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0444/43

October/November 2016

2 hours 30 minutes

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

For π , use either your calculator value or 3.142.

The total of the points for this paper is 130.

Write your calculator model in the box below.

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

Formula List

For the equation

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

$$A = 2\pi rh$$

Lateral surface area, A , of cone of radius r , sloping edge l .

$$A = \pi rl$$

Surface area, A , of sphere of radius r .

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

Volume, V , of pyramid, base area A , height h .

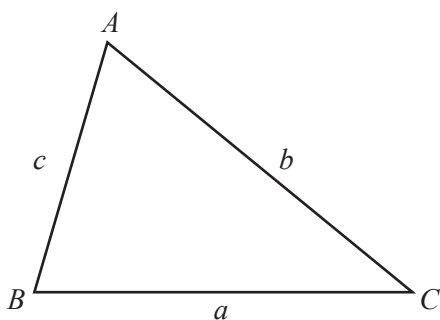
$$V = \frac{1}{3}Ah$$

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

$$V = \frac{1}{3}\pi r^2 h$$

Volume, V , of sphere of radius r .

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

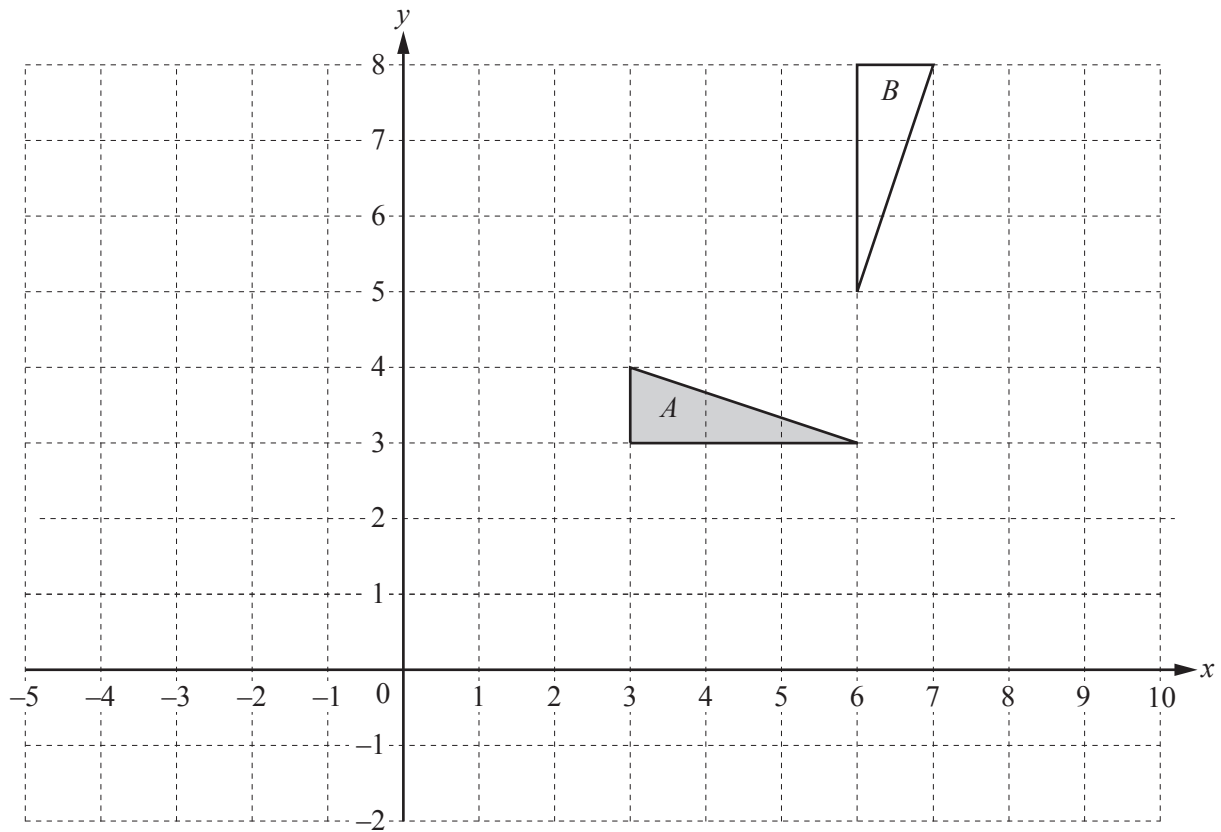


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1



- (a) Draw the image when triangle A is reflected in the line $x = 1$. [2]
- (b) Draw the image when triangle A is translated by the vector $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$. [2]
- (c) Draw the image when triangle A is enlarged by scale factor 2 with center $(4, 5)$. [2]
- (d) Describe fully the **single** transformation that maps triangle A onto triangle B .

..... [3]

.....

- 2 (a) A jigsaw puzzle has edge pieces and inside pieces.
The ratio edge pieces : inside pieces = 3 : 22.

(i) There are 924 inside pieces.

Calculate the total number of pieces in the puzzle.

..... [2]

(ii) Find the percentage of the total number of pieces that are edge pieces.

.....% [1]

- (iii) Anjum and Betty spent a total of 9 hours completing the puzzle.
The ratio Anjum's time : Betty's time = 7 : 5.

Work out how much time Anjum spent on the puzzle.

..... hours [2]

- (b) The price of the puzzle was \$15.99 in a sale.
This was 35% less than the original price.

Calculate the original price of the puzzle.

\$..... [3]

- (c) Betty takes a photograph of the completed puzzle.
The photograph and the completed puzzle are mathematically similar.

The area of the photograph is 875 cm^2 and the area of the puzzle is 2835 cm^2 .
The length of the photograph is 35 cm.

Work out the length of the puzzle.

..... cm [3]

- (d) (i) The area of another puzzle is 6610 cm^2 .

Change 6610 cm^2 into m^2 .

..... m^2 [1]

- (ii) The cost price of this puzzle is \$12.50 .
The selling price is \$18.50 .

Calculate the percentage profit.

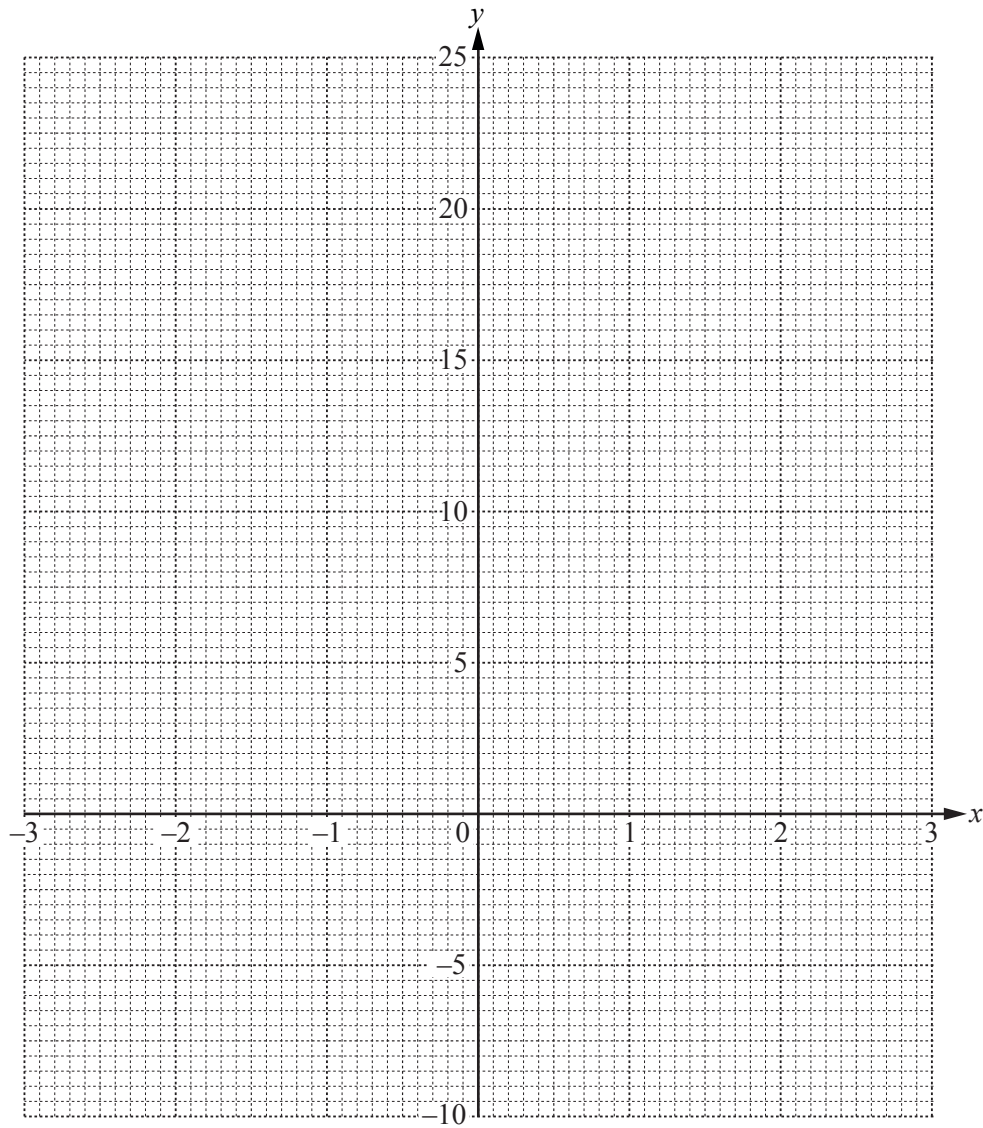
.....% [3]

- 3 (a) Complete the table for $y = 3x + \frac{2}{x^2} + 1$, $x \neq 0$.

x	-3	-2	-1	-0.5	-0.3		0.3	0.5	1	2	3
y	-7.8		0	7.5	22.3		24.1		6	7.5	10.2

[2]

- (b) On the grid, draw the graph of $y = 3x + \frac{2}{x^2} + 1$ for $-3 \leq x \leq -0.3$ and $0.3 \leq x \leq 3$.



[5]

- (c) Write down the value of the largest integer, k , so that the equation $3x + \frac{2}{x^2} + 1 = k$ has exactly one solution.

$k = \dots\dots\dots$ [1]

- (d) (i) By drawing a suitable straight line on the grid, solve $3x + \frac{2}{x^2} + 1 = 15 - 3x$.

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

- (ii) The equation $3x + \frac{2}{x^2} + 1 = 15 - 3x$ can be written in the form $ax^3 + bx^2 + cx + 2 = 0$, where a , b and c are integers.

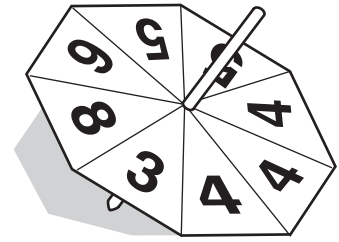
Find a , b and c .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [3]

- 4 Sandra has a fair eight-sided spinner.
The numbers on the spinner are 3, 4, 4, 4, 5, 5, 6 and 8.
Sandra spins the spinner twice and records each number it lands on.



Find the probability that

- (a) both numbers are 8,

..... [2]

- (b) the two numbers are not both 8,

..... [1]

- (c) one number is odd and one number is even,

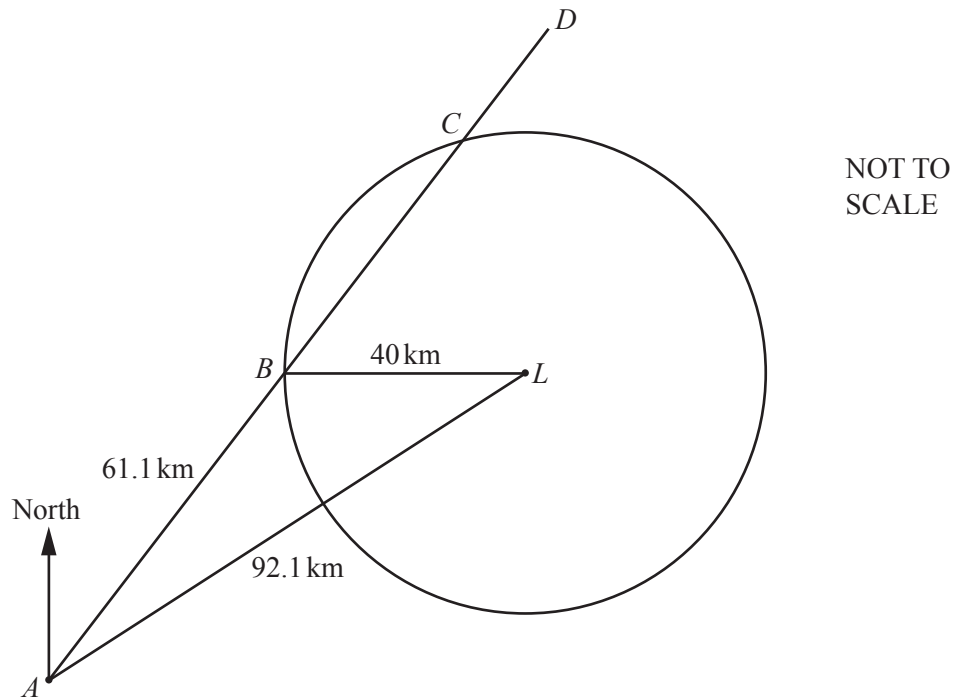
..... [2]

(d) the total of the two numbers is at least 13,

..... [3]

(e) the second number is bigger than the first number.

..... [3]



The diagram shows the position of a port, A , and a lighthouse, L .
 The circle, center L and radius 40 km, shows the region where the light from the lighthouse can be seen.
 The straight line, $ABCD$, represents the course taken by a ship after leaving the port.
 When the ship reaches position B it is due west of the lighthouse.

$AL = 92.1$ km, $AB = 61.1$ km and $BL = 40$ km.

(a) Use the cosine rule to show that angle $ABL = 130.1^\circ$, correct to 1 decimal place.

[4]

- (b) Calculate the bearing of the lighthouse, L , from the port, A .

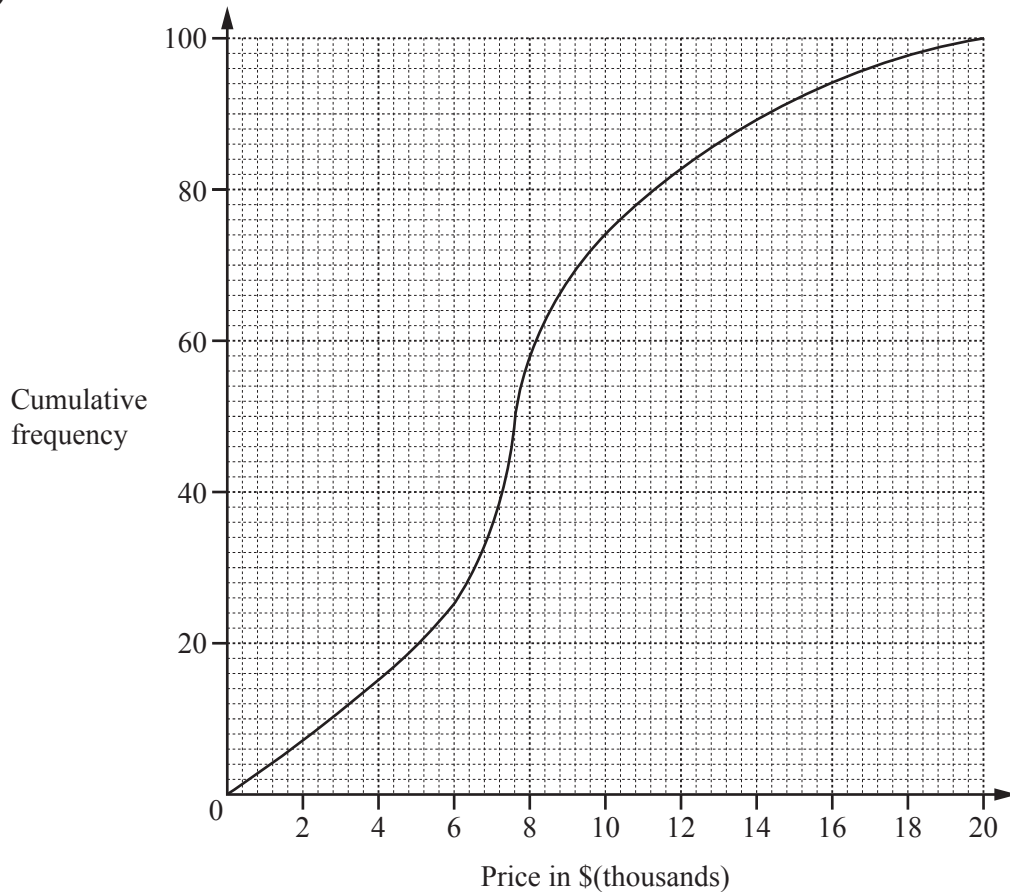
..... [4]

- (c) The ship sails at a speed of 28 km/h.

Calculate the length of time for which the light from the lighthouse can be seen from the ship.
Give your answer correct to the nearest minute.

..... h min [5]

6 (a) (i)



The cumulative frequency diagram shows information about the prices of 100 cars on Website A. Use the information to complete this table.

Lower quartile	Median	Upper quartile	Inter-quartile range
\$	\$7600	\$	\$

[2]

(ii) This table shows information about the prices of cars on Website B.

Lower quartile	Median	Upper quartile	Inter-quartile range
\$7600	\$10 800	\$13 600	\$6000

Here are two statements comparing the distributions of the prices of cars on Website A and Website B.

For each statement write True or False.

Give a reason for each answer, stating clearly which statistic you use to make your decision.

(a) The prices of cars on Website A are lower than the prices of cars on Website B.

..... because

..... [1]

- (b) A greater percentage of cars have a price more than \$13 600 on Website A compared to Website B.

..... because

..... [1]

- (b) The table shows the prices of cars on Website B.

Price (\$ P)	Number of cars
$0 < P \leq 6\,000$	9
$6\,000 < P \leq 8\,000$	29
$8\,000 < P \leq 10\,000$	20
$10\,000 < P \leq 12\,000$	14
$12\,000 < P \leq 14\,000$	21
$14\,000 < P \leq 22\,000$	27

Calculate an estimate of the mean price of the 120 cars.

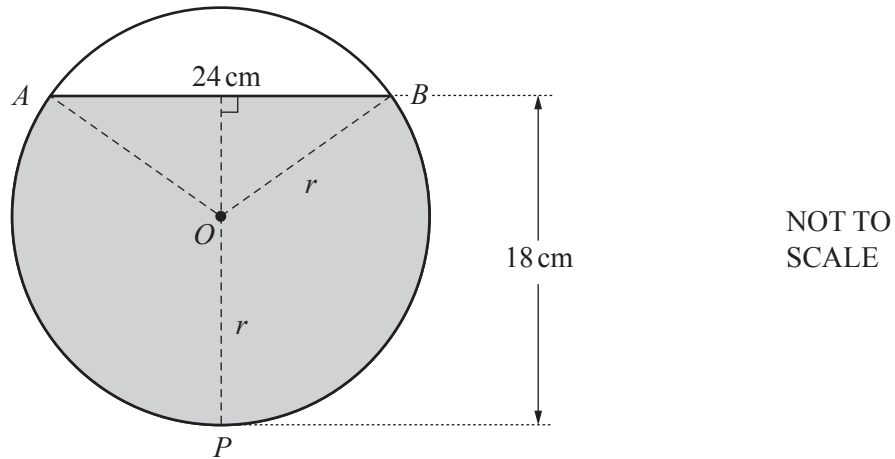
\$..... [4]

- (c) The price of a car is \$8760.
 Bryan pays a deposit of 25% of this price and then 24 equal monthly payments.
 After 24 months, he will have paid a total of \$9948.

Calculate the cost of one monthly payment.

\$..... [3]

7



The diagram shows the cross section of a cylinder, center O , radius r , lying on its side.
 The cylinder contains water to a depth of 18 cm.
 The width, AB , of the surface of the water is 24 cm.

- (a) Use an algebraic method to show that $r = 13$ cm.

[4]

- (b) Show that angle $AOB = 134.8^\circ$, correct to 1 decimal place.

[2]

- (c) (i) Calculate the area of the major sector $OAPB$.

.....cm² [3]

- (ii) Calculate the area of the shaded segment APB .

.....cm² [3]

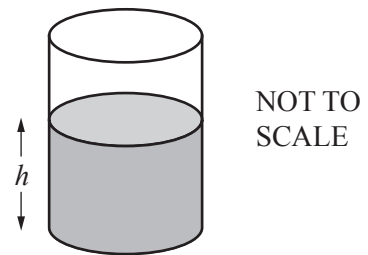
- (iii) The length of the cylinder is 40 cm.

Calculate the volume of water in the cylinder.

.....cm³ [1]

- (d) The cylinder is turned so that it stands on one of its circular ends.
In this position, the depth of the water is h .

Find h .



$h =$ cm [2]

8 (a) $\mathbf{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{n} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

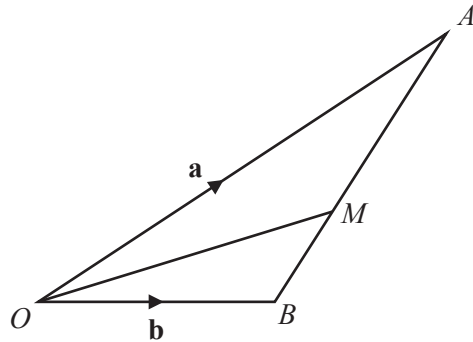
(i) Work out $2\mathbf{m} - 3\mathbf{n}$.

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

(ii) Calculate $|2\mathbf{m} - 3\mathbf{n}|$.

..... [2]

(b) (i)



NOT TO
SCALE

In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
The point M lies on AB such that $AM : MB = 3 : 2$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(a) $\overrightarrow{AB}$,

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

(b) $\overrightarrow{AM}$,

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

(c) $\overrightarrow{OM}$.

$$\overrightarrow{OM} = \dots\dots\dots [2]$$

- (ii) OM is extended to the point C .
 $\overrightarrow{OC} = \mathbf{a} + k\mathbf{b}$

Find the value of k .

$$k = \dots\dots\dots [1]$$

9 (a) Solve.

$$8x - 5 = 22 - 4x$$

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

(b) Solve.

$$6x \geq 2x + 14$$

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

(c) Factor.

$$x^2 - 4x - 21$$

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

(d) Expand the parentheses and simplify.

$$(3x - 2y)(4x + 3y)$$

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

- 10 (a) Complete the table for the four sequences A, B, C and D.

	Sequence				Next term	n th term
A	2	5	8	11		
B	20	14	8	2		
C	1	4	9	16		
D	0	2	6	12		

[10]

- (b) The sum of the first n terms of a sequence is $\frac{n(3n+1)}{2}$.

- (i) When the sum of the first n terms is 155, show that $3n^2 + n - 310 = 0$.

[2]

- (ii) Solve $3n^2 + n - 310 = 0$.

$$n = \dots\dots\dots \text{ or } n = \dots\dots\dots [3]$$

- (iii) Complete the statement.

The sum of the first terms of this sequence is 155.

[1]

Question 11 is printed on the next page.

11 Solve.

$$\frac{2}{x+3} + \frac{1}{12} = \frac{3}{2x-1}$$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [7]

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