UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2013**

1 hour 30 minutes

Candidates answer on the Question Paper.

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

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.

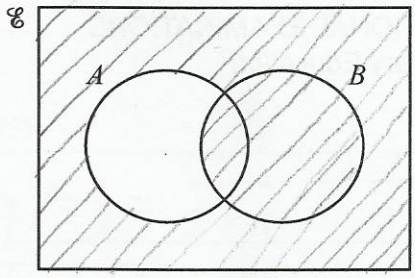
Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees 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.

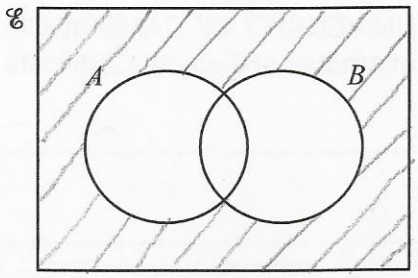
This document consists of **12** printed pages.

For Examiner's Use

1 Shade the required region on each Venn diagram.



$A' \cup B$



$A' \cap B'$

[2]

---

2 Factorise completely.

$kp + 3k + mp + 3m$

$= k(p+3) + m(p+3)$

$= (k+m)(p+3)$

Answer $(k+m)(p+3)$ [2]

---

3 The first five terms of a sequence are shown below.

13 9 5 1 −3

−4 −4 −4 −4

Find the nth term of this sequence.

Common difference $= -4$

So n^{th} term $= -4n + b$

$n=1: \ 13 = -4 + b \Rightarrow b = 17$

Answer $-4n + 17$ [2]

For Examiner's Use

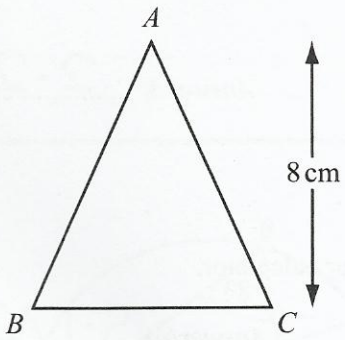
4 Calculate $(4.3 \times 10^8) + (2.5 \times 10^7)$.

Give your answer in standard form.

$= 455000000$

Answer 4.55×10^8 [2]

5



NOT TO SCALE

Triangle ABC has a height of 8 cm and an area of 42 cm^2.

Calculate the length of BC.

Area $= \frac{1}{2}$ base $\times$ height

$42 = \frac{1}{2} \times BC \times 8 = 4BC$

$BC = 10.5$ cm

Answer $BC =$ 10.5 cm [2]

For Examiner's Use

6 George and his friend Jane buy copies of the same book on the internet.
George pays \$16.95 and Jane pays £11.99 on a day when the exchange rate is \$1 = £0.626.

Calculate, in dollars, how much more Jane pays.

George: \$16.95

Jane: $\$\left(\frac{11.99}{0.626}\right) = \$19.1533...$

Difference $= 19.1533... - 16.95$
$= 2.2033...$

Answer \$ 2.20 [2]

---

7 **(a)** Use your calculator to work out $\sqrt{65} - 1.7^2$.

Write down all the numbers displayed on your calculator.

Answer(a) 5.172257748 [1]

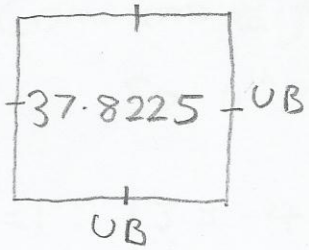
(b) Write your answer to **part (a)** correct to 2 significant figures.

Answer(b) 5.2 [1]

---

8 Joe measures the side of a square correct to 1 decimal place.
He calculates the **upper** bound for the area of the square as 37.8225 cm^2.

Work out Joe's measurement for the side of the square.



$UB = \sqrt{37.8225}$
$= 6.15$

Answer 6.1 cm [2]

For Examiner's Use

9 A car, 4.4 metres long, has a fuel tank which holds 65 litres of fuel when full.
The fuel tank of a mathematically similar model of the car holds 0.05 litres of fuel when full.

Calculate the length of the model car in centimetres.

$\text{Volume factor} = \frac{65}{0.05} = 1300$

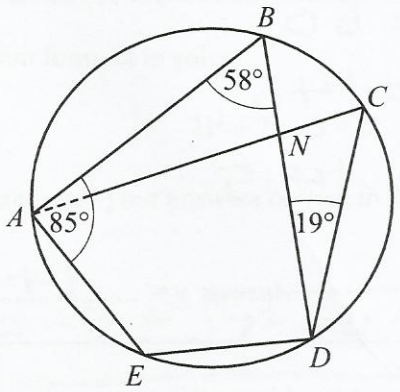
$\text{Scale factor} = \sqrt[3]{1300} = 10.9139...$

$4.4\text{m} = 440\text{cm}$

$\text{Length}_{\text{model}} = \frac{440}{10.9139...} = 40.3154...$

Answer 40.3 cm [3]

10



NOT TO SCALE

A, *B*, *C*, *D* and *E* are points on a circle.
Angle *ABD* = 58°, angle *BAE* = 85° and angle *BDC* = 19°.
BD and *CA* intersect at *N*.

Calculate

(a) angle *BDE*,

$180 - 85 = 95$

Answer(a) Angle *BDE* = 95° [1]

(b) angle *AND*.

Angles in Same segment: $A\hat{C}D = 58°$

$C\hat{N}D = 180 - 19 - 58 = 103°$, $A\hat{N}D = 180 - 103$

Answer(b) Angle *AND* = 77° [2]

For Examiner's Use

11 Without using a calculator, work out $\frac{6}{7} \div 1\frac{2}{3}$.

Write down all the steps in your working.

$= \frac{6}{7} \div \frac{5}{3} = \frac{6}{7} \times \frac{3}{5}$

$= \frac{18}{35}$

Answer $\frac{18}{35}$ [3]

---

12 Solve the equation.

$5(2y - 17) = 60$

$\Rightarrow 10y - 85 = 60$

$\Rightarrow 10y = 145$

$\Rightarrow y = 14.5$

Answer $y =$ 14.5 [3]

---

13 Carol invests \$6250 at a rate of 2% per year compound interest.

Calculate the **total** amount Carol has after 3 years.

Year 1 : $6250 \times 1.02 = 6375$

Year 2 : $6375 \times 1.02 = 6502.5$

Year 3 : $6502.5 \times 1.02 = 6632.55$

Answer \$ 6632.55 [3]

For Examiner's Use

14 y is inversely proportional to x^3.
$y = 5$ when $x = 2$.

Find y when $x = 4$.

$y \propto \frac{1}{x^3} \Rightarrow y = \frac{k}{x^3}$

$5 = \frac{k}{2^3} \Rightarrow k = 40 \Rightarrow y = \frac{40}{x^3}$

When $x = 4$, $y = \frac{40}{4^3} = 0.625$

Answer $y =$ 0.625 [3]

---

15 Use the quadratic equation formula to solve

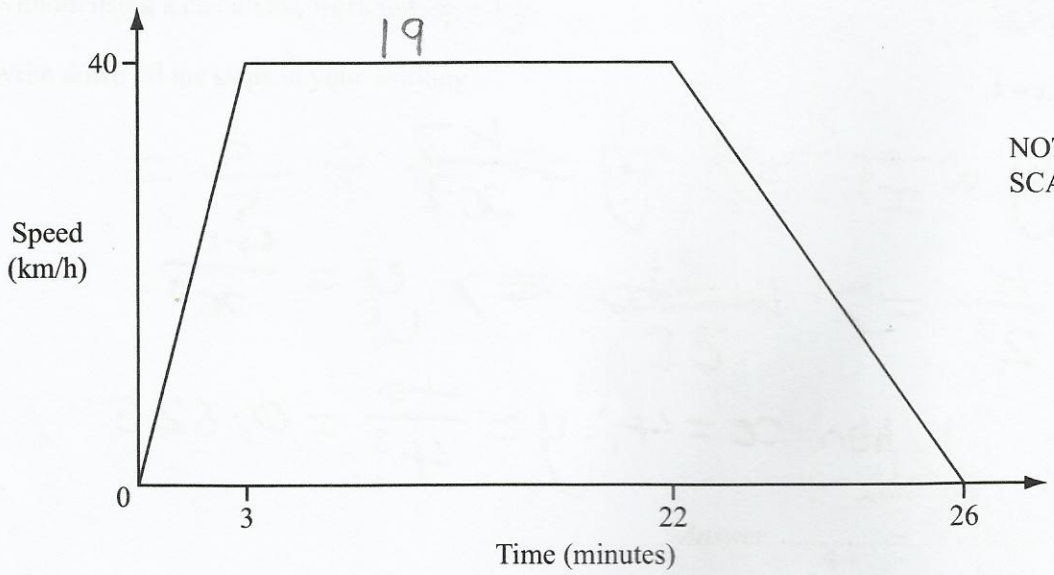
$$2x^2 + 7x - 3 = 0 .$$

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

$$x = \frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)}$$

Answer $x =$ 0.39 or $x =$ -3.89 [4]

For Examiner's Use



The diagram shows the speed-time graph of a train journey between two stations.

The train accelerates for 3 minutes, travels at a constant maximum speed of 40 km/h, then takes 4 minutes to slow to a stop.

Calculate the distance in kilometres between the two stations.

$26\text{mins} = \frac{26}{60}\text{hrs}$, $19\text{mins} = \frac{19}{60}\text{hrs}$

$\text{Distance} = \frac{1}{2}(a+b)h$

$= \frac{1}{2}\left(\frac{26}{60} + \frac{19}{60}\right) \times 40$

$= 15\text{km}$

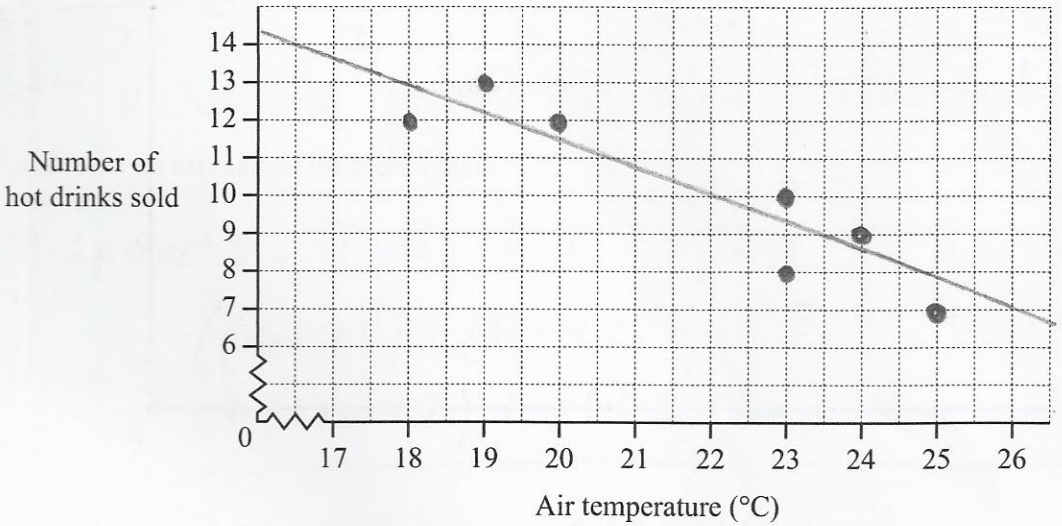
Answer ..... 15 ..... km [4]

For Examiner's Use

17 The owner of a small café records the average air temperature and the number of hot drinks he sells each day for a week.

Air temperature (°C)	18	23	19	23	24	25	20
Number of hot drinks sold	12	8	13	10	9	7	12

(a) On the grid, draw a scatter diagram to show this information.



[2]

(b) What type of correlation does your scatter diagram show?

Answer(b) Negative [1]

(c) Draw a line of best fit on the grid. [1]

---

18 Solve $6x + 3 < x < 3x + 9$ for **integer** values of x.

Split into 2 inequalities:

$6x + 3 < x$ | $x < 3x + 9$

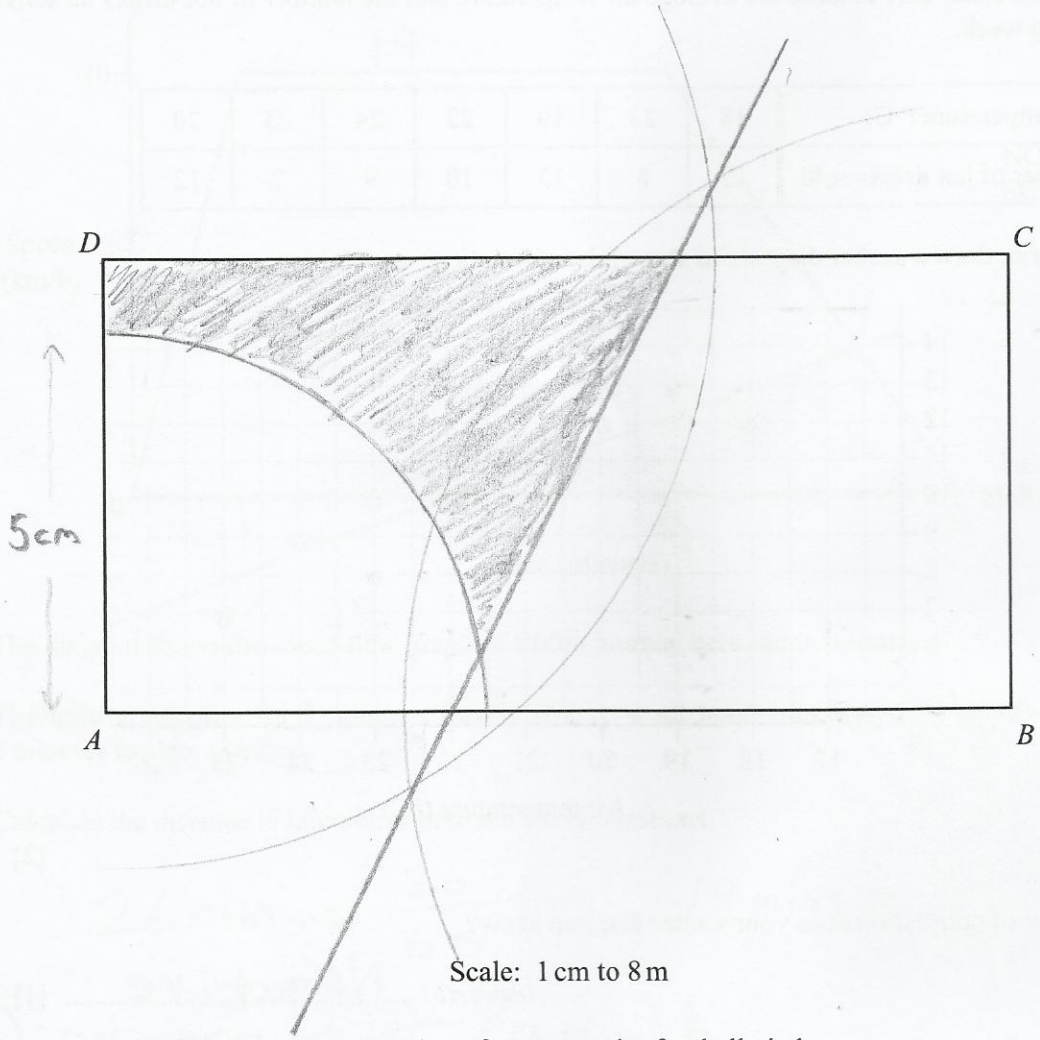
$\Rightarrow 3 < -5x$ | $\Rightarrow -2x < 9$

$\Rightarrow -0.6 > x$ | $\Rightarrow x > -4.5$

So $-4.5 < x < -0.6$

Answer -4, -3, -2, -1 [4]

For Examiner's Use



Scale: 1 cm to 8 m

The rectangle *ABCD* is a scale drawing of a rectangular football pitch.
The scale used is 1 centimetre to represent 8 metres.

(a) Construct the locus of points 40 m from *A* and inside the rectangle. [2]

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

(c) Shade the region on the football pitch which is more than 40 m from *A* **and** nearer to *D* than to *B*. [1]

For Examiner's Use

20 The heights, in metres, of 200 trees in a park are measured.

Height (hm)	$2 < h \leqslant 6$	$6 < h \leqslant 10$	$10 < h \leqslant 13$	$13 < h \leqslant 17$	$17 < h \leqslant 19$	$19 < h \leqslant 20$
Frequency	23	47	45	38	32	15

(a) Find the interval which contains the median height.

$n = 200: \frac{n+1}{2} = \frac{200+1}{2} = 100.5$

100.5^{th} value is in $10 < h \leqslant 13$ *Answer(a)* $10 < h \leqslant 13$ [1]

(b) Calculate an estimate of the mean height.

Midpoints: 4, 8, 11·5, 15, 18, 19·5

$$\text{Mean} \approx \frac{((4\times23)+(8\times47)+(11.5\times45)+(15\times38)+(18\times32)+(19.5\times15))}{200}$$

$= 12.12$

Answer(b) 12·12 m [4]

(c) Complete the cumulative frequency table for the information given in the table above.

Height (hm)	$2 < h \leqslant 6$	$h \leqslant 10$	$h \leqslant 13$	$h \leqslant 17$	$h \leqslant 19$	$h \leqslant 20$
Cumulative frequency	23	70	115	153	185	200

[2]

Question 21 is printed on the next page.

For Examiner's Use

21 $f(x) = 5x + 4$ $\quad g(x) = \frac{1}{2x}, \ x \neq 0$ $\quad h(x) = \left(\frac{1}{2}\right)^x$

Find

(a) fg(5),

$g(5) = \frac{1}{2\times 5} = \frac{1}{10}$

$\Rightarrow fg(5) = f\left(\frac{1}{10}\right) = 5\left(\frac{1}{10}\right) + 4 = 4.5$

Answer(a) 4.5 [2]

(b) gg(x) in its simplest form,

$g(g(x)) = g\left(\frac{1}{2x}\right) = \frac{1}{2\left(\frac{1}{2x}\right)} = 1 \div \frac{1}{x}$

$= x$

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

(c) $f^{-1}(x)$,

$x = \frac{f(x) - 4}{5} \Rightarrow f^{-1}(x) = \frac{x-4}{5}$

Answer(c) $f^{-1}(x)$ = $\frac{x-4}{5}$ [2]

(d) the value of x when $h(x) = 8$.

$h(x) = 8 \Rightarrow \left(\frac{1}{2}\right)^x = 8$

$\Rightarrow (2^{-1})^x = 8 \Rightarrow 2^{-x} = 8$

$\Rightarrow -x = 3$

Answer(d) x = -3 [2]

* 2463784401 *

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 1 2 7 7 8 6 5 7 2 9 *

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2013**

2 hours 30 minutes

Candidates answer on the Question Paper.

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

READ THESE INSTRUCTIONS FIRST

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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.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 A tennis club has 560 members.

(a) The ratio men : women : children = 5 : 6 : 3.

(i) Show that the club has 240 women members.

Answer(a)(i)

14 parts = 560

6 parts = $\frac{560}{14} \times 6 = 240$

[2]

(ii) How many members are children?

$\frac{240}{2} = 120$

Answer(a)(ii) 120 [1]

(b) $\frac{5}{8}$ of the 240 women members play in a tournament.

How many women members do **not** play in the tournament?

$\frac{3}{8} \times 240 = 90$

Answer(b) 90 [2]

(c) The annual membership fee in 2013 is \$198 for each adult and \$75 for each child.

(i) Calculate the total amount the 560 members pay in 2013.

Adults : 560 − 120 = 440

Total = 440 × 198 + 120 × 75 = 96120

Answer(c)(i) \$ 96120 [2]

(ii) The adult fee of \$198 in 2013 is 5.6% more than the fee in 2012.

Calculate the adult fee in 2012.

(2013) 105.6 % : 198

(2012) 100 % : $\frac{198}{105.6} \times 100 = 187.5$

Answer(c)(ii) \$ 187.50 [3]

For Examiner's Use

(d) The club buys 36 tennis balls for \$9.50 and sells them to members for \$0.75 each.

Calculate the percentage profit the club makes.

$36 \times 0.75 = 27$

$\frac{27 - 9.5}{9.5} \times 100 = 184.2105...$

Answer(d) 184 % [3]

(e) A tennis court is a rectangle with length 23.7 m and width 10.9 m, each correct to 1 decimal place.

Calculate the upper and lower bounds of the perimeter of the court.

UB(perimeter) $= (23.75 \times 2) + (10.95 \times 2)$
$= 69.4$

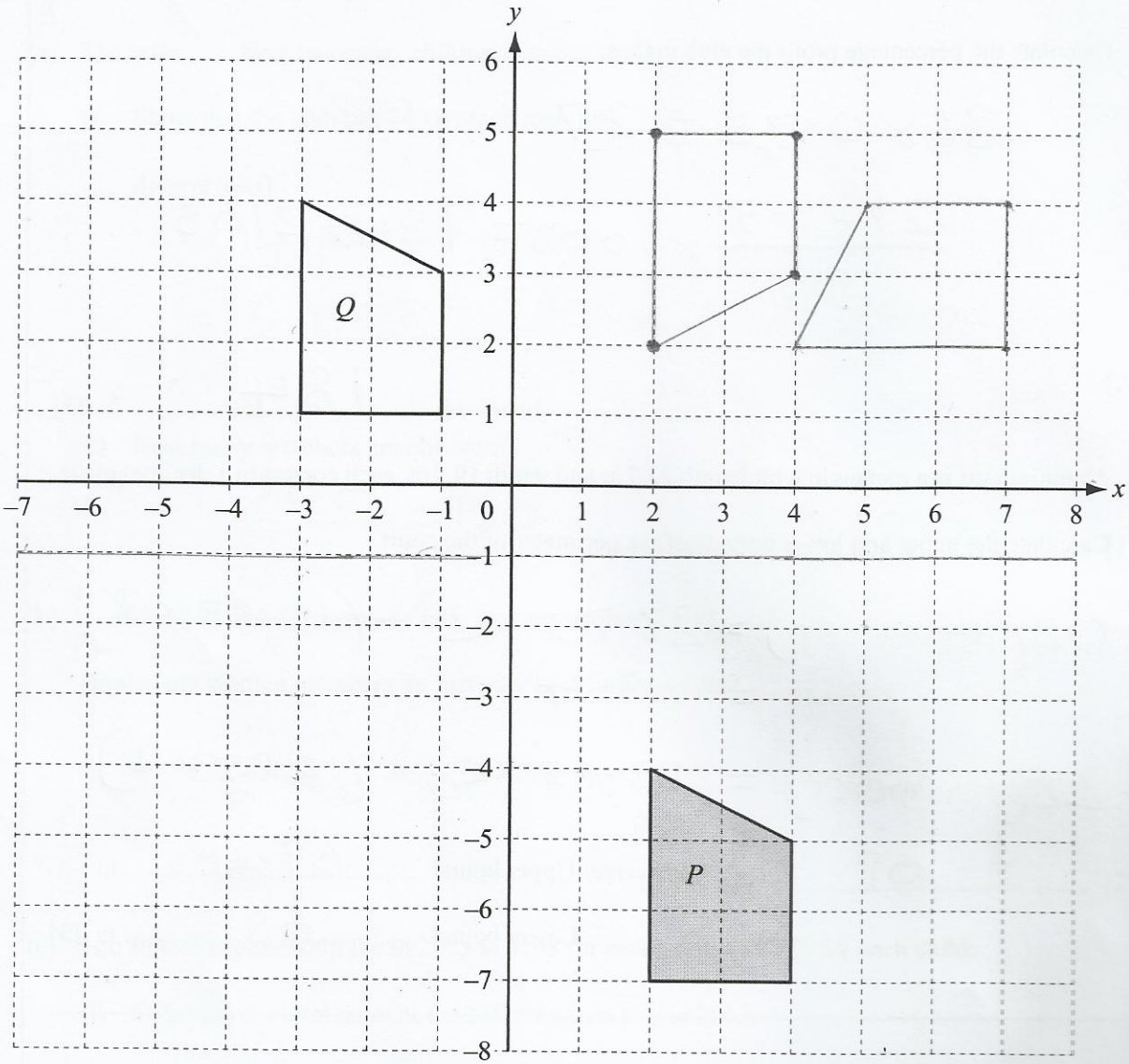
LB(perimeter) $= (23.65 \times 2) + (10.85 \times 2)$
$= 69$

Answer(e) Upper bound 69.4 m

Lower bound 69 m [3]

For Examiner's Use

2 (a)



(i) Describe fully the **single** transformation which maps shape P onto shape Q.

Answer(a)(i) Translation by vector $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$ [2]

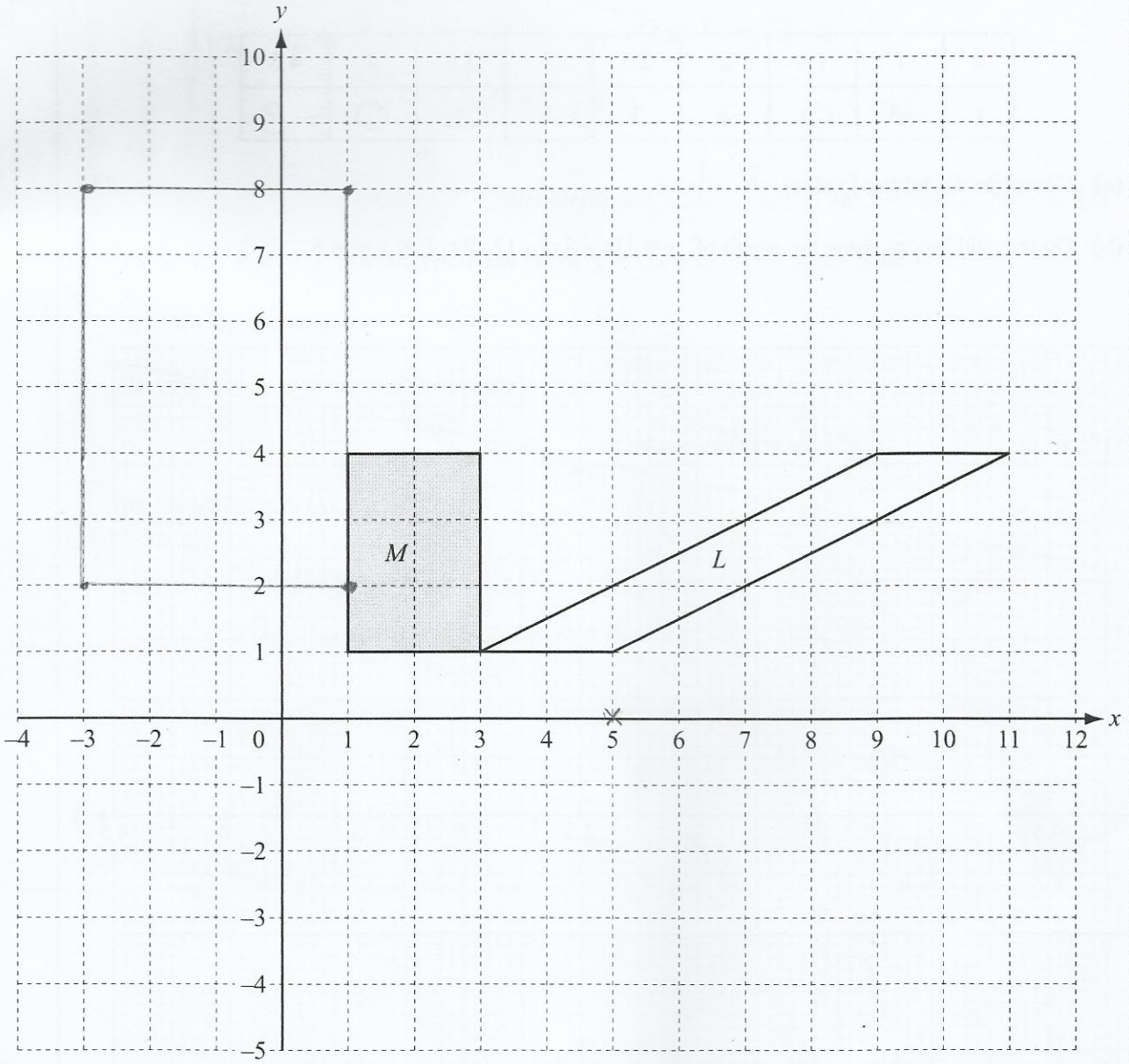
(ii) On the grid above, draw the image of shape P after reflection in the line $y = -1$. [2]

(iii) On the grid above, draw the image of shape P under the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. [3]

Rotation 90° anti-clockwise about (0,0)

For Examiner's Use

(b)



(i) Describe fully the **single** transformation which maps shape *M* onto shape *L*.

Answer(b)(i) Shear, x-axis invariant, Scale factor 2 [3]

(ii) On the grid above, draw the image of shape *M* after enlargement by scale factor 2, centre (5, 0). [2]

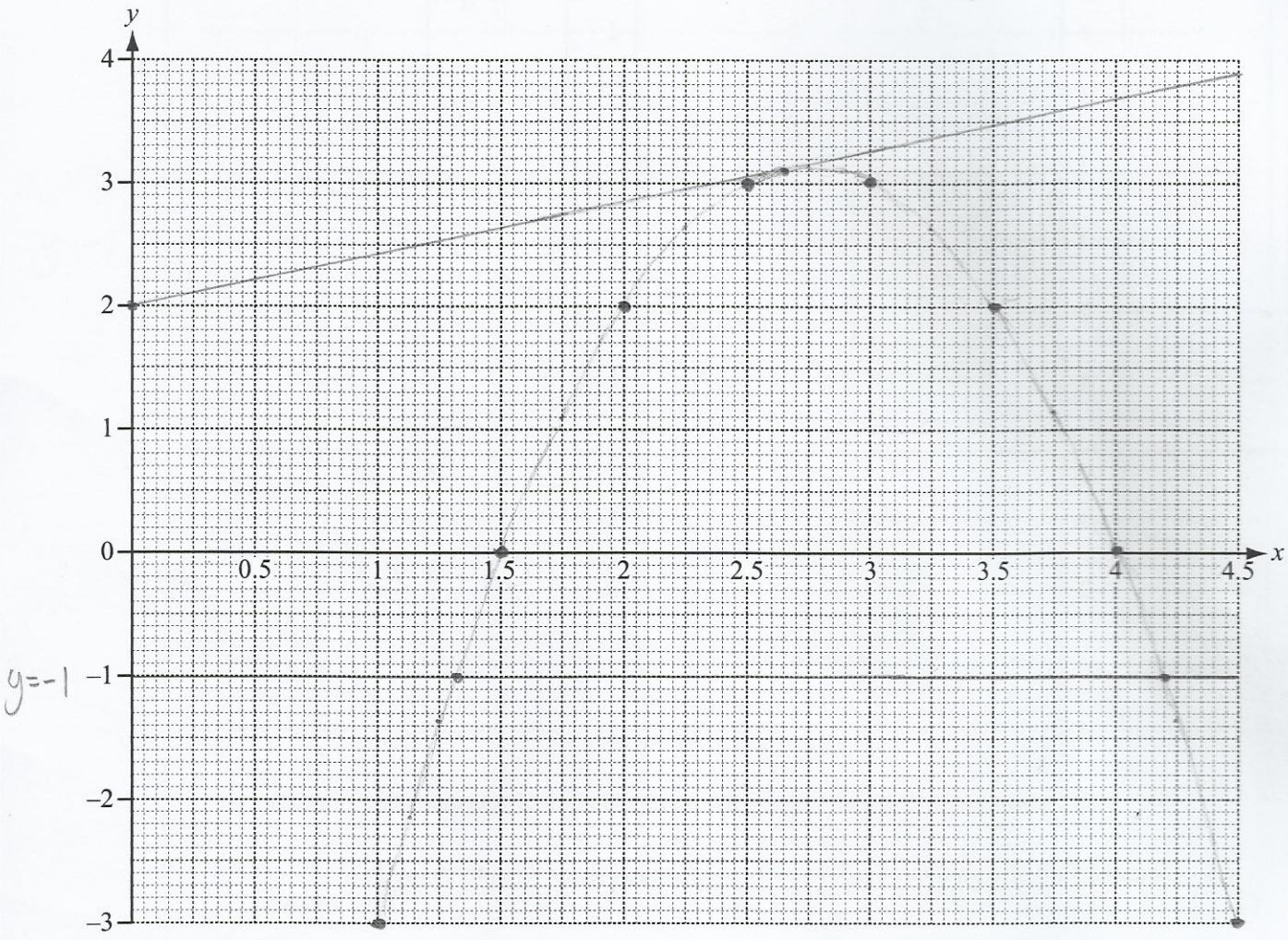
For Examiner's Use

3 The table shows some values for the function $y = 11x - 2x^2 - 12$ for $1 \leqslant x \leqslant 4.5$.

x	1	1.5	2	2.5	3	3.5	4	4.5
y	–3	0	2	3	3	2	0	–3

(a) Complete the table of values. [3]

(b) On the grid below, draw the graph of $y = 11x - 2x^2 - 12$ for $1 \leqslant x \leqslant 4.5$.



[4]

For Examiner's Use

(c) By drawing a suitable line, use your graph to solve the equation $11x - 2x^2 = 11$.

$11x - 2x^2 = 11 \Rightarrow 11x - 2x^2 - 12 = -1$

So draw $y = -1$

Answer(c) $x =$ 1·3 or $x =$ 4·2 [2]

(d) The line $y = mx + 2$ is a tangent to the curve $y = 11x - 2x^2 - 12$ at the point P.

By drawing this tangent,

(i) find the co-ordinates of the point P,

Answer(d)(i) (2·65, 3·1) [2]

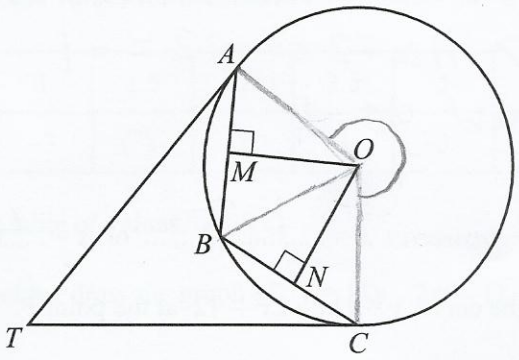
(ii) work out the value of m.

$3.1 = m \times 2.65 + 2$

$m = 0.41509...$

Answer(d)(ii) $m =$ 0·415 [2]

For Examiner's Use



NOT TO SCALE

A, B and C lie on the circle centre O, radius 8.5 cm.
$AB = BC = 10.7$ cm.
OM is perpendicular to AB and ON is perpendicular to BC.

(a) Calculate the area of the circle.

$\pi(8.5)^2 = 226.9800\ldots$

Answer(a) 227 cm^2 [2]

(b) Write down the length of MB.

$\frac{10.7}{2} = 5.35$

Answer(b) 5.35 cm [1]

(c) Calculate angle MOB and show that it rounds to 39° correct to the nearest degree.

Answer(c) $\sin(M\hat{O}B) = \frac{5.35}{8.5}$ $(OB = 8.5)$

$M\hat{O}B = \sin^{-1}\left(\frac{5.35}{8.5}\right) = 39.006736\ldots$
$= 39$ (nearest degree) [2]

(d) Using angle $MOB = 39°$, calculate the length of the **major** arc AC.

$A\hat{O}C = 39 \times 4 = 156°$
$\Rightarrow$ Reflex $A\hat{O}C = 360 - 156 = 204°$

Arc $AC = \frac{204}{360} \times 2 \times \pi \times 8.5 = 30.26400\ldots$

Answer(d) 30.3 cm [3]

(e) The tangents to the circle at A and at C meet at T.

Explain clearly why triangle ATB is congruent to triangle CTB.

Answer(e) "Tangents from an external point are equal in length"
$\Rightarrow AT = CT$

$AB = BC = 10.7$, TB is common to $\triangle ATB$ and $\triangle CTB$
So triangles ATB and CTB contain the same 3 sides.
$\Rightarrow \triangle ATB$ is congruent to $\triangle CTB$. [3]

For Examiner's Use

5 Paul buys a number of large sacks of fertiliser costing $\$x$ each.

He spends \$27.

(a) Write down, in terms of x, an expression for the number of large sacks which Paul buys.

Answer(a) $\frac{27}{x}$ [1]

(b) Rula buys a number of small sacks of fertiliser.
Each small sack costs \$2 less than a large sack.
Rula spends \$25.

Write down, in terms of x, an expression for the number of small sacks which Rula buys.

Answer(b) $\frac{25}{x-2}$ [1]

(c) Rula buys 4 more sacks than Paul.
Write down an equation in x and show that it simplifies to $2x^2 - 3x - 27 = 0$.

Answer(c)

$$\frac{25}{x-2} - \frac{27}{x} = 4$$

$$\Rightarrow \frac{25x - 27(x-2)}{x(x-2)} = 4$$

$$\Rightarrow -2x + 54 = 4x^2 - 8x$$

$$\Rightarrow 4x^2 - 6x - 54 = 0 \Rightarrow 2x^2 - 3x - 27 = 0$$ [4]

(d) Solve $2x^2 - 3x - 27 = 0$.

$$2x^2 - 3x - 27 = 0 \Rightarrow (2x - 9)(x + 3) = 0$$

$$\Rightarrow x = \frac{9}{2} \text{ or } -3$$

Answer(d) $x =$ 4.5 or $x =$ −3 [3]

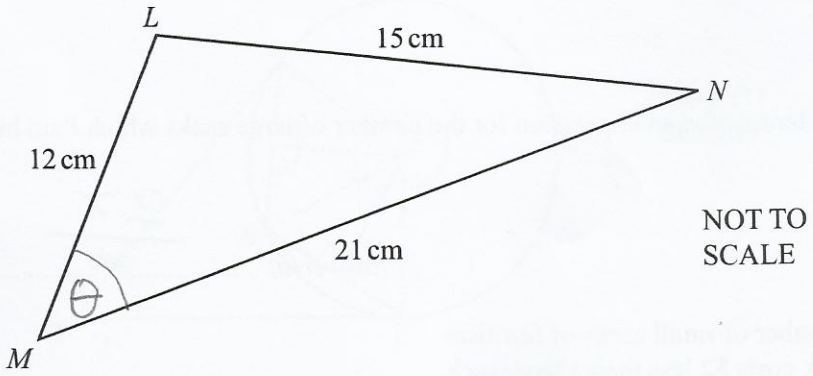
(e) Calculate the number of sacks which Paul buys.

$$\frac{27}{4.5} = 6$$

Answer(e) 6 [1]

For Examiner's Use

6 (a)



NOT TO SCALE

The diagram shows triangle LMN with $LM = 12$ cm, $LN = 15$ cm and $MN = 21$ cm.

(i) Calculate angle LMN.
Show that this rounds to 44.4°, correct to 1 decimal place.

Answer(a)(i)

$$\cos\theta = \frac{12^2+21^2-15^2}{2(12)(21)}$$

$$\theta = \cos^{-1}\left(\frac{12^2+21^2-15^2}{2(12)(21)}\right)$$

$$= 44.4153\ldots$$

$$= 44.4 \text{ (1dp)}$$

[4]

(ii) Calculate the area of triangle LMN.

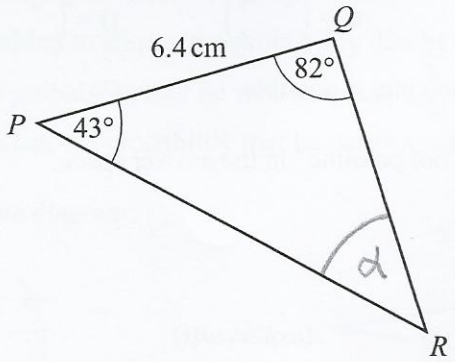
$$\text{Area}_{\triangle LMN} = \frac{1}{2}(12)(21)\sin(44.4153\ldots)$$

$$= 88.1816\ldots$$

Answer(a)(ii) 88.2 cm^2 [2]

For Examiner's Use

(b)



NOT TO SCALE

The diagram shows triangle PQR with $PQ = 6.4$ cm, angle $PQR = 82°$ and angle $QPR = 43°$.

Calculate the length of PR.

$x = 180 - 43 - 82 = 55°$

$$\frac{6.4}{\sin 55} = \frac{PR}{\sin 82}$$

$$\Rightarrow PR = \frac{6.4 \sin 82}{\sin 55} = 7.7369\ldots$$

Answer(b) PR = 7.74 cm [4]

For Examiner's Use

7 $\mathbf{A} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $\mathbf{B} = (6 \quad -4)$ $\mathbf{C} = \begin{pmatrix} 2 & 4 \\ 1 & 3 \end{pmatrix}$ $\mathbf{D} = \begin{pmatrix} 2 & 9 \\ -1 & -3 \end{pmatrix}$

(a) Calculate the result of each of the following, if possible.

If a calculation is not possible, write "not possible" in the answer space.

(i) 3A

Answer(a)(i) $\begin{pmatrix} 15 \\ 21 \end{pmatrix}$ [1]

(ii) AC

Answer(a)(ii) Not possible [1]

(iii) BA

$(6 \times 5) + (-4 \times 7) = 2$

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

(iv) C + D

Answer(a)(iv) $\begin{pmatrix} 4 & 13 \\ 0 & 0 \end{pmatrix}$ [1]

(v) $\mathbf{D}^2$

$\begin{pmatrix} 2 & 9 \\ -1 & -3 \end{pmatrix} \begin{pmatrix} 2 & 9 \\ -1 & -3 \end{pmatrix}$

Answer(a)(v) $\begin{pmatrix} -5 & -9 \\ 1 & 0 \end{pmatrix}$ [2]

(b) Calculate $\mathbf{C}^{-1}$, the inverse of **C**.

$\det(C) = (2 \times 3) - (4 \times 1) = 2$

$C^{-1} = \frac{1}{2} \begin{pmatrix} 3 & -4 \\ -1 & 2 \end{pmatrix}$

Answer(b) $\begin{pmatrix} \frac{3}{2} & -2 \\ \frac{-1}{2} & 1 \end{pmatrix}$ [2]

For Examiner's Use

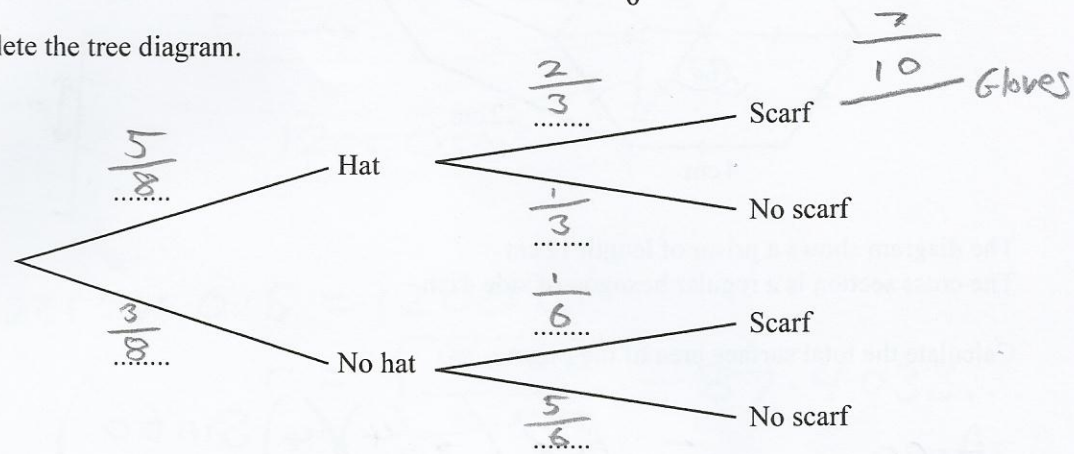
8 **In this question, give all your answers as fractions.**

When Ivan goes to school in winter, the probability that he wears a hat is $\frac{5}{8}$.

If he wears a hat, the probability that he wears a scarf is $\frac{2}{3}$.

If he does not wear a hat, the probability that he wears a scarf is $\frac{1}{6}$.

(a) Complete the tree diagram.



[3]

(b) Find the probability that Ivan

(i) does not wear a hat and does not wear a scarf,

$\frac{3}{8} \times \frac{5}{6} = \frac{15}{48}$

Answer(b)(i) $\frac{15}{48}$ [2]

(ii) wears a hat but does not wear a scarf,

$\frac{5}{8} \times \frac{1}{3} = \frac{5}{24}$

Answer(b)(ii) $\frac{5}{24}$ [2]

(iii) wears a hat or a scarf but not both.

$\left(\frac{5}{8} \times \frac{1}{3}\right) + \left(\frac{3}{8} \times \frac{1}{6}\right) = \frac{13}{48}$

Answer(b)(iii) $\frac{13}{48}$ [2]

(c) If Ivan wears a hat and a scarf, the probability that he wears gloves is $\frac{7}{10}$.

Calculate the probability that Ivan does **not** wear all three of hat, scarf and gloves.

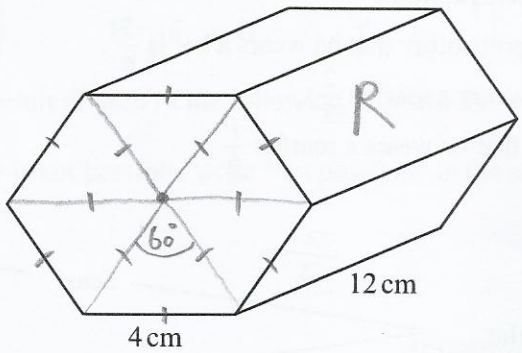
$P(\text{Hat, Scarf, gloves}) = \frac{5}{8} \times \frac{2}{3} \times \frac{7}{10} = \frac{70}{240}$

$P(\text{Not all three}) = 1 - \frac{70}{240} = \frac{170}{240}$

Answer(c) $\frac{170}{240}$ [3]

For Examiner's Use

9 (a)



NOT TO SCALE

The diagram shows a prism of length 12 cm.
The cross section is a regular hexagon of side 4 cm.

Calculate the total surface area of the prism.

$\text{Area}_{\text{hexagon}} = 6 \times \left(\frac{1}{2}(4)(4)\sin 60\right)$
$= 41.5692...$

$\text{Area}_R = 12 \times 4 = 48$

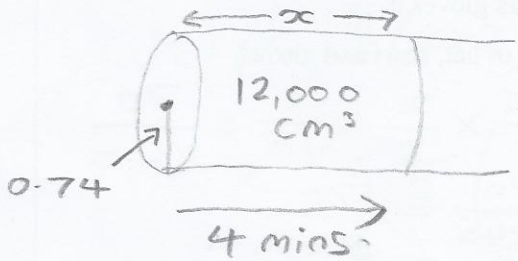
$\text{Surface Area} = 2 \times \text{Area}_{\text{Hexagon}} + 6 \times \text{Area}_R$
$= 371.1384...$

Answer(a) 371 cm^2 [4]

(b) Water flows through a cylindrical pipe of radius 0.74 cm.
It fills a 12 litre bucket in 4 minutes.

(i) Calculate the speed of the water through the pipe in centimetres per minute.

$12\ell = 12{,}000\ \text{cm}^3$



$\pi(0.74^2)x = 12{,}000$
$x = 6975.380...$

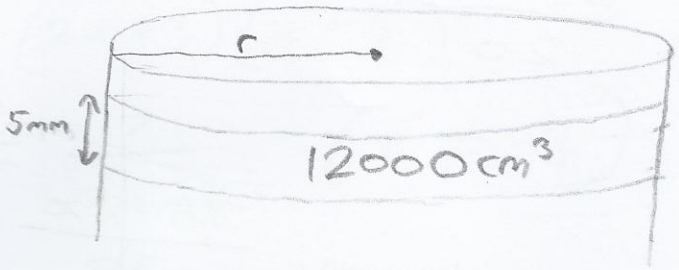
$\text{Speed} = \frac{x}{4} = 1743.845...$

Answer(b)(i) 1740 cm/min [4]

For Examiner's Use

(ii) When the 12 litre bucket is emptied into a circular pool, the water level rises by 5 **millimetres**.

Calculate the radius of the pool correct to the nearest centimetre.



$\pi r^2 \times 0.5 = 12000$

$r = \sqrt{\frac{12000}{0.5\pi}} = 87.4038...$

Answer(b)(ii) ..... 87 ..... cm [5]

For Examiner's Use

10 (a) Write as a single fraction

(i) $\frac{5}{4} - \frac{2x}{5}$,

$= \frac{25}{20} - \frac{8x}{20} = \frac{25-8x}{20}$

Answer(a)(i) $\frac{25-8x}{20}$ [2]

(ii) $\frac{4}{x+3} + \frac{2x-1}{3}$.

$= \frac{4\times 3 + (x+3)(2x-1)}{3(x+3)} = \frac{2x^2+5x+9}{3(x+3)}$

Answer(a)(ii) $\frac{2x^2+5x+9}{3(x+3)}$ [3]

(b) Solve the simultaneous equations.

$9x - 2y = 12$ (1)
$3x + 4y = -10$ (2)

① × 2 : $18x - 4y = 24$
\+ ② : $3x + 4y = -10$

$21x = 14$
$x = \frac{14}{21}$

① : $9\left(\frac{14}{21}\right) - 2y = 12$
$y = -3$

Answer(b) $x = \frac{2}{3}$

$y = -3$ [3]

For Examiner's Use

(c) Simplify $\dfrac{7x+21}{2x^2+9x+9}$.

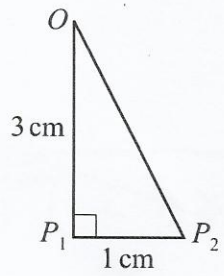
$$= \frac{7(x+3)}{(2x+3)(x+3)}$$

$$= \frac{7}{2x+3} \quad (x \neq -3)$$

Answer(c) $\dfrac{7}{2x+3}$ [4]

For Examiner's Use

11 Sidney draws the triangle OP_1P_2.
$OP_1 = 3$ cm and $P_1P_2 = 1$ cm.
Angle $OP_1P_2 = 90°$.



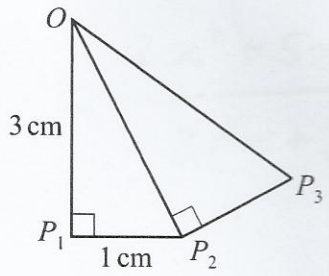
NOT TO SCALE

(a) Show that $OP_2 = \sqrt{10}$ cm.

Answer(a) $OP_2 = \sqrt{1^2+3^2} = \sqrt{10}$

[1]

(b) Sidney now draws the lines P_2P_3 and OP_3.
Triangle OP_2P_3 is mathematically similar to triangle OP_1P_2.



NOT TO SCALE

(i) Write down the length of P_2P_3 in the form $\frac{\sqrt{a}}{b}$ where a and b are integers.

Scale factor $= \frac{\sqrt{10}}{3}$

$P_2P_3 = 1 \times \frac{\sqrt{10}}{3}$

Answer(b)(i) $P_2P_3 =$ $\frac{\sqrt{10}}{3}$ cm [1]

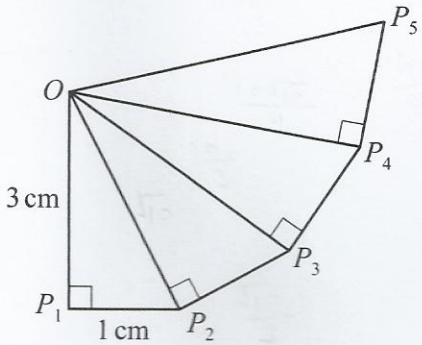
(ii) Calculate the length of OP_3 giving your answer in the form $\frac{c}{d}$ where c and d are integers.

$OP_3 = \sqrt{10} \times \frac{\sqrt{10}}{3} = \frac{10}{3}$

Answer(b)(ii) $OP_3 =$ $\frac{10}{3}$ cm [2]

(c) Sidney continues to add mathematically similar triangles to his drawing.

Find the length of OP_5.



NOT TO SCALE

$\sqrt{10} \times \left(\frac{\sqrt{10}}{3}\right)^3$

$= \frac{\sqrt{10} \times 10\sqrt{10}}{27} = \frac{100}{27}$

Answer(c) $OP_5 =$ 3.70 cm [2]

For Examiner's Use

(d) (i) Show that angle $P_1OP_2 = 18.4°$, correct to 1 decimal place.

Answer(d)(i) $\tan P_1\hat{O}P_2 = \frac{1}{3}$

$P_1\hat{O}P_2 = \tan^{-1}\left(\frac{1}{3}\right)$

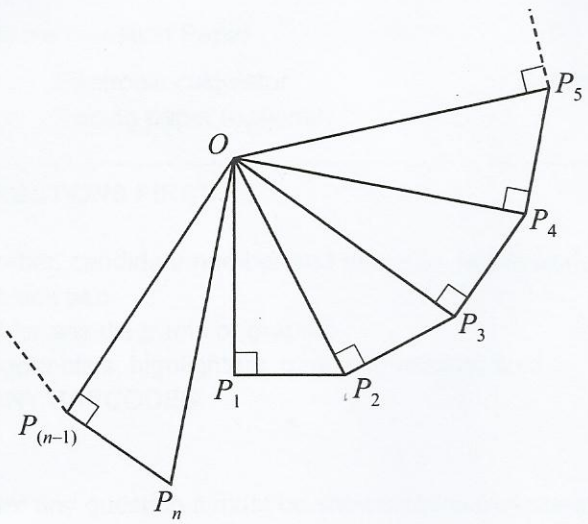
$= 18.4349...°$

$= 18.4°$ (1dp) [2]

(ii) Write down the size of angle P_2OP_3.

Answer(d)(ii) Angle P_2OP_3 = 18.4° [1]

(iii) The last triangle Sidney can draw without covering his first triangle is triangle $OP_{(n-1)}P_n$.



NOT TO SCALE

Calculate the value of n.

$\frac{360}{18.4} = 19.5652...$

So we can fit 19 triangles without covering.

$\Rightarrow P_{n-1} = P_{19}$

$\Rightarrow n = 20$

Answer(d)(iii) n = 20 [3]

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