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# Level 1 Mathematics and Statistics, 2017

## 91028 Investigate relationships between tables, equations and graphs

9.30 a.m. Monday 20 November 2017
Credits: Four

| Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|
| Investigate relationships between tables, equations and graphs. | Investigate relationships between tables, equations and graphs, using relational thinking. | Investigate relationships between tables, equations and graphs, using extended abstract thinking. |

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

Show ALL working.

Grids are provided on some pages. This is working space for the drawing of a graph or a diagram, constructing a table, writing an equation, or writing your answer.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.
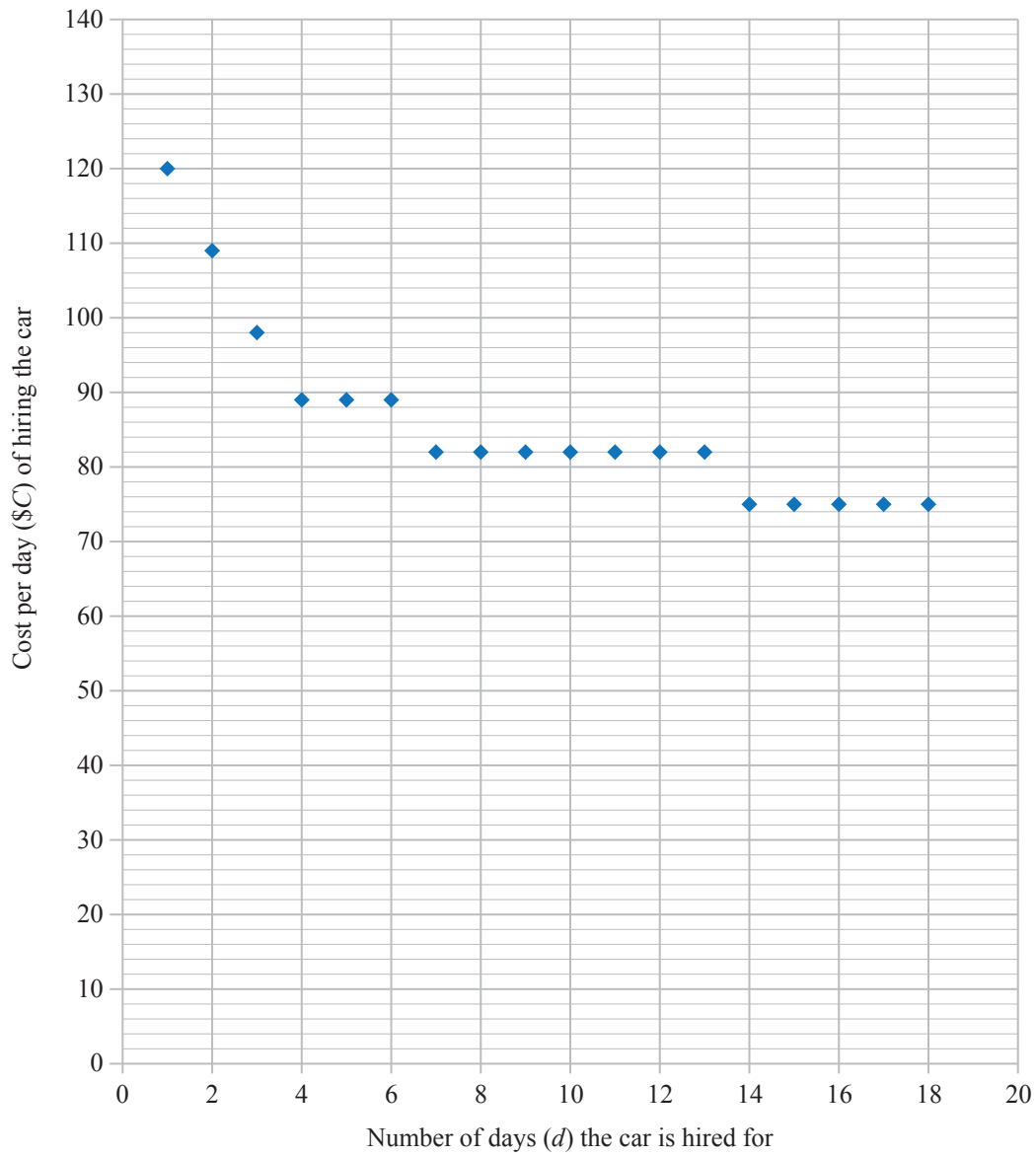
**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**TOTAL**

ASSESSOR'S USE ONLY

**QUESTION ONE**

(a)   *Rent A Car* is a car rental company. The graph below shows the **cost per day** ($C$), of hiring one of their standard-sized cars, as the **number of days the car is hired for** ($d$) increases.

(i)   How much cheaper per day is it to hire the car for 3 days than 1 day?

_____

_____

(ii)  Give the equation for the **cost per day** of hiring the car:

(1)   for 4 to 6 days

_____

(2)   for the first 3 days.

_____

_____

_____

(b)  *Rent A Car* decides to introduce a special deal, and produces a sign as shown on the right.

Mere is trying to find the cheapest option for renting a car. She asks what this 'SPECIAL DEAL' actually means.

The company gives Mere the formula they use to work out the daily rate.
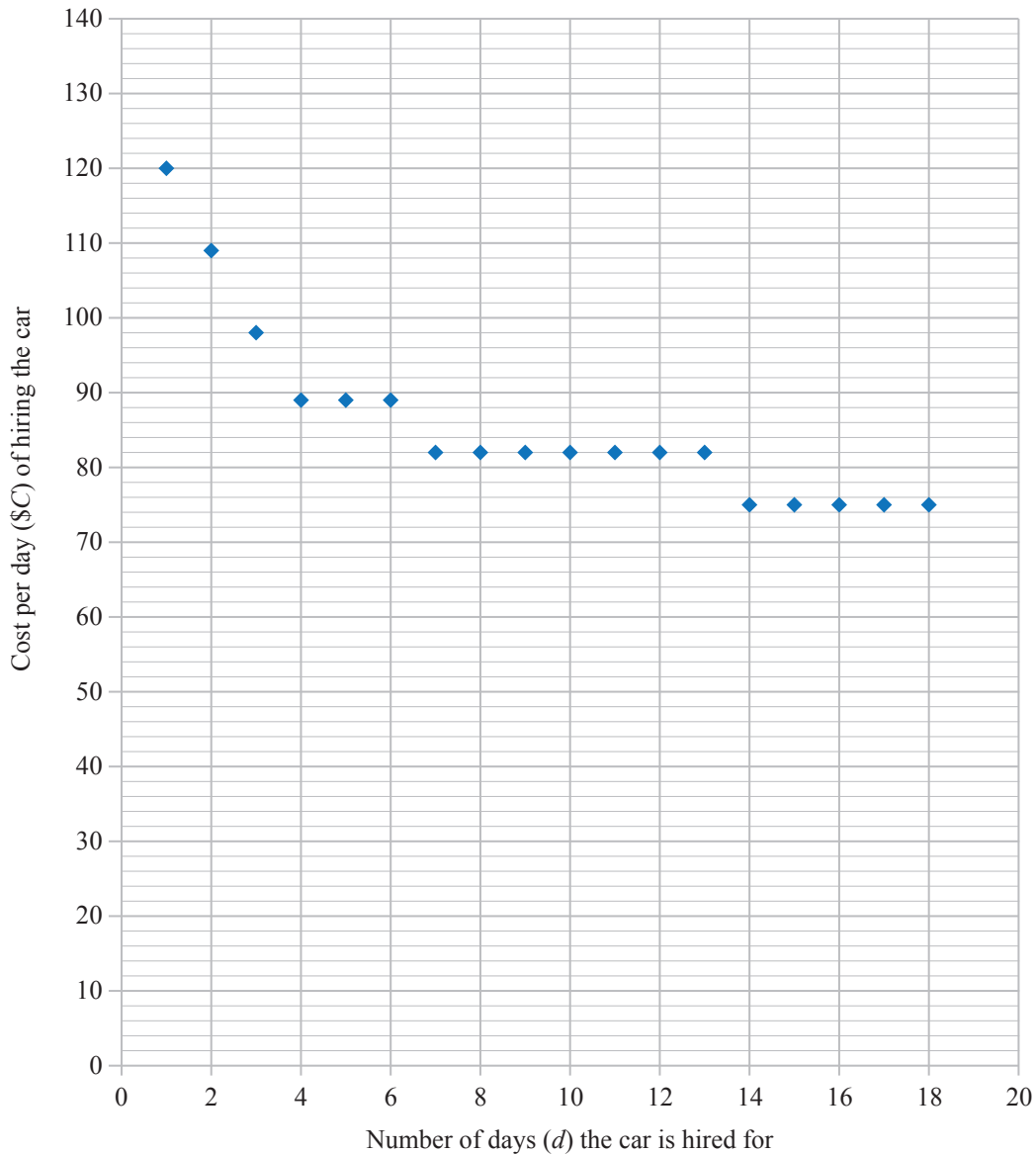
$$C = 140 \times 0.9^{\,d-1}$$

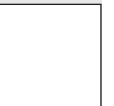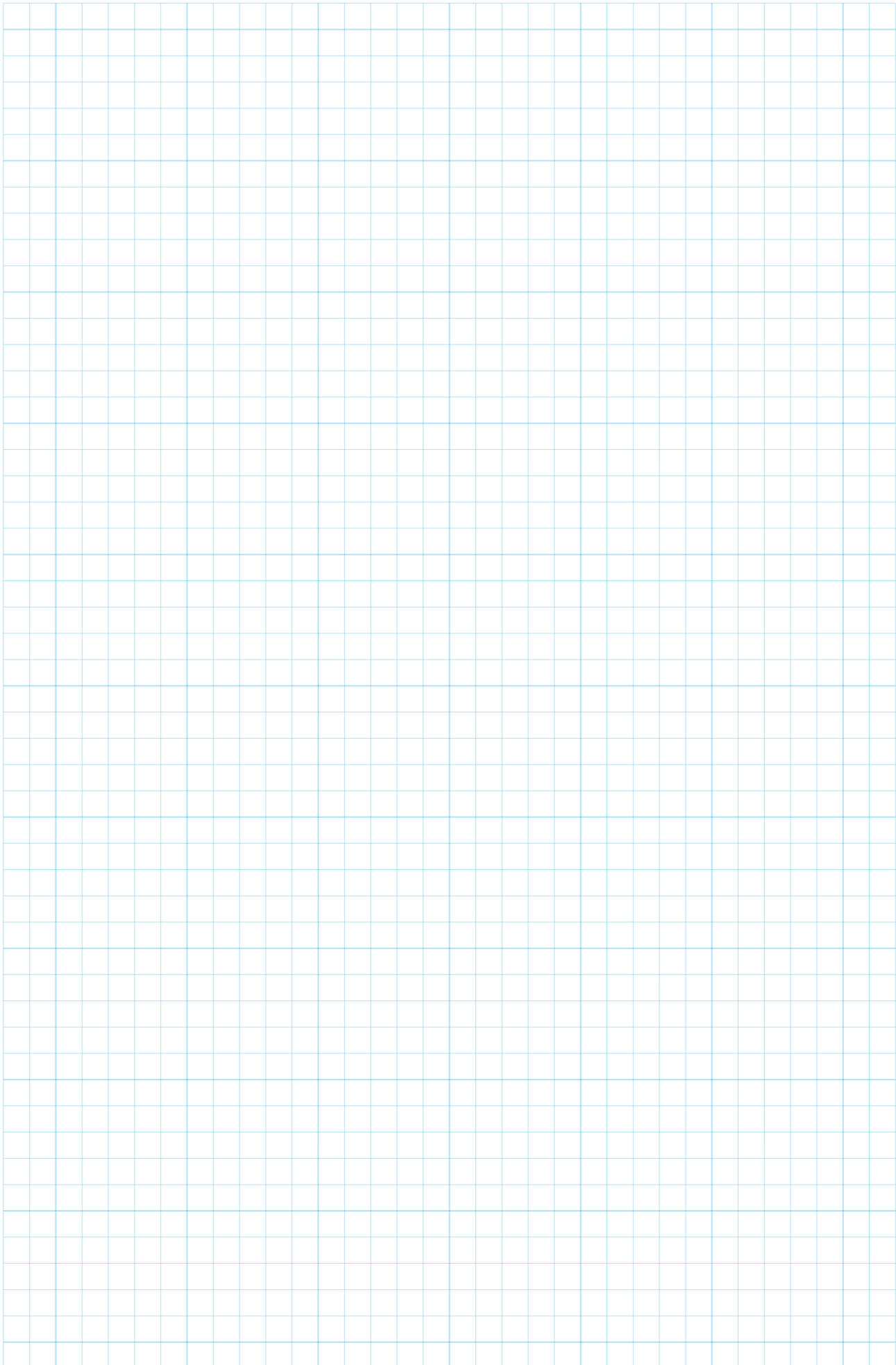where $C$ is the daily cost and $d$ is the number of days for which the car is hired.

Investigate, using an equation, table, or graph, whether Mere is any better off with this 'special deal' offer compared to the original price, as shown on the graph from page 2 (reproduced below).
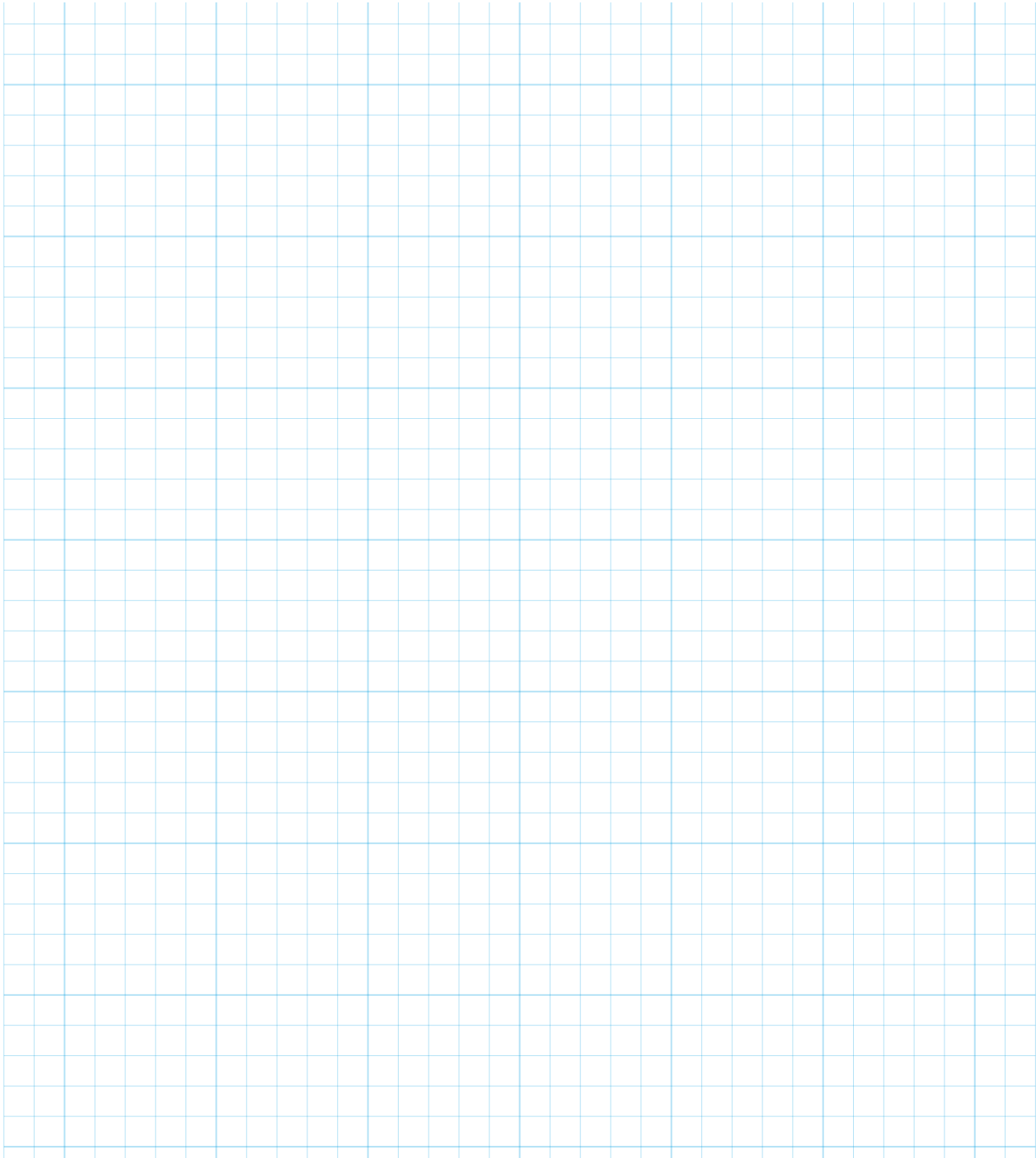
*Justify your answer.*

**RENT A CAR**
**SPECIAL DEAL**

**Maximum daily price $140**

**reducing daily by 10%**
**for each additional day**
**the car is hired.**

**(Minimum price charged**
**per day is $80)**

**Graph repeated from Page 2**



Cost per day ($C$) of hiring the car
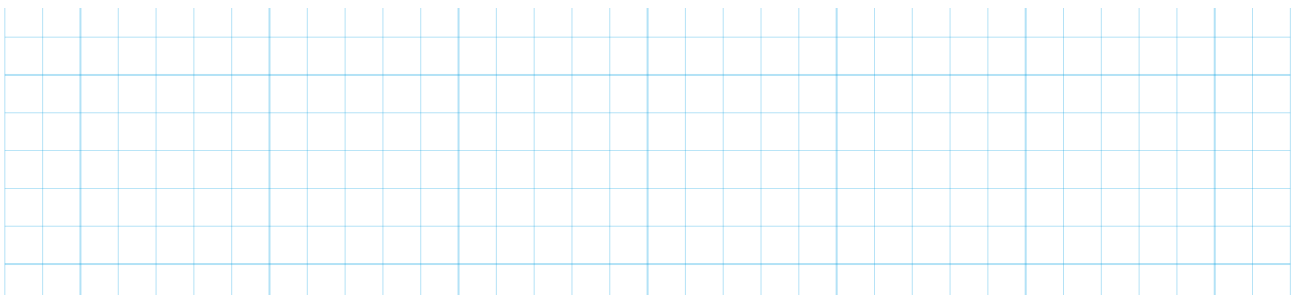
Number of days ($d$) the car is hired for

**QUESTION TWO**

(a)  (i)  Sketch the graph of $y = 2^x$.

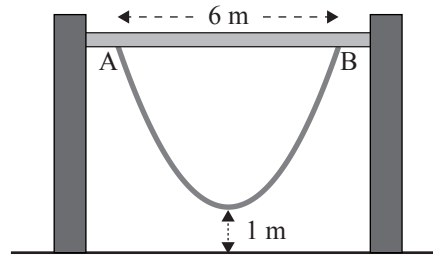(ii)  Give the equation of this graph if it is translated down by 3 units, and then reflected in the $y$-axis.

(b)  In a children's playground there is a rope hanging from two points, A and B, on a horizontal beam.

A and B are 6 metres apart.

The lowest point of the rope is 1 m above the ground.

The shape of the rope can be modelled by

$$y = \frac{x}{3}(x-p)+4$$
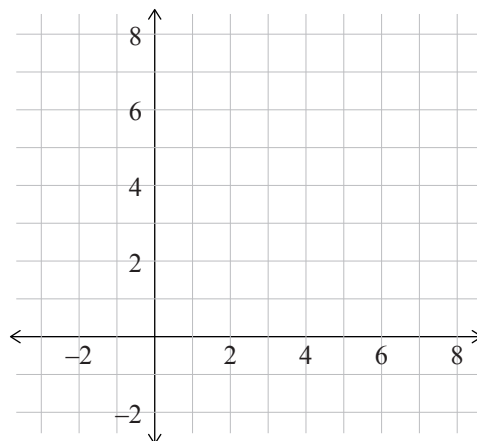
where $y$ is the height above the ground, and $x$ is the distance from A.

(i)  How high above the ground is A?

(ii)  Give the value of $p$.

(iii)  On the grid below sketch the graph that models the shape of the rope.

(iv) Holes are drilled through a 2 m long horizontal board.

The rope passes through the holes to make the seat of a swing.

The height of the seat is 1.2 metres above the ground.



How far apart would the holes in the board need to be if the shape of the rope above the seat stays the same?

Give your answer to 2 dp.

## QUESTION THREE

(a) (i) Give the equation of the parabola shown below.



_____

_____

_____
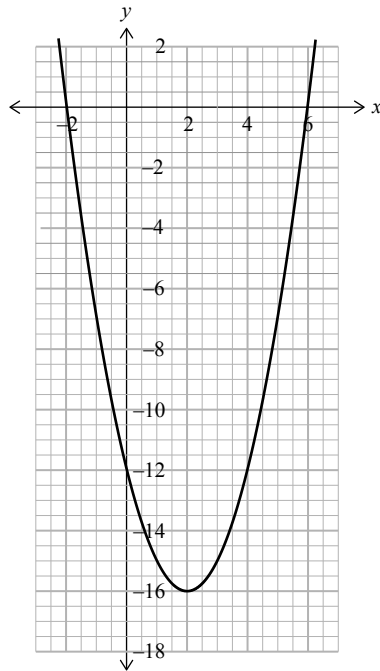
(ii) Give the equation of the above graph if it is translated by 2 units to the right.

_____

_____

_____

_____

(b)     Jono has some strips of plastic that are each 12 cm long.

He cuts one of these strips into two pieces and uses them as the two shorter sides of a right-angled triangle.

He starts by cutting a piece 4 cm long from a 12 cm strip, and uses this as one side of a right-angled triangle. He places the remaining 8 cm piece at right angles as the second side, as shown below.



4 cm

8 cm
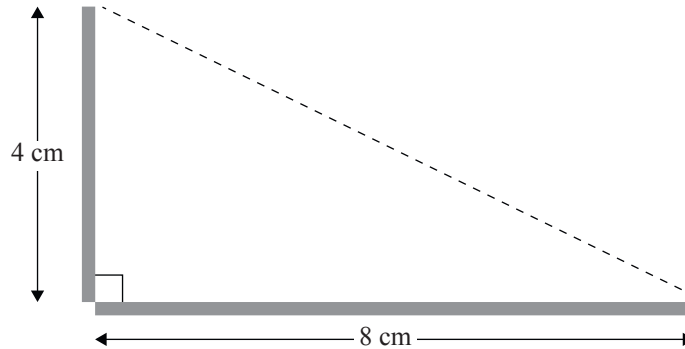
He then calculates the area of the triangle that would be formed by joining the two end points.

(i)     Use a table, equation, or graph to investigate the relationship between the area of the triangle, and the different lengths of the piece of plastic that can be cut from the 12 cm strip.
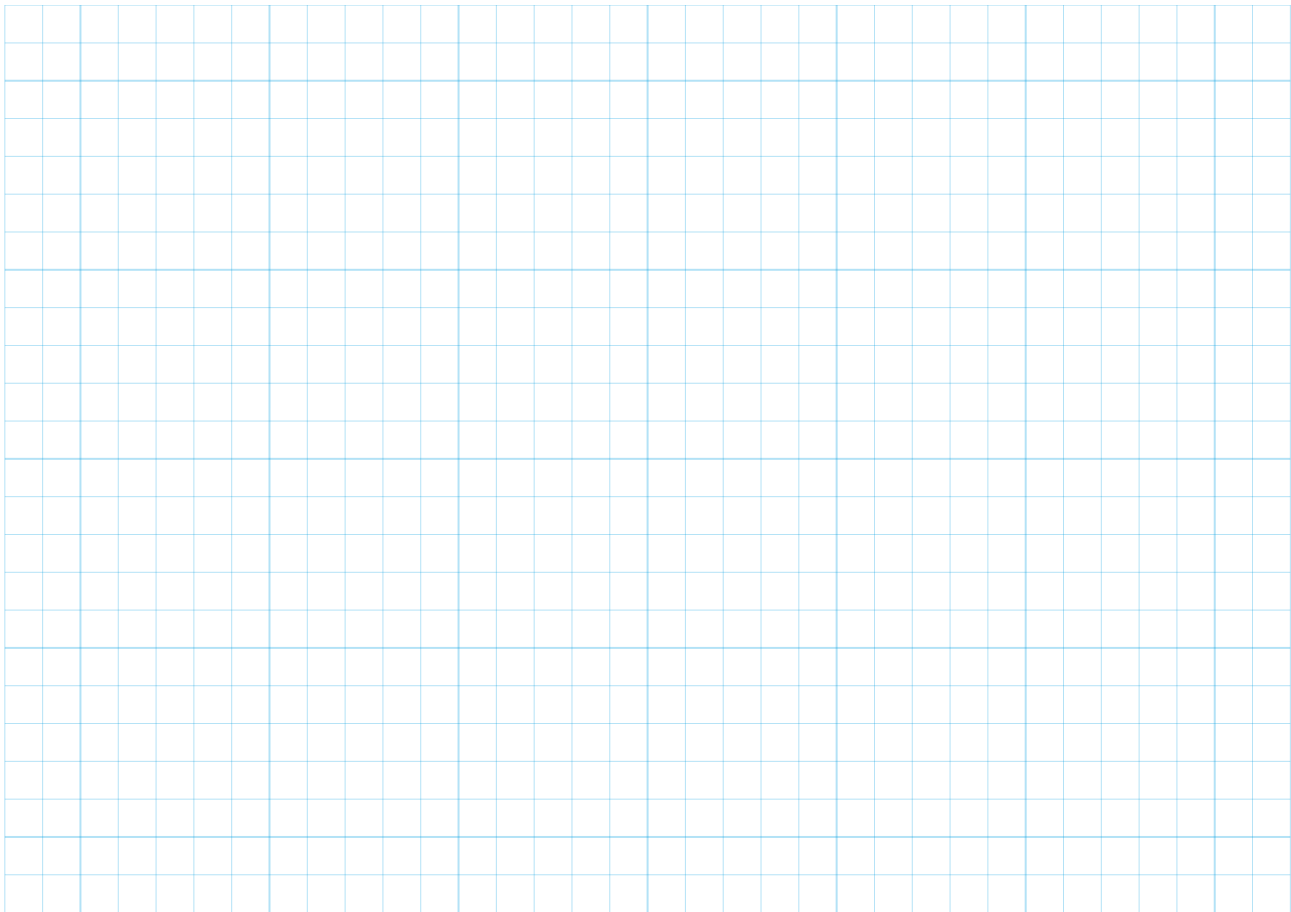
State the equation that best represents the relationship between the area of the triangle and the length of plastic cut from the 12 cm strip.

(ii) What features can be noticed about the area when Jono increases the length of the strip of plastic that he cuts from the 12 cm strip?

(iii) Clearly describe how the features of the graph of the relationship would change if the total length of the strip of plastic was $n$ cm longer.

Include the co-ordinates of the vertex of the parabola.

*NOTE: You do not need to draw the graph.*

**Extra paper if required.**
**Write the question number(s) if applicable.**

QUESTION
NUMBER

QUESTION
NUMBER

**Extra paper if required.**
**Write the question number(s) if applicable.**

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