]

(b) **Using a straight edge and compasses only,** construct

(i) the perpendicular bisector of *AB*, [2]

(ii) the locus of points, inside the quadrilateral, which are equidistant from *AB* and from *BC*. [2]

(c) The point *Q* is equidistant from *A* and from *B* **and** equidistant from *AB* and from *BC*.

(i) Label the point *Q* on the diagram. [1]

(ii) Measure the distance of *Q* from the line *AB*.

Answer(c)(ii) .... cm [1]

(d) On the diagram, shade the region inside the quadrilateral which is

- less than 6 cm from *D*
  and
- nearer to *A* than to *B*
  and
- nearer to *AB* than to *BC*. [1]

9 $f(x) = 3x + 1$ $g(x) = (x + 2)^2$

For Examiner's Use

(a) Find the values of

(i) gf(2),

Answer(a)(i) .... [2]

(ii) ff(0.5).

Answer(a)(ii) .... [2]

(b) Find $f^{-1}(x)$, the inverse of $f(x)$.

Answer(b) .... [2]

(c) Find $fg(x)$.

Give your answer in its simplest form.

Answer(c) .... [2]

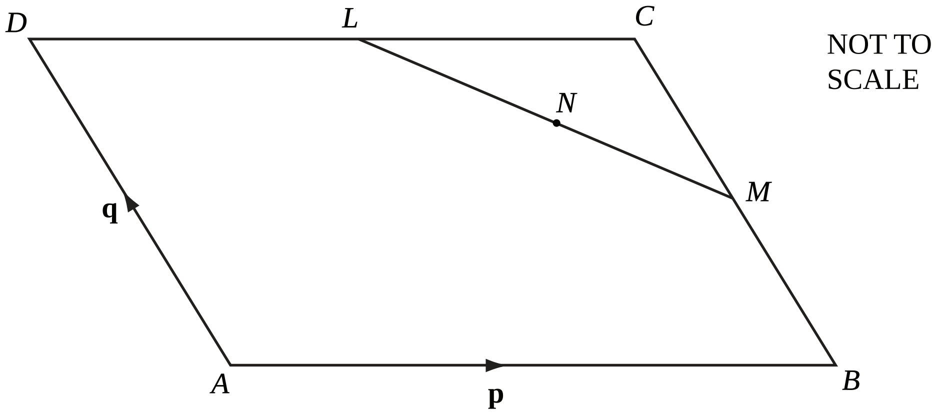
(d) Solve the equation $x^2 + f(x) = 0$.

Show all your working and give your answers correct to 2 decimal places.

For Examiner's Use

Answer(d) x = ... or x = ... [4]

10 **(a)**



$ABCD$ is a parallelogram.
L is the midpoint of DC, M is the midpoint of BC and N is the midpoint of LM.
$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AD} = \mathbf{q}$.

(i) Find the following in terms of **p** and **q**, in their simplest form.

(a) $\overrightarrow{AC}$

Answer(a)(i)(a) $\overrightarrow{AC} =$ .... [1]

(b) $\overrightarrow{LM}$

Answer(a)(i)(b) $\overrightarrow{LM} =$ .... [2]

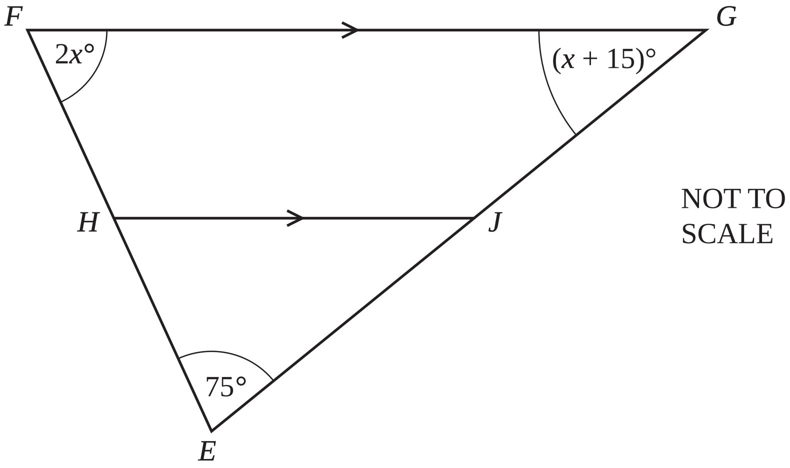
(c) $\overrightarrow{AN}$

Answer(a)(i)(c) $\overrightarrow{AN} =$ .... [2]

(ii) Explain why your answer for $\overrightarrow{AN}$ shows that the point N lies on the line AC.

Answer(a)(ii) .... [1]

(b)



EFG is a triangle.
HJ is parallel to *FG*.
Angle *FEG* = 75°.
Angle *EFG* = 2x° and angle *FGE* = (x + 15)°.

(i) Find the value of x.

Answer(b)(i) x = ... [2]

(ii) Find angle *HJG*.

Answer(b)(ii) Angle *HJG* = ... [1]

For Examiner's Use

  [Turn over

11 (a) (i) The first three positive integers 1, 2 and 3 have a sum of 6.

Write down the sum of the first 4 positive integers.

Answer(a)(i) .... [1]

(ii) The formula for the sum of the first n integers is $\frac{n(n+1)}{2}$.

Show the formula is correct when $n = 3$.

Answer(a)(ii)

[1]

(iii) Find the sum of the first 120 positive integers.

Answer(a)(iii) .... [1]

(iv) Find the sum of the integers

121 + 122 + 123 + 124 + ... + 199 + 200.

Answer(a)(iv) .... [2]

(v) Find the sum of the even numbers

2 + 4 + 6 + ... + 800.

Answer(a)(v) .... [2]

(b) **(i)** Complete the following statements about the sums of cubes and the sums of integers.

$1^3 = 1$ $\qquad$ $1 = 1$

$1^3 + 2^3 = 9$ $\qquad$ $1 + 2 = 3$

$1^3 + 2^3 + 3^3 =$ .... $\qquad$ $1 + 2 + 3 =$ ....

$1^3 + 2^3 + 3^3 + 4^3 =$ .... $\qquad$ $1 + 2 + 3 + 4 =$ .... [2]

(ii) The sum of the first 14 integers is 105.

Find the sum of the first 14 cubes.

Answer(b)(ii) .... [1]

(iii) Use the formula in **part(a)(ii)** to write down a formula for the sum of the first *n* cubes.

Answer(b)(iii) .... [1]

(iv) Find the sum of the first 60 cubes.

Answer(b)(iv) .... [1]

(v) Find *n* when the sum of the first *n* cubes is 278 784.

Answer(b)(v) *n* = ... [2]

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