Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2017

Mathematics

Unit T3
(With calculator)
Higher Tier

[GMT31]

MONDAY 9 JANUARY, 9.15am–11.15am

ML

TIME

2 hours, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

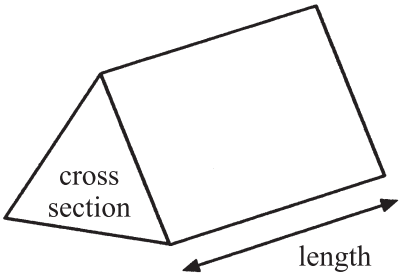
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only.
Answer **all twenty-five** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in Questions **1** and **15**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

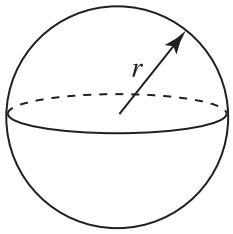
Formula Sheet

Volume of prism = area of cross section × length



Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

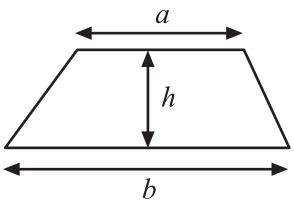


Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

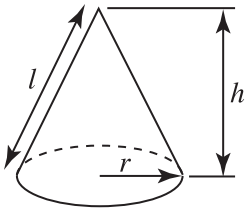
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Area of trapezium $= \frac{1}{2}(a+b)h$

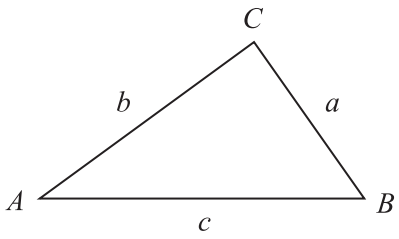


Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



In any triangle *ABC*



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

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

Area of triangle $= \frac{1}{2}ab\sin C$

Quality of written communication will be assessed in this question.

1 Julie needs to buy 20 oranges for school hockey matches.

She goes to two different shops.
In each shop one orange costs 40p.

Both shops have a special offer on oranges.

Which is better value?

Show your working clearly.

Answer _____ [4]

[Turn over

2

Northern Gas

Standing charge is 9.71 pence per day

Gas costs 4.27 pence per unit

Colin's gas meter was read on 1st September. The reading was

1	4	3	7	9

The meter was read again on 1st December. The reading was

2	2	1	9	9

(a) Complete the box to show the number of units used.

[1]

(b) Colin has to pay his gas bill for the 91 days from 1st September to 1st December.
VAT is charged at 5% on the total.
Calculate the total gas bill.

Answer £ _____ [4]

3

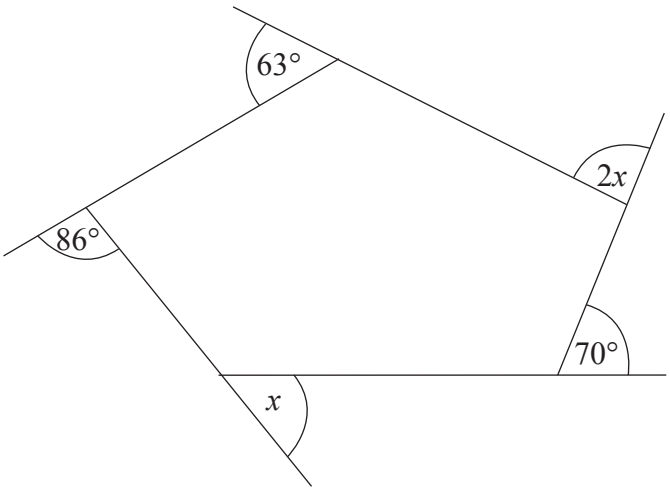


Diagram not drawn accurately

Work out the size of angle x in the diagram above.

Answer $x =$ _____ ° [4]

[Turn over

4 **(a)** Write an expression for the **total** cost in £ of x books at £3 each and y books at £7 each.

Answer £ _____ [2]

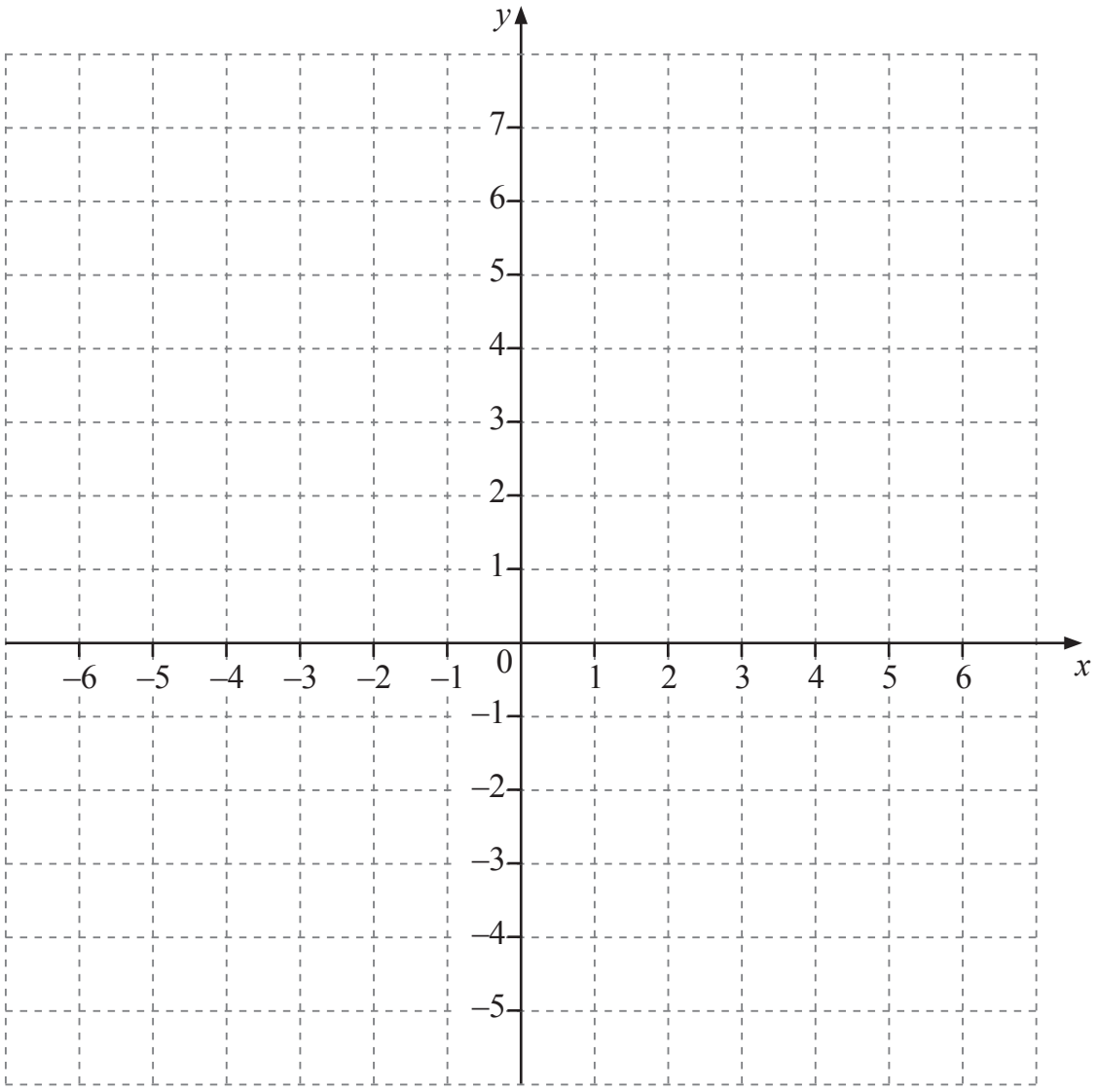
(b) Factorise

(i) $5t + 35$ Answer _____ [1]

(ii) $p^2 - 9p$ Answer _____ [1]

5 L is the point $(-5, 6)$. N is the point $(3, -2)$.

Find the co-ordinates of the midpoint of LN.



Answer (_____ , _____) [2]

[Turn over

6 **(a)** A circular garden has a radius of 7 metres.

Calculate the area of the garden.

Answer _____ [3]

(b) The perimeter of a different garden is 64 metres, measured to the nearest metre.

Write down the greatest and least value of the perimeter.

Answer greatest _____ m

least _____ m [2]

7 Jack is a pupil at Northfield Boys School. He wants to know how many times a month the people in his town go to a football match. He asks 600 pupils in his school.

Write down **two** reasons why the information that Jack gets back may not show how many times a month people in his town go to a football match.

Reason 1 _____

_____ [1]

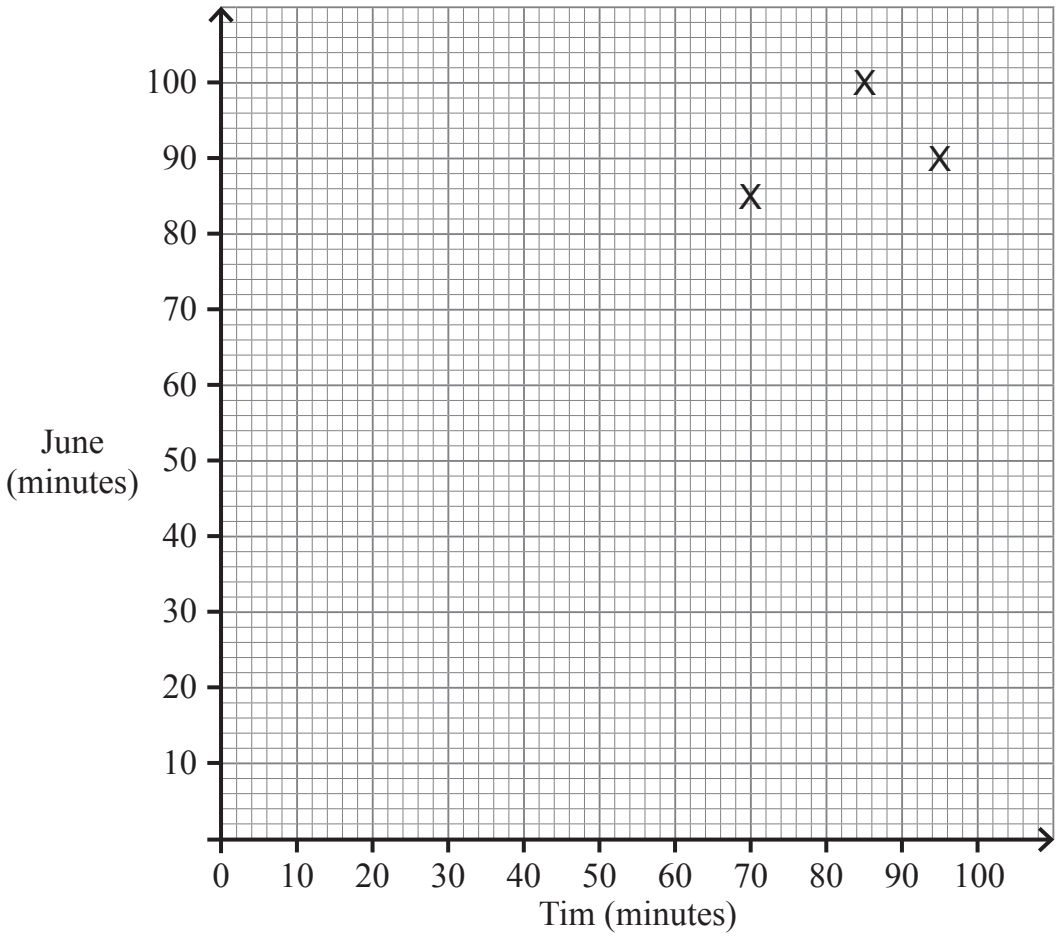
Reason 2 _____

_____ [1]

[Turn over

8 Tim and June recorded the amount of time in minutes they spent on different homeworks during one week. The results are shown below.

	Maths	**English**	**Art**	Geography	History	Science	Music	ICT
Tim	**70**	**85**	**95**	50	65	40	10	50
June	**85**	**100**	**90**	75	70	60	40	60



(a) Use the data to complete the scatter graph. The first three results are already plotted. [2]

(b) Draw the line of best fit. [1]

(c) Tim spent 70 minutes on a Technology homework.

Use your line of best fit to estimate the time that June spent on the Technology homework.

Answer _____ minutes [1]

(d) What type of correlation does your graph show?

Answer _____ [1]

[Turn over

9 A sequence has n^{th} term $n^2 + 4$

(a) Write down the first 3 terms of the sequence.

Answer _____ , _____ , _____ [2]

(b) Here are three sequences

$n^3 + 2$ $3n + 1$ $4n - 1$

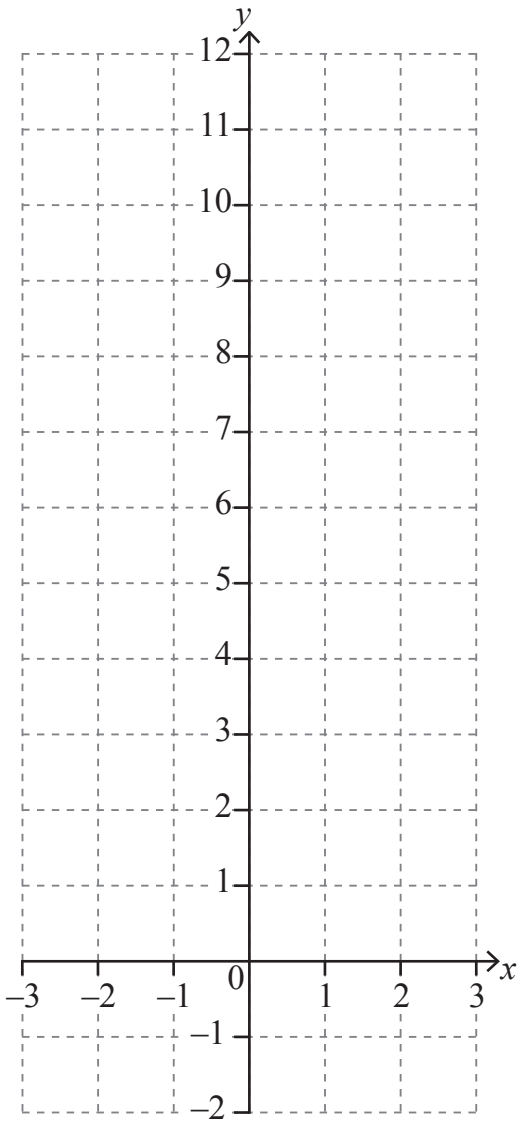
The number 13 is a term in one of these. Which one?
Explain your answer clearly.

Answer _____

because _____

_____ [2]

10 Draw the graph of $y = 5 - 2x$ on the grid below.



[3]

[Turn over

11 Solve $4 + 3(2x - 5) = x + 9$

Answer $x =$ _____ [3]

12 **(a)** Write 1620 as a product of its prime factors.

Answer _____ [2]

(b) **(i)** Write down three square factors of 1620

Answer _____ [2]

(ii) Write down one cube factor of 1620

Answer _____ [1]

[Turn over

13 A coat costs £150

A shop has a sale giving 12% discount.
With 12% discount the shop makes a profit of £7

What would the percentage profit be if the coat was sold at the full marked price of £150?

Show all your working clearly.

Answer _____ % [5]

14 Simplify $\frac{5t}{6} - \frac{t}{2}$

Answer _____ [3]

Quality of written communication will be assessed in this question.

15 ABCD is a square.

ABE is an equilateral triangle.

Explain why angle DEC = 150°

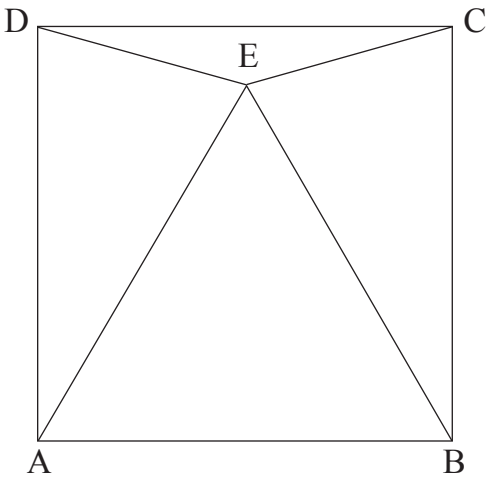
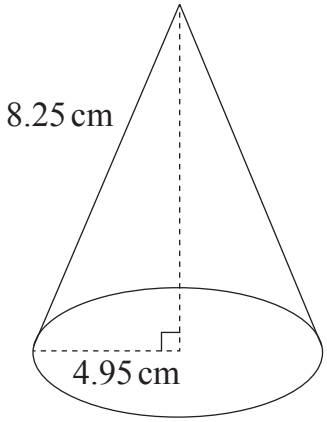


Diagram not drawn accurately

[4]

[Turn over

16 A cone has a slant height of 8.25 cm and a radius of 4.95 cm.



Calculate the vertical height of the cone.

Answer _____ cm [3]

17 The weekly wages of eight office workers are listed below.

£202 £212 £221 £242 £250 £250 £260 £284

One person's wage of £110 is not on the list. If this wage is now added to the list, write down whether each of the following will increase, decrease or stay the same.

(a) the mean wage will _____ [1]

(b) the modal wage will _____ [1]

(c) the median wage will _____ [1]

(d) the range of the wages will _____ [1]

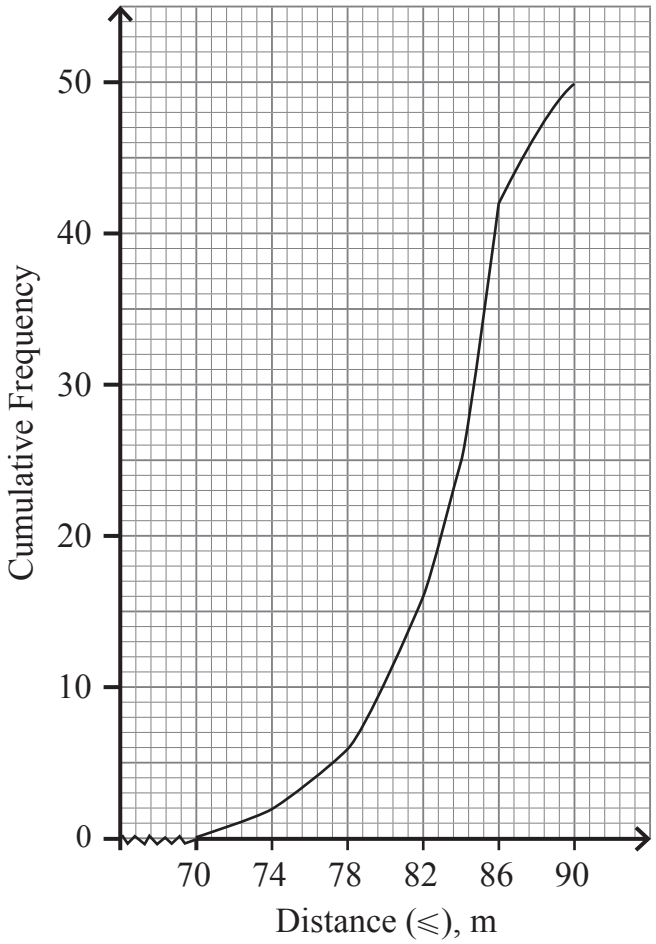
BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

[Turn over

18 The cumulative frequency graph shows the distances thrown by 50 competitors in a javelin competition.



(a) Use the graph to estimate the median distance thrown.

Answer _____ m [1]

(b) Use the graph to complete the two tables below.

(i)

Distance (less than or equal to), m	Cumulative Frequency
70	0
74	2
78	6
82	
86	
90	

[1]

(ii)

Distance d (m)	Frequency
$66 < d \leqslant 70$	0
$70 < d \leqslant 74$	2
$74 < d \leqslant 78$	4
$78 < d \leqslant 82$	
$82 < d \leqslant 86$	
$86 < d \leqslant 90$	

[2]

(c) Use table **(b) (ii)** to estimate the mean distance thrown.

Answer _____ m [4]

[Turn over

19 **(a)** Complete the missing power

$$5^6 \div 5^2 = 5^{\square}$$ [1]

(b) Show, **without the use of a calculator**, that

$$\frac{8^4}{16^2} = 16$$

[3]

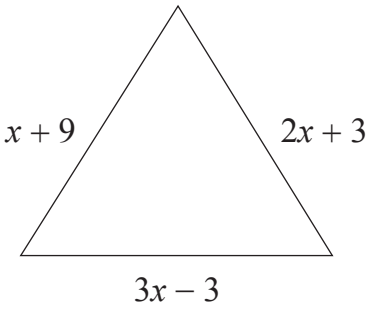
20 **(a)** Expand and simplify $3(4x + 3)(2x - 1)$

Answer _____ [3]

(b) Factorise $t^2 - 49$

Answer _____ [1]

21



The diagram shows an equilateral triangle.

Form and solve an equation to calculate the **perimeter** of the triangle.

Equation _____ [1]

Answer perimeter = _____ [3]

[Turn over

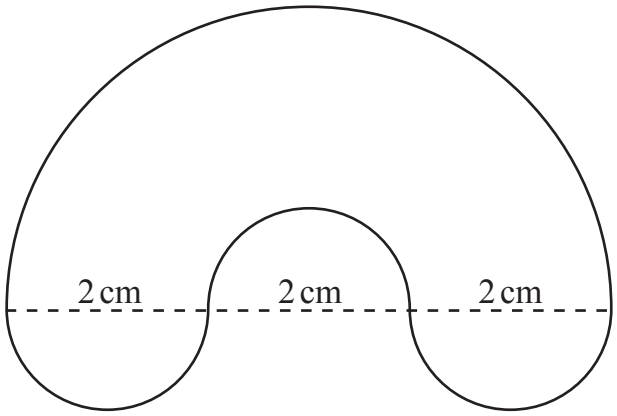
22 Solve the equation $\frac{3(x-2)}{4} - 3 = \frac{x+4}{3}$

Show all your working clearly.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

23 A shape with four semicircular edges is shown.

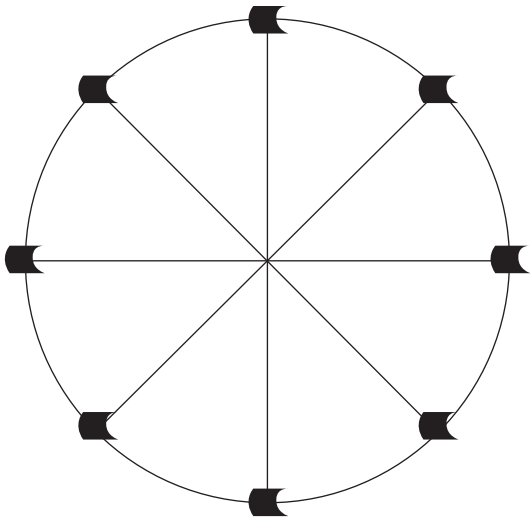


Calculate the perimeter of the shape.

Answer _____ cm [4]

[Turn over

24 The diagram shows a big wheel at a fairground. The radius of the wheel is 26 m.

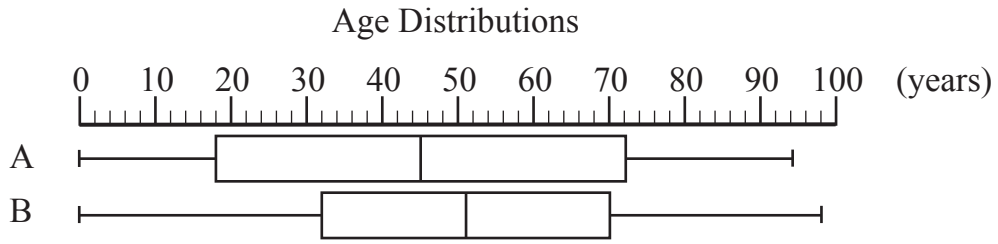


When the wheel starts to turn, Jill is in the bottom carriage on the ground.

How high will Jill's carriage be above the ground when the wheel has turned 115º?

Answer _____ m [4]

25 The box plots show the distribution of ages of the people living in two cities, A and B.



(a) In which city is the interquartile range greater? How can you tell this from the diagram?

Answer city _____ because _____

_____ [1]

(b) In which city are people generally older? Explain your answer.

Answer city _____ because _____

_____ [1]

(c) Complete the sentence

75% of the people in city A are aged over _____ [1]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
Total Marks	

Examiner Number