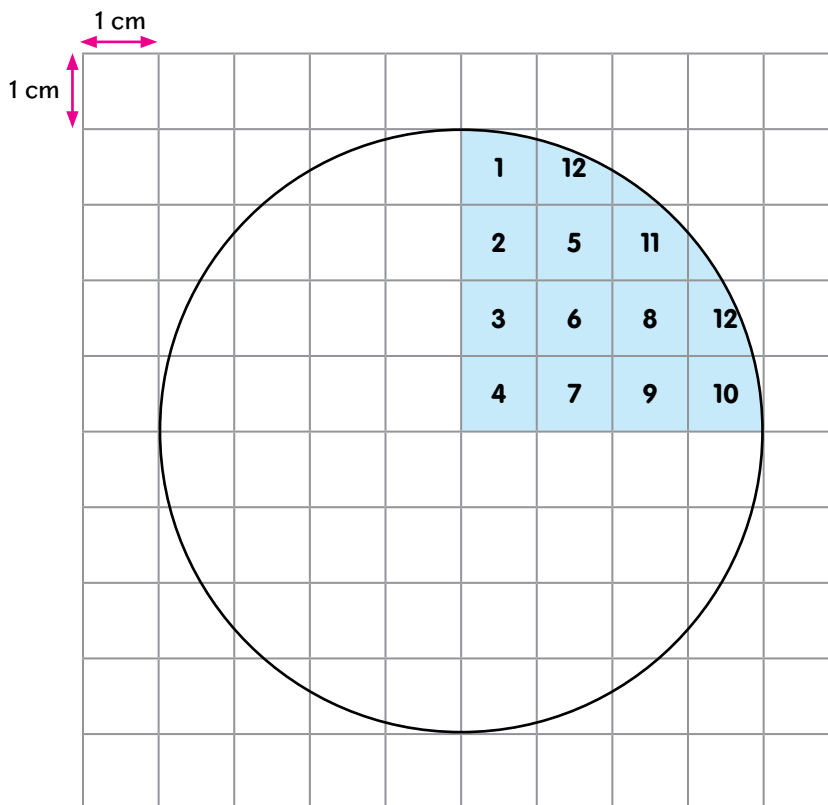


Area of a Circle

Let's Learn



- A circle is drawn on 1-cm square grid. Let us find the approximate area of this circle.



Count the number of squares that make up $\frac{1}{4}$ of the circle.

There are about 12 whole squares.

The area of $\frac{1}{4}$ of the circle is about 12 cm^2 .

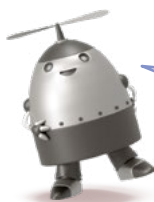
$$4 \times 12 = 48$$

The area of the circle is approximately **48 cm²**.

Include both whole squares and partial squares that together make up whole squares.



Is there another way to find the area of a circle without counting the squares?

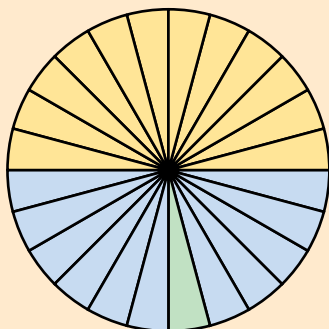


Hands-on Activity



Let us find the area of a circle cut-out.

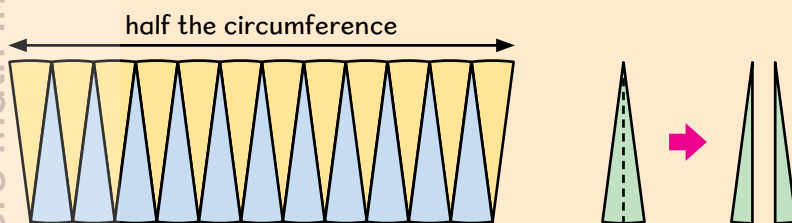
Step 1 Divide the circle into 24 equal parts and cut out the parts.



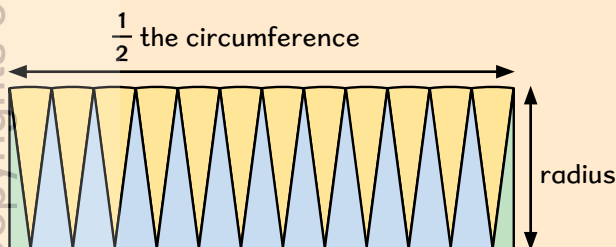
Half of the circle or 12 parts are coloured yellow, 11 parts are coloured blue and 1 part is coloured green.



Step 2 Arrange the 12 yellow parts and 11 blue parts as shown. Cut the green part into halves.



Step 3 Place one half of the green cut-out at each end. The figure that is formed looks like a rectangle. We can find the approximate area of the circle as shown below.



Area of circle $\approx$ Area of rectangle

$=$ Length $\times$ Breadth

$= \frac{1}{2} \times \text{Circumference} \times \text{Radius}$

$= \frac{1}{2} \times$ $\times \text{Radius}$

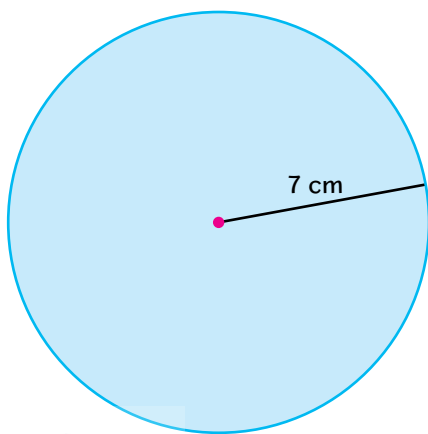
$=$

Give your answer in terms of π .



$$\text{Area of circle} = \pi r^2$$

- 2 A circle has a radius of 7 cm. Find its area. (Take $\pi = \frac{22}{7}$)

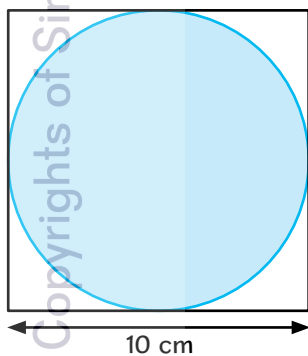


$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 7 \text{ cm} \times 7 \text{ cm}$$

$$= 154 \text{ cm}^2$$

- 3 Find the area of the circle. (Take $\pi = 3.14$)



$$\text{Diameter} = 10 \text{ cm}$$

$$\text{Radius} = 10 \text{ cm} \div 2$$

$$= 5 \text{ cm}$$

$$\text{Area of circle} = \pi r^2$$

$$= \pi \times 5 \text{ cm} \times 5 \text{ cm}$$

$$= 3.14 \times 5 \text{ cm} \times 5 \text{ cm}$$

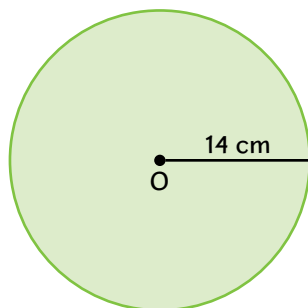
$$= 78.5 \text{ cm}^2$$

Let's Practise



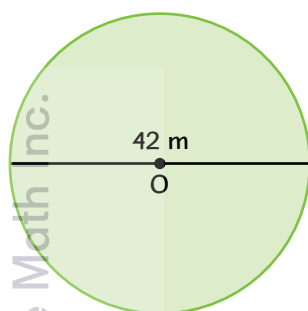
- 1 Find the area of each circle. (Take $\pi = \frac{22}{7}$)

(a)



cm^2

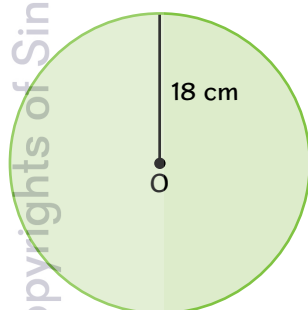
(b)



m^2

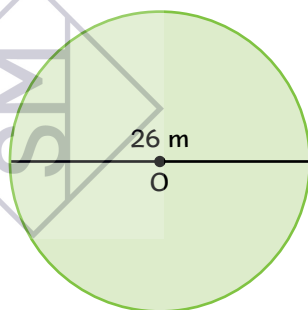
- 2 Find the area of each circle. (Take $\pi = 3.14$)

(a)



cm^2

(b)



m^2

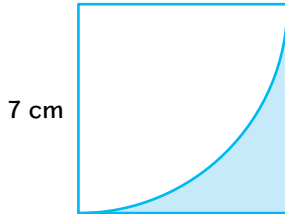


Area and Perimeter of Composite Figures

Let's Learn



- 1 The figure shows a quarter circle in a square.



The radius of the quarter circle is 7 cm.



- (a) Find the perimeter of the shaded part.
 (b) Find the area of the shaded part. (Take $\pi = \frac{22}{7}$)

$$\begin{aligned} \text{(a) Quarter of circumference} &= \frac{1}{4} \times 2\pi r \\ &= \frac{1}{4} \times 2 \times \frac{22}{7} \times 7 \text{ cm} \\ &= 11 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Perimeter of the shaded part} &= 11 \text{ cm} + 7 \text{ cm} + 7 \text{ cm} \\ &= \mathbf{25 \text{ cm}} \end{aligned}$$

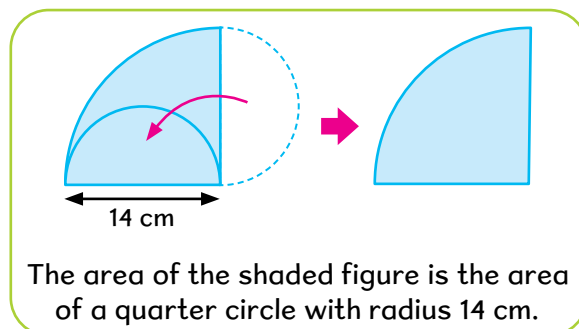
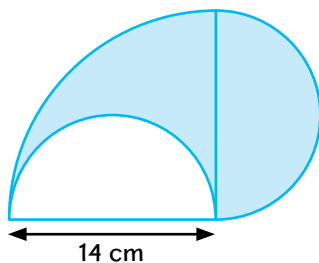
$$\begin{aligned} \text{(b) Area of the square} &= 7 \text{ cm} \times 7 \text{ cm} \\ &= 49 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of quarter circle} &= \frac{1}{4} \times \pi r^2 \\ &= \frac{1}{4} \times \frac{22}{7} \times 7 \text{ cm} \times 7 \text{ cm} \\ &= \frac{77}{2} \text{ cm}^2 \end{aligned}$$

$$\text{Area of the shaded part} = \text{Area of the square} - \text{Area of the quarter circle}$$

$$\begin{aligned} &= 49 \text{ cm}^2 - \frac{77}{2} \text{ cm}^2 \\ &= \frac{98}{2} \text{ cm}^2 - \frac{77}{2} \text{ cm}^2 \\ &= \frac{21}{2} \text{ cm}^2 \\ &= \mathbf{10\frac{1}{2} \text{ cm}^2} \end{aligned}$$

- 2 Find the area of the shaded part given that the diameter of the unshaded semicircle is 14 cm. (Take $\pi = \frac{22}{7}$)

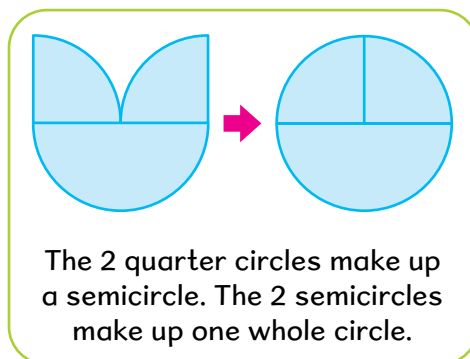
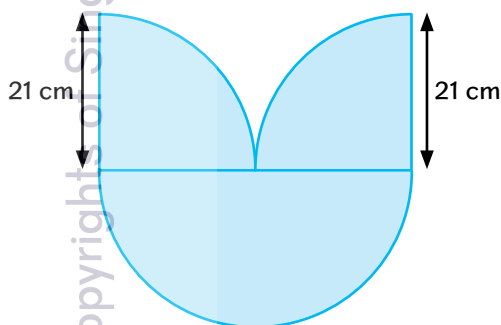


Area of the quarter circle = Area of the shaded part

$$\begin{aligned}
 &= \frac{1}{4} \pi r^2 \\
 &= \frac{1}{4} \times \frac{22}{7} \times 14^2 \text{ cm}^2 \\
 &= 154 \text{ cm}^2
 \end{aligned}$$



- 3 The figure is made up of two quarter circles and a semicircle. Find the perimeter of the figure. (Take $\pi = \frac{22}{7}$)



$$\text{Circumference} = 2\pi r$$

$$\begin{aligned}
 &= 2 \times \frac{22}{7} \times 21^2 \text{ cm} \\
 &= 132 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Perimeter of the figure} &= 132 \text{ cm} + 21 \text{ cm} + 21 \text{ cm} \\
 &= 174 \text{ cm}
 \end{aligned}$$

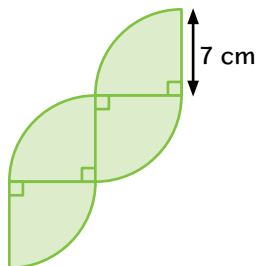


Let's Practise



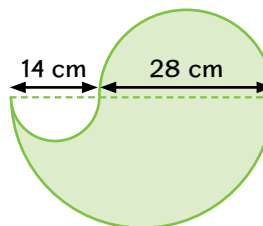
- 1 Find the area of each shaded figure. (Take $\pi = \frac{22}{7}$)

(a) Radius = 7 cm



Area = cm²

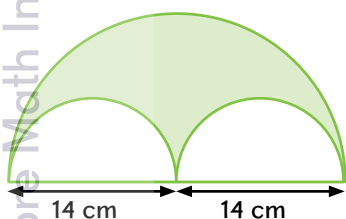
(b) Diameter of the small circle = 14 cm
Diameter of the bigger circle = 28 cm



Area = cm²

- 2 Find the area and perimeter of the shaded part in each figure. (Take $\pi = \frac{22}{7}$)

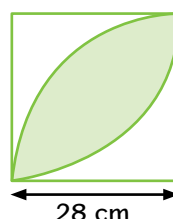
(a)



Area = cm²

Perimeter = cm

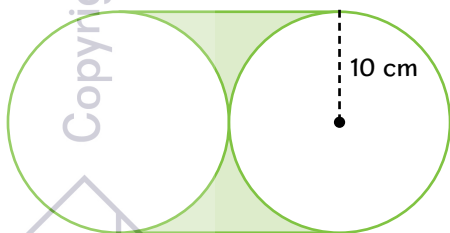
(b)



Area = cm²

Perimeter = cm

- 3 The figure shows 2 identical circles touching each other.
The radius of each circle is 10 cm.

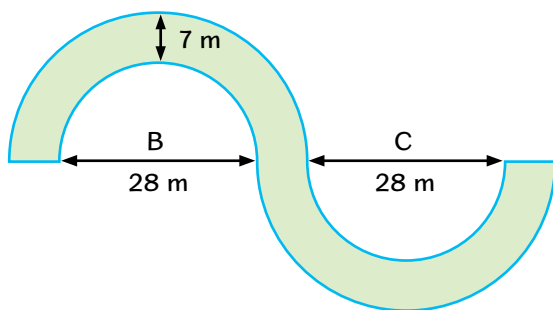


(a) Find the perimeter of the shaded part.

(b) Find the area of the shaded part.

(Take $\pi = 3.14$)

- 4 The figure shows a curved path that is 7 m wide throughout. The diameters of the smaller semicircles are 28 m each. Find the area of the path. (Take $\pi = \frac{22}{7}$)



Go to PB 6B Practice 7

Mathematics AROUND US

You can find many structures in Singapore that involve circles.

- 1 The photograph below shows Mapletree Business City. There is a circular road built around a round structure. This type of road layout is called a **roundabout**.

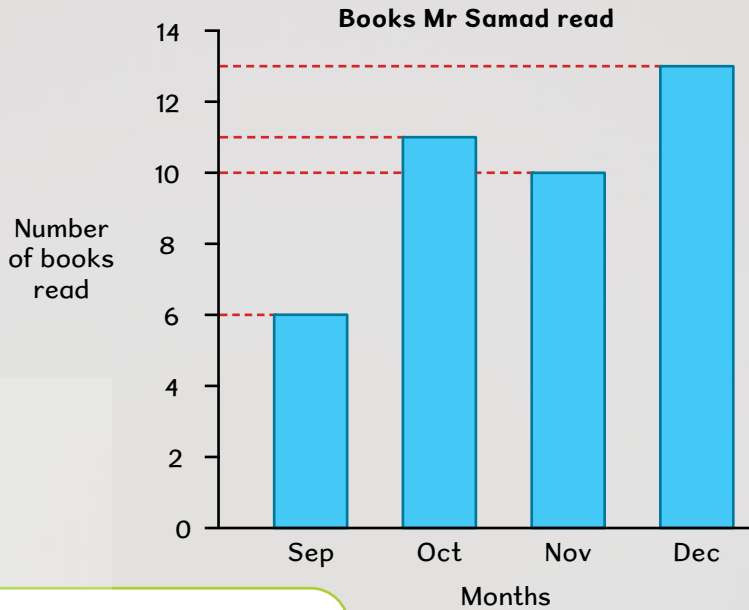


What do you think is the purpose of a roundabout?
How might the circumference of the central structure affect the flow of traffic?

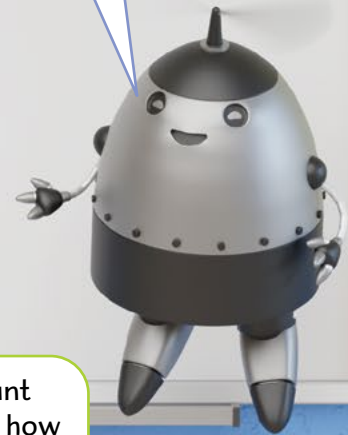


8

Average



Suppose Samad read the same number of books each month, how many books would he have read each month?



If I move some cubes so that the four towers have the same height, how many cubes will there be in each tower?

If I even out the amount of water in the beakers, how much water will there be in each beaker?



Finding Total Amount

Let's Learn



- 1 The average of 3 numbers is 18.
What is the sum of the numbers?

$$18 \times 3 = 54$$

The sum of the numbers is **54**.

When averaged,
each number is 18.



Total amount = Average $\times$ Number of data items

- 2 The average volume of water in 5 glasses is 120 ml.
What is the total volume of water in the 5 glasses?



Average volume of water in each glass is 120 ml.



When the average
volume of water is
120 ml, does it mean
all the 5 glasses
contain the same
volume of water?

$$\begin{aligned}\text{Total volume} &= 120 \text{ ml} \times 5 \\ &= 600 \text{ ml}\end{aligned}$$

The total volume of water in the 5 glasses is **600 ml**.



Let's Practise



- 1 The average of 6 numbers is 25.
What is the sum of the numbers?
- 2 Joan spent an average of 2 hours a day on a project from Monday to Thursday.
What was the total amount of time that Joan spent on doing her project?
- 3 The average cost of 8 mobile phones is \$315.
What is the total cost of the 8 mobile phones?



Finding Number of Data Items

Let's Learn



- 1 Gopal spent \$45 on some T-shirts.
The average cost of the T-shirts is \$9.
How many T-shirts did he buy?

$$\begin{aligned}\text{Number of T-shirts} &= \$45 \div \$9 \\ &= 5\end{aligned}$$

Gopal bought **5** T-shirts.



$$\text{Number of data items} = \text{Total amount} \div \text{Average}$$

- 2 Vani has 90 tarts.
She packs them into boxes.
The average number of tarts in each box is 6.
How many boxes of tarts does she have?

$$\begin{aligned}\text{Number of boxes} &= 90 \div 6 \\ &= 15\end{aligned}$$

Vani has **15** boxes of tarts.

Do all the boxes have the same number of tarts?



Let's Practise



- 1 James bought some books for \$72.
The average cost of a book was \$8.
How many books did he buy?
- 2 A fruit seller has some watermelons.
The total mass of the watermelons is 70 kg.
The average mass of a watermelon is 5 kg.
How many watermelons does the fruit seller have?



Word Problems

Let's Learn



- 1 The average of 4 numbers is 20.
The sum of 3 of the numbers is 69.
What is the fourth number?

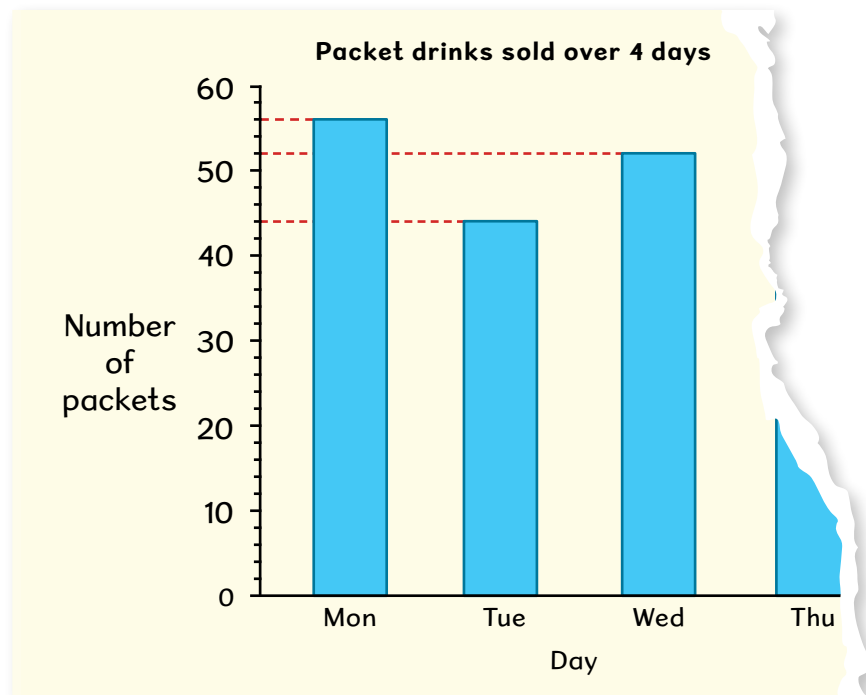
$$4 \times 20 = 80$$

The sum of the 4 numbers is 80.

$$80 - 69 = 11$$

The fourth number is **11**.

- 2 The bar graph shows the number of packet drinks sold by a drink seller over 4 days.
The average number of packet drinks sold each day was 48.
The bar for Thursday is partially torn off.



How many packet drinks were sold on Thursday?

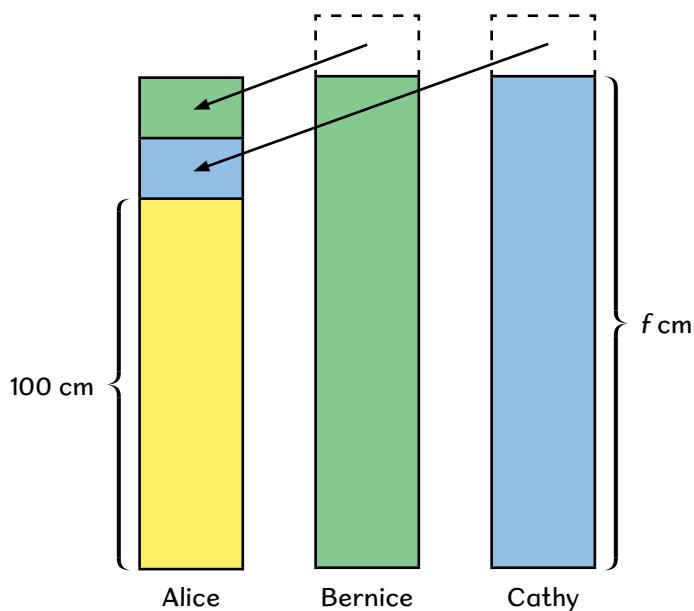
$$48 \times 4 = 192$$

A total of 192 packet drinks were sold over 4 days.

$$192 - 56 - 44 - 52 = 40$$

40 packet drinks were sold on Thursday.

- 8 The average height of Alice, Bernice and Cathy is f cm.
 Alice is 100 cm tall.
 Bernice and Cathy have the same height.
- (a) Find Bernice's height in terms of f .
 (b) If $f = 140$, how tall is Cathy?



(a) Total height of 3 girls $= 3 \times f$
 $= 3f$ cm

Total height of Bernice and Cathy $= (3f - 100)$ cm

Bernice's height is $\left(\frac{3f - 100}{2}\right)$ cm.

(b) Height of Cathy $= \left(\frac{3f - 100}{2}\right)$ cm

If $f = 140$,

$$\frac{3f - 100}{2} = \frac{3 \times 140 - 100}{2}$$

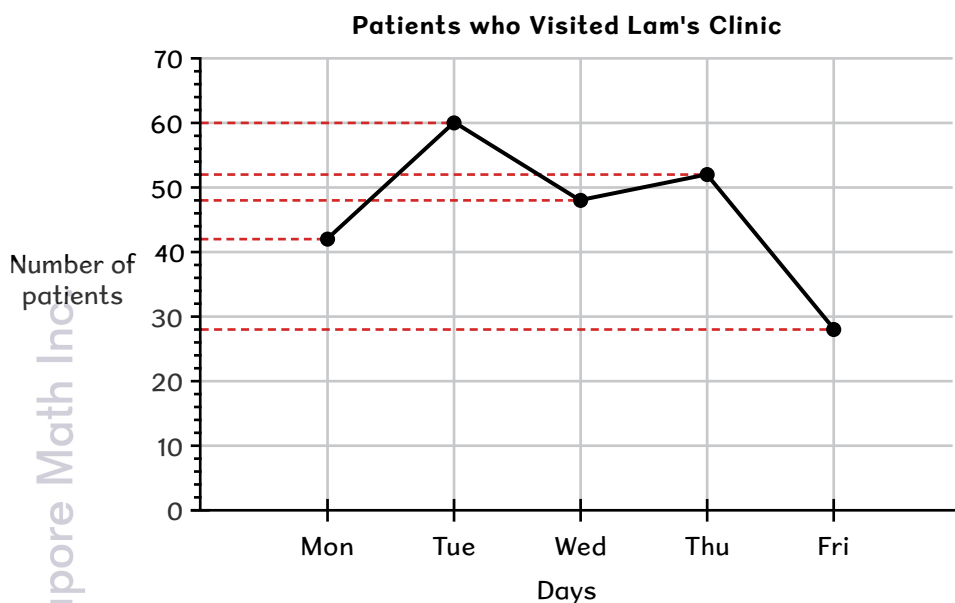
$$= 160$$

Cathy is **160 cm** tall.

Let's Practise



- 1 The average of 5 numbers is 50.
The sum of 4 of the numbers is 192.
What is the fifth number?
- 2 The line graph shows the number of patients at Lam's clinic over 5 days.

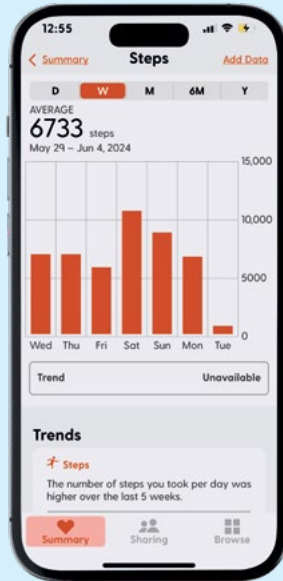


- (a) Find the average number of patients for each day.
- (b) The average number of patients from Monday to Saturday was 48.
How many patients were there on Saturday?

- 3 There are 4 boxes, A, B, C and D, on a balance scale.
The average mass of boxes A, B and C is 20 kg.
Find the average mass of the 4 boxes.



This health app shows the average number of steps taken by a person in a week



- How is the average number of steps calculated?
- How do people use the weekly averages to help them?



Thinking Aloud

- Let us explore a pattern based on the numbers shown below.

Numbers	Average
2 4	3
8 9 10	9
5 10 15	10
10 20 30 40	25

- What do you notice about the averages of the given numbers?
- Without using the formula for finding average, what is the average of the following numbers?
 - 6 and 8
 - 16, 19 and 22
 - 50, 60, 70 and 80
 - 4 and 5