UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

8313990391

MATHEMATICS (US) **0444/43**

Paper 4 (Extended) **October/November 2013**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center 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 work is needed for any question it must be shown in the space provided.
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 digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 130.

Write your calculator model in the box below.

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

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UNIVERSITY of CAMBRIDGE International Examinations

Formula List

For the equation $ax^2 + bx + c = 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\quad A = 2\pi rh$

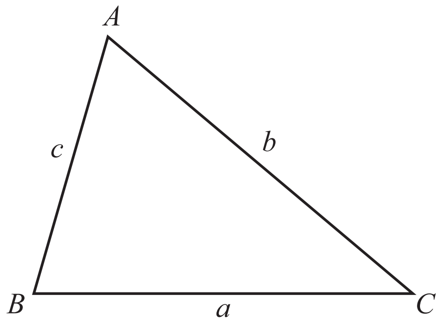
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

Surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$



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

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

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

1 **(a)** **(i)** In a camera magazine, 63 pages are used for ads.
The ratio number of pages of ads : number of pages of reviews = 7 : 5 .

Calculate the number of pages used for reviews.

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

(ii) In another copy of the magazine, 56 pages are used for reviews and for photographs.
The ratio number of pages of reviews : number of pages of photographs = 9 : 5 .

Calculate the number of pages used for photographs.

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

(iii) One copy of the magazine costs \$4.90 .
An annual subscription costs \$48.80 for 13 copies.

Calculate the percent of discount by having an annual subscription.

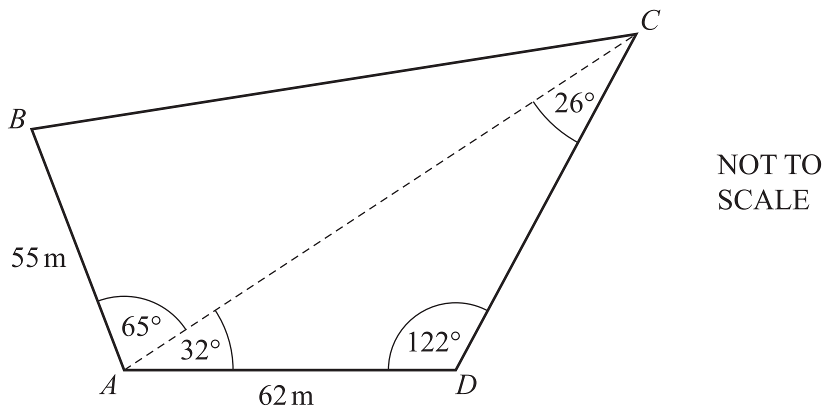
Answer(a)(iii) .... % [3]

(b) In a car magazine, 25% of the pages are used for selling second-hand cars,
$62\frac{1}{2}$% of the **remaining** pages are used for features,
and the other 36 pages are used for reviews.

Work out the total number of pages in the magazine.

Answer(b) .... [4]

2 A field, *ABCD*, is in the shape of a quadrilateral.
A footpath crosses the field from *A* to *C*.



(a) Use the sine rule to calculate the distance *AC* and show that it rounds to 119.9 m, correct to 1 decimal place.

Answer(a)

[3]

(b) Calculate the length of *BC*.

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

For Examiner's Use

(c) Calculate the area of triangle *ACD*.

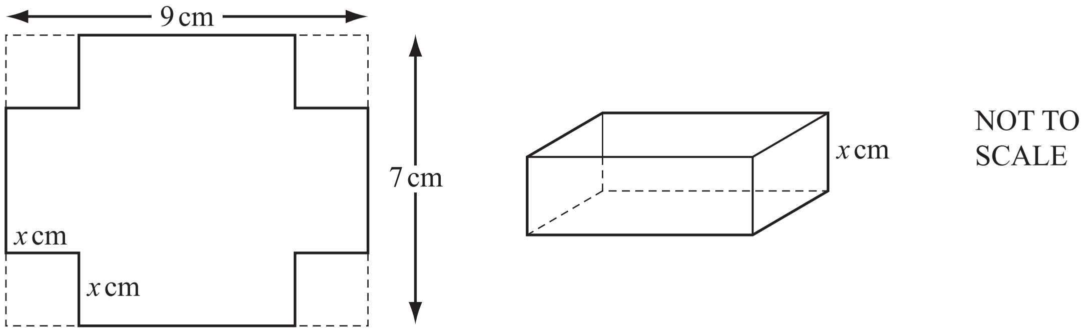
Answer(c) .... m^2 [2]

(d) The field is for sale at $4.50 per square meter.

Calculate the cost of the field.

Answer(d) $ .... [3]

3 A rectangular metal sheet measures 9 cm by 7 cm.
A square, of side x cm, is cut from each corner.
The metal is then folded to make an open box of height x cm.



(a) Write down, in terms of x, the length and width of the box.

Answer(a) Length = ...

Width = ... [2]

(b) Show that the volume, V, of the box is $4x^3 - 32x^2 + 63x$.

Answer(b)

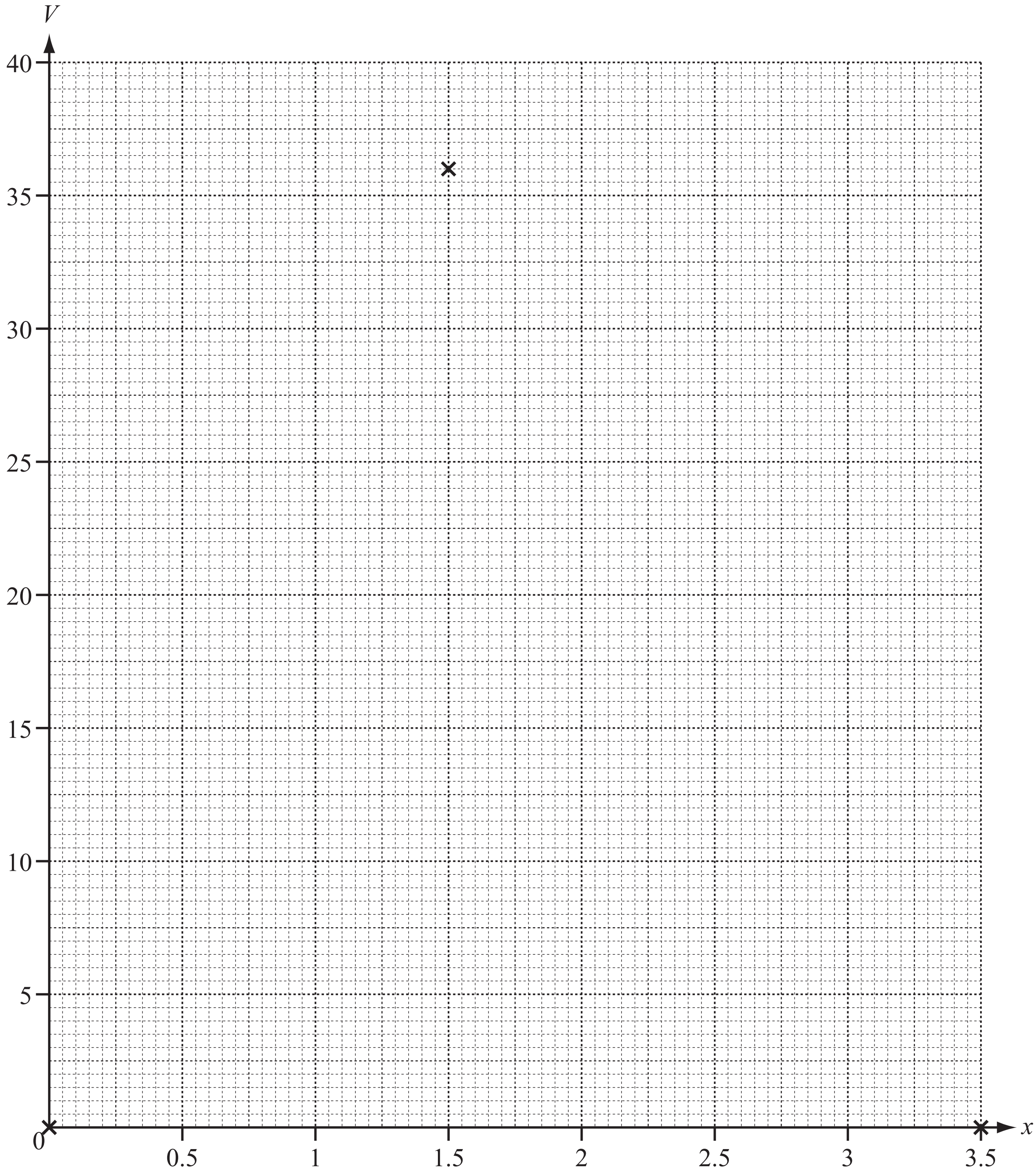
[2]

(c) Complete this table of values for $V = 4x^3 - 32x^2 + 63x$.

x	0	0.5	1	1.5	2	2.5	3	3.5
V	0		35	36	30		9	0

[2]

(d) On the grid opposite, draw the graph of $V = 4x^3 - 32x^2 + 63x$ for $0 \leqslant x \leqslant 3.5$.
Three of the points have been plotted for you.



[3]

(e) The volume of the box is at least 30 cm^3.
Write down, as an inequality, the possible values of x.

Answer(e) .... [2]

(f) **(i)** Write down the maximum volume of the box.

Answer(f)(i) .... cm^3 [1]

(ii) Write down the value of x which gives the maximum volume.

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

4 **(a)** One angle of an isosceles triangle is 48°.

Write down the possible pairs of values for the remaining two angles.

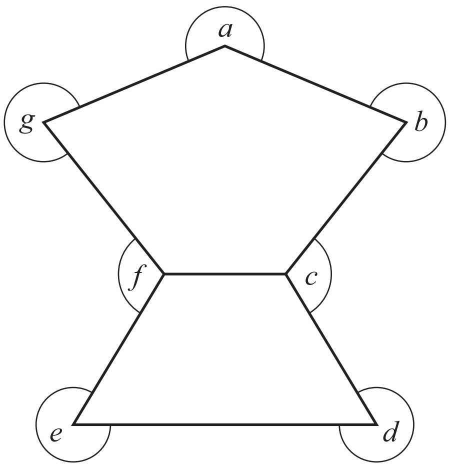
Answer(a) .... and ....

.... and .... [2]

(b) Calculate the sum of the interior angles of a pentagon.

Answer(b) .... [2]

(c) Calculate the sum of the angles a, b, c, d, e, f and g shown in this diagram.

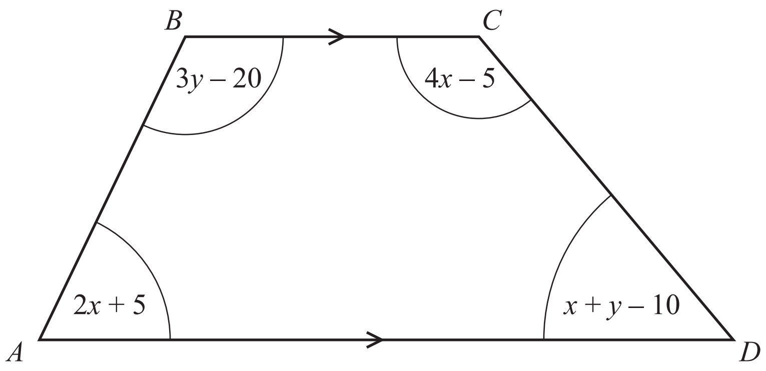


NOT TO SCALE

Answer(c) .... [2]

For Examiner's Use

(d) The trapezoid, $ABCD$, has four angles as shown.
All the angles are in degrees.



NOT TO SCALE

(i) Show that $7x + 4y = 390$.

Answer(d)(i)

[1]

(ii) Show that $2x + 3y = 195$.

Answer(d)(ii)

[1]

(iii) Solve this system of linear equations.

Answer(d)(iii) x = ...

y = ... [4]

(iv) Use your answer to **part (d)(iii)** to find the sizes of all four angles of the trapezoid.

Answer(d)(iv) .... , ... , ... , ... [1]

For Examiner's Use

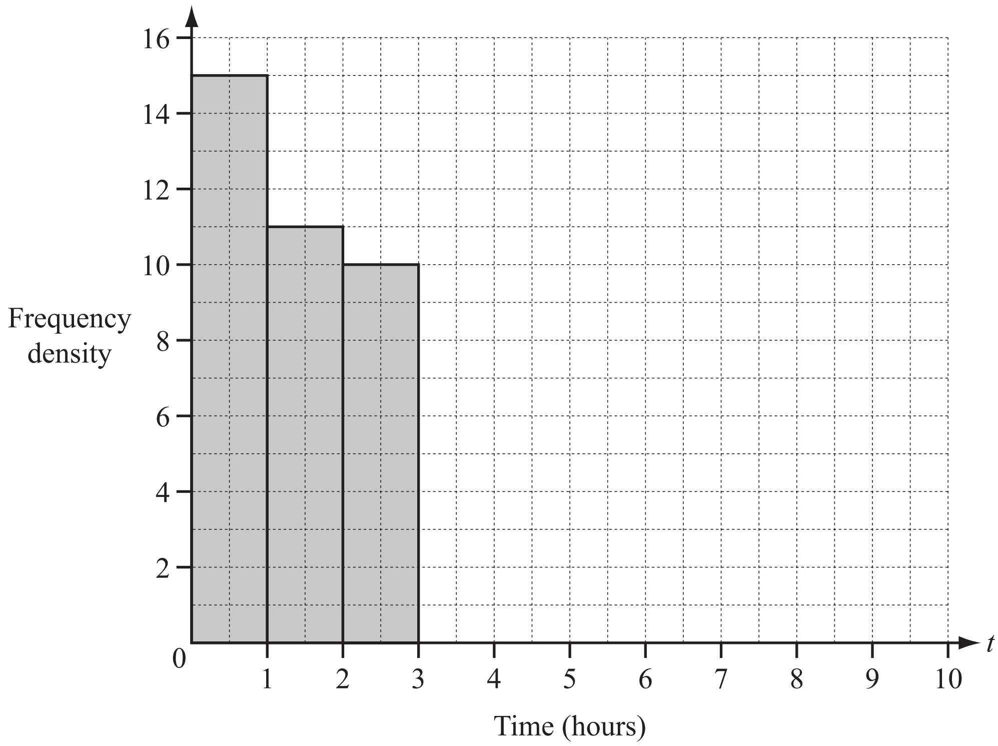
5 **(a)** 80 students were asked how much time they spent on the internet in one day.
This table shows the results.

Time (t hours)	$0 < t \leqslant 1$	$1 < t \leqslant 2$	$2 < t \leqslant 3$	$3 < t \leqslant 5$	$5 < t \leqslant 7$	$7 < t \leqslant 10$
Number of students	15	11	10	19	13	12

(i) Calculate an estimate of the mean time spent on the internet by the 80 students.

Answer(a)(i) .... hours [4]

(ii) On the grid, complete the histogram to show this information.

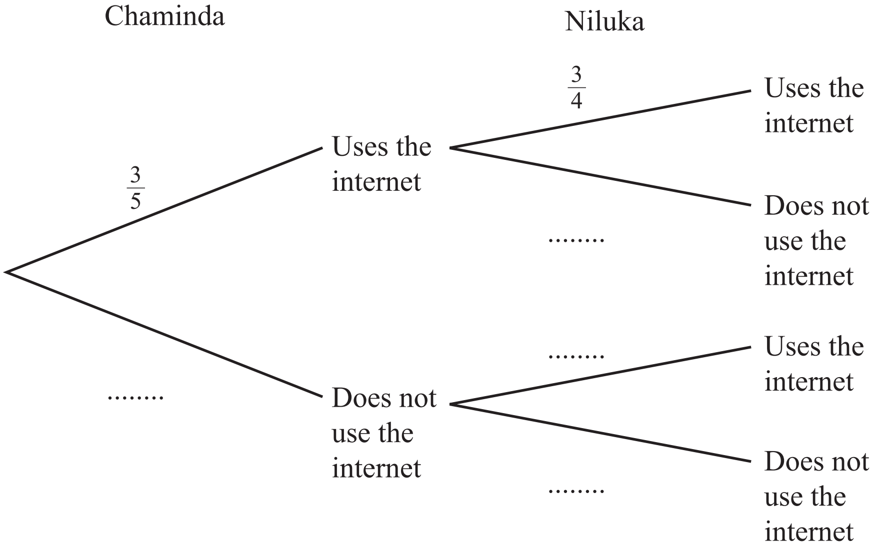


[4]

(b) The probability that Chaminda uses the internet on any day is $\frac{3}{5}$.

The probability that Niluka uses the internet on any day is $\frac{3}{4}$.

(i) Complete the tree diagram.



[2]

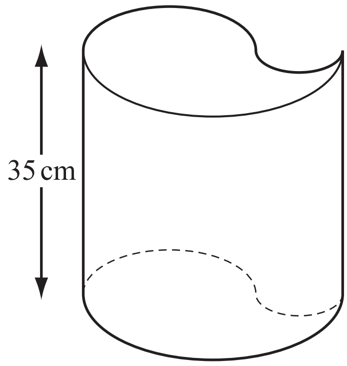
(ii) Calculate the probability, that on any day, at least one of the two students uses the internet.

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

(iii) Calculate the probability that Chaminda uses the internet on three consecutive days.

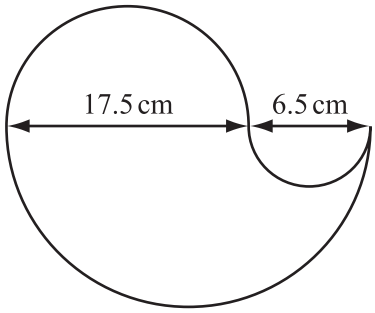
Answer(b)(iii) .... [2]

6 Sandra has designed this open container.
The height of the container is 35 cm.



NOT TO SCALE

The cross section of the container is designed from three semi-circles with diameters 17.5 cm, 6.5 cm and 24 cm.



NOT TO SCALE

(a) Calculate the area of the cross section of the container.

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

(b) Calculate the external surface area of the container, including the base.

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

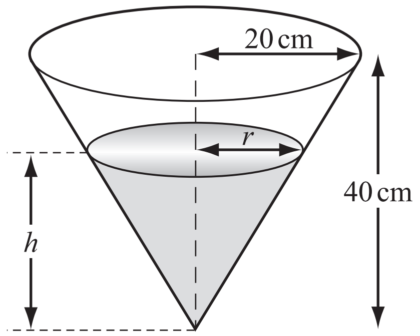
For Examiner's Use

(c) The container has a height of 35 cm.

Calculate the capacity of the container.
Give your answer in liters.

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

(d) Sandra's container is completely filled with water.
All the water is then poured into another container in the shape of a cone.
The cone has radius 20 cm and height 40 cm.



NOT TO SCALE

(i) The diagram shows the water in the cone.

Show that $r = \frac{h}{2}$.

Answer(d)(i)

[1]

(ii) Find the height, *h*, of the water in the cone.

Answer(d)(ii) h = ... cm [3]

For Examiner's Use

7 **(a)** The co-ordinates of P are (–4, –4) and the co-ordinates of Q are (8, 14).

(i) Find the slope of the line PQ.

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

(ii) Find the equation of the line PQ.

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

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

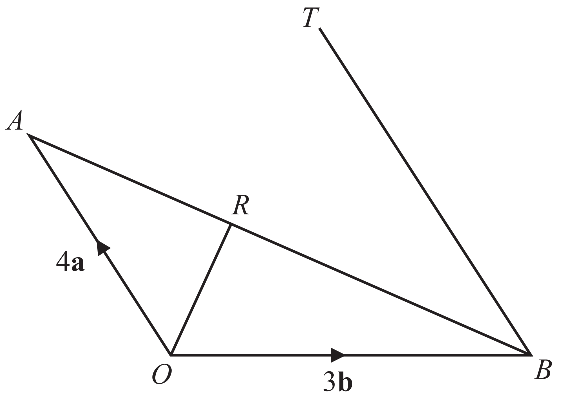
Answer(a)(iii) $\overrightarrow{PQ} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(iv) Find the magnitude of $\overrightarrow{PQ}$.

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

For Examiner's Use

(b)



In the diagram, $\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.

R lies on AB such that $\overrightarrow{OR} = \frac{1}{5}(12\mathbf{a} + 6\mathbf{b})$.

T is the point such that $\overrightarrow{BT} = \frac{3}{2}\overrightarrow{OA}$.

(i) Find the following in terms of **a** and **b**, giving each answer in its simplest form.

(a) $\overrightarrow{AB}$

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

(b) $\overrightarrow{AR}$

Answer(b)(i)(b) $\overrightarrow{AR}$ = ... [2]

(c) $\overrightarrow{OT}$

Answer(b)(i)(c) $\overrightarrow{OT}$ = ... [1]

(ii) Complete the following statement.

The points O, R and T are in a straight line because ....

.... [1]

(iii) Triangle OAR and triangle TBR are similar.

Find the value of $\dfrac{\text{area of triangle } TBR}{\text{area of triangle } OAR}$.

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

For Examiner's Use

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

(i) Calculate the value of s when $u = 14$, $t = 10$ and $a = 1.5$.

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

(ii) Calculate the positive value of t when $s = 20$, $u = 5$ and $a = 2$.
Show all your working out and give your answer correct to 2 decimal places.

Answer(a)(ii) $t =$ .... [3]

(iii) Solve the formula for a.

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

(b) Each month the cost, in dollars, of running a car is

$C(m) = 100 + \frac{m}{2} + \frac{200}{m}$, $m \geqslant 10$, where m is the number of miles traveled.

(i) Find the values of

(a) C(20),

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

(b) C(200),

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

(c) C(2000).

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

(ii) Write down an approximate function, C(m) in terms of m, when $m > 200$.

Answer(b)(ii) C(m) = ... [1]

9 **(a)** Simplify.

$$\frac{x^2 - 3x}{x^2 - 9}$$

Answer(a) .... [3]

(b) Solve.

$$\frac{15}{x} - \frac{20}{x+1} = 2$$

Answer(b) x = ... or x = ... [7]

10 The first four diagrams in a sequence are shown below.

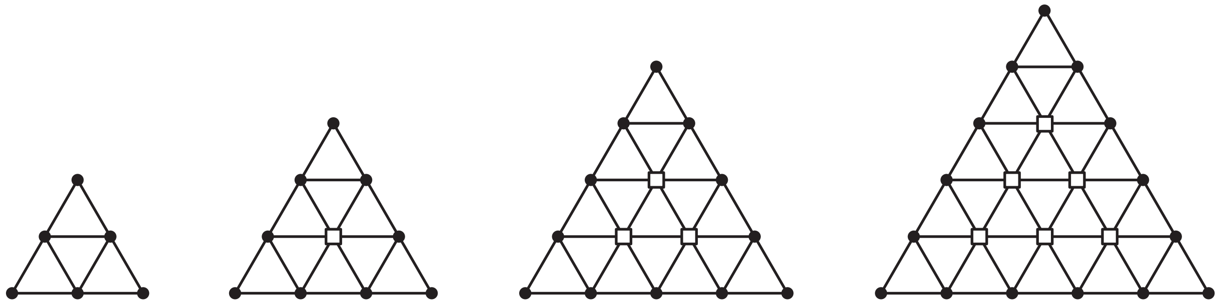


Diagram 1 Diagram 2 Diagram 3 Diagram 4

The diagrams are made from dots (●) and squares (□) joined by lines.

(a) Complete the table.

Diagram	1	2	3	4	5		n
Number of dots	6	9	12				
Number of squares	0	1	3				$\frac{1}{2}n(n-1)$
Number of triangles	4	9	16				
Number of lines	9	18	30	45	63		$\frac{3}{2}(n+1)(n+2)$

[9]

(b) Which diagram has 360 lines?

Answer(b) .... [2]

For Examiner's Use

(c) The **total** number of lines in the first n diagrams is

$$\frac{1}{2}n^3 + pn^2 + qn.$$

(i) When $n = 1$, show that $p + q = 8\frac{1}{2}$.

Answer(c)(i)

[1]

(ii) By choosing another value of n and using the equation in **part (c)(i)**, find the values of p and q.

Answer(c)(ii) p = ...

q = ... [5]

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