PERIMETER

A LENGTH UNITS

A.1 CHOOSING LENGTH UNITS

MCQ 1: Which unit will be used to measure how long a pencil is?

Choose 1 answer:

☒ Centimeters

☐ Meters

☐ Kilometers

Answer: Centimeters will be used to measure how long a pencil is.

MCQ 2: Which unit will be used to measure the distance between two cities?

Choose 1 answer:

☐ Millimeters

☐ Centimeters

☐ Meters

☒ Kilometers

Answer: Kilometers will be used to measure the distance between two cities.

MCQ 3: Which unit will be used to measure how tall a tree is?

Choose 1 answer:

☐ Millimeters

☐ Centimeters

☒ Meters

☐ Kilometers

Answer: Meters will be used to measure how tall a tree is.

MCQ 4: Which unit will be used to measure the length of an ant?

Choose 1 answer:

☒ Millimeters

☐ Centimeters

☐ Meters

☐ Kilometers

Answer: Millimeters will be used to measure the length of an ant.

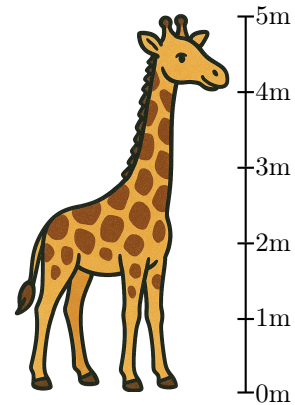**MCQ 5:** Which unit will be used to measure how long a book is?

Choose 1 answer:

☐ Millimeters

☒ Centimeters

☐ Meters

☐ Kilometers

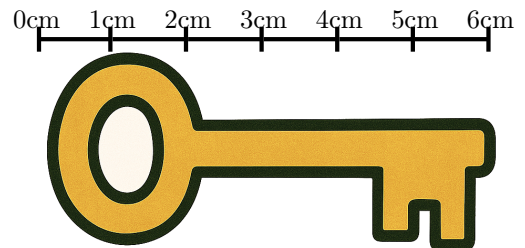*Answer:* Centimeters will be used to measure how long a book is.

A.2 MEASURING

Ex 6:

The giraffe measures ⬜ 5 ⬜ **meters** ⬜ tall.
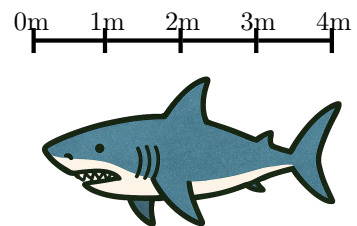
Answer: The giraffe measures 5 meters tall.

Ex 7:

The key measures ⬜ 6 ⬜ **centimeters** ⬜ long.
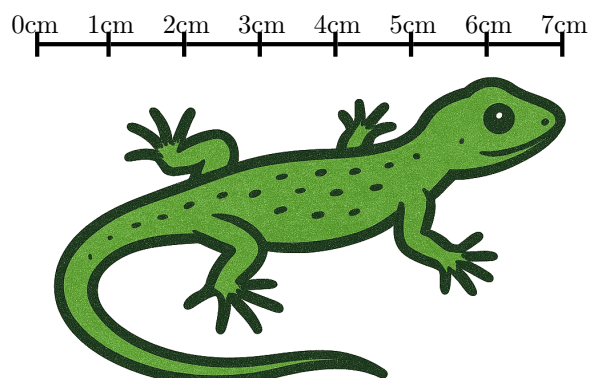
Answer: The key measures 6 centimeters long.

Ex 8:

The shark measures ⬜ 4 ⬜ **meters** ⬜ long.

Answer: The shark measures 4 meters long.

Ex 9:

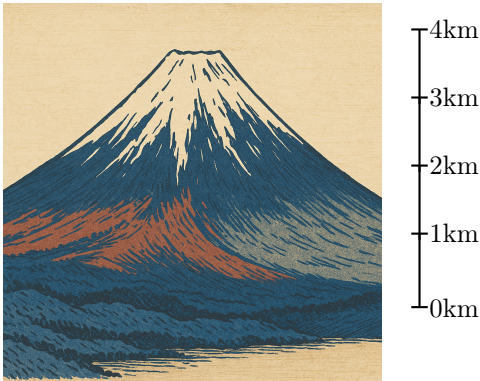The lizard measures $\boxed{7}$ $\boxed{\textbf{centimeters}}$ long.

Answer: The lizard measures 7 centimeters long.

Ex 10:

Mount Fuji measures $\boxed{4}$ $\boxed{\textbf{kilometers}}$ tall.

Answer: Mount Fuji measures 4 kilometers tall.
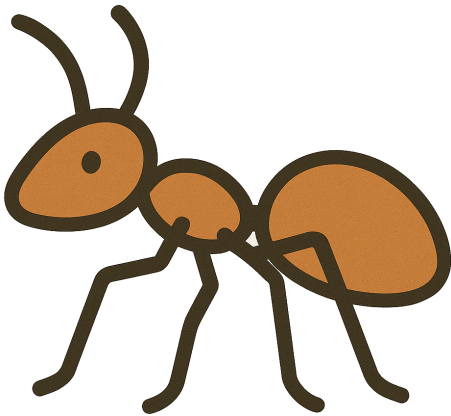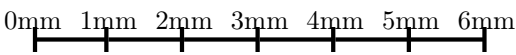

Ex 11:
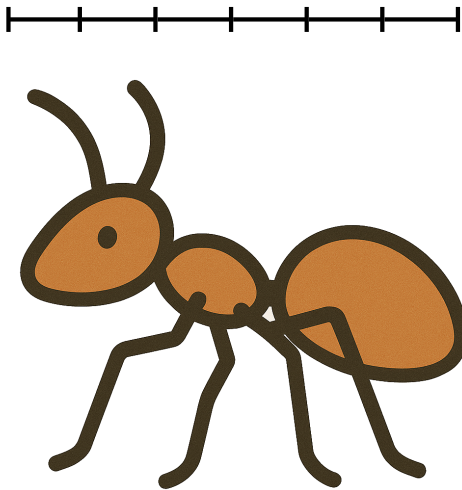
The ant measures $\boxed{6}$ $\boxed{\textbf{millimeters}}$ long.

Answer: The ant measures 6 millimeters long.

B CONVERSION OF LENGTH UNITS

B.1 CONVERTING UNITS OF LENGTH

Ex 12: Convert:

$$2\,\text{km} = \boxed{2000}\ \text{m}.$$

Answer:

- *Multiplication Method:*

$$2\,\text{km} = 2 \times 1\,000\,\text{m}$$
$$= 2\,000\,\text{m}$$

- *Conversion Table Method:*

km			m		cm	mm
2	**0**	**0**	**0**			

So,

$$2\,\text{km} = 2\,000\text{m}$$

Ex 13: Convert:

$$4\,\text{m} = \boxed{400}\ \text{cm}.$$

Answer:

- *Multiplication Method:*

$$4\,\text{m} = 4 \times 100\,\text{cm}$$
$$= 400\,\text{cm}$$

- *Conversion Table Method:*

km			m		cm	mm
			4	**0**	**0**	

So,

$$4\,\text{m} = 400\,\text{cm}$$

Ex 14: Convert:

$$300\,\text{cm} = \boxed{3}\ \text{m}.$$

Answer:

- *Division Method:*

$$300\,\text{cm} = 300 \div 100\,\text{m}$$
$$= 3\,\text{m}$$

- *Conversion Table Method:*

km			m		cm	mm
			3	0	0	

So,

$$300\,\text{cm} = 3\,\text{m}$$

Ex 15: Convert:

$$4\,000\,\text{m} = \boxed{4}\,\text{km}.$$

Answer:

- *Division Method:*

$$4\,000\,\text{m} = 4\,000 \div 1\,000\,\text{km}$$
$$= 4\,\text{km}$$

- *Conversion Table Method:*

km			m		cm	mm
4	**0**	**0**	**0**			

So,

$$4\,000\,\text{m} = 4\,\text{km}$$

Ex 16: Convert:

$$23\,\text{cm} = \boxed{230}\,\text{mm}.$$

Answer:

- *Multiplication Method:*

$$23\,\text{cm} = 23 \times 10\,\text{mm}$$
$$= 230\,\text{mm}$$

- *Conversion Table Method:*

km			m		cm	mm
				2	3	**0**

So,

$$23\,\text{cm} = 230\,\text{mm}$$

Ex 17: Convert:

$$6\,000\,\text{mm} = \boxed{6}\,\text{m}.$$

Answer:

- *Division Method:*

$$6\,000\,\text{mm} = 6\,000 \div 1\,000\,\text{m}$$
$$= 6\,\text{m}$$

- *Conversion Table Method:*

km			m		cm	mm
			6	0	0	0

So,

$$6\,000\,\text{mm} = 6\,\text{m}$$

B.2 CONVERTING UNITS OF LENGTH WITH DECIMAL NUMBERS

Ex 18: Convert:

$$2.3\,\text{km} = \boxed{2300}\,\text{m}.$$

Answer:

- *Multiplication Method:*

$$2.3\,\text{km} = 2.3 \times 1\,000\,\text{m}$$
$$= 2\,300\,\text{m}$$

- *Conversion Table Method:*

km			m		cm	mm
2	3	**0**	**0.**			

So,

$$2.3\,\text{km} = 2\,300\,\text{m}.$$

Ex 19: Convert:

$$1.60\,\text{m} = \boxed{160}\,\text{cm}.$$

Answer:

- *Multiplication Method:*

$$1.60\,\text{m} = 1.60 \times 100\,\text{cm}$$
$$= 160\,\text{cm}$$

- *Conversion Table Method:*

km			m		cm	mm
			1	6	**0.**	

So,

$$1.60\,\text{m} = 160\,\text{cm}.$$

Ex 20: Convert:

$$22.5\,\text{cm} = \boxed{225}\,\text{mm}.$$

Answer:

- *Multiplication Method:*

$$22.5\,\text{cm} = 22.5 \times 10\,\text{mm}$$
$$= 225\,\text{mm}$$

- *Conversion Table Method:*

km			m		cm	mm
				2	2	5**.**

So,

$$22.5\,\text{cm} = 225\,\text{mm}.$$

Ex 21: Convert:

$$185\,\text{cm} = \boxed{1.85}\,\text{m}.$$

Answer:

- *Division Method:*

$$185\,\text{cm} = 185 \div 100\,\text{m}$$
$$= 1.85\,\text{m}$$

- *Conversion Table Method:*

km			m		cm	mm
			1.	8	5	

So,

$$185\,\text{cm} = 1.85\,\text{m}.$$

Ex 22: Convert:

$$2\,300\,\text{m} = \boxed{2.3}\ \text{km}.$$

Answer:

- *Division Method:*

$$2\,300\,\text{m} = 2\,300 \div 1\,000\,\text{km}$$
$$= 2.3\,\text{km}$$

- *Conversion Table Method:*

km			m		cm	mm
2.	3	0	0			

So,

$$2\,300\,\text{m} = 2.3\,\text{km}.$$

Ex 23: Convert:

$$42.2\,\text{km} = \boxed{42200}\ \text{m}.$$

Answer:

- *Multiplication Method:*

$$42.2\,\text{km} = 42.2 \times 1\,000\,\text{m}$$
$$= 42\,200\,\text{m}$$

- *Conversion Table Method:*

	km			m		cm	mm
4	2	2	0	0.			

So,

$$42.2\,\text{km} = 42\,200\,\text{m}.$$

B.3 SOLVING PROBLEMS WITH UNIT CONVERSIONS

MCQ 24: Hugo and Louis go walking. Louis walks 5 000 meters, and Hugo walks 4.2 kilometers. Who did the longest walk?

⊠ Louis

☐ Hugo

Answer: To compare their distances, we need to use the same unit. We can convert either to meters or to kilometers. Let's look at both options.

Option 1: Convert to meters (Louis's unit)
Hugo walks 4.2 km. Using the conversion table:

km			m		cm	mm
4	2	0	0	0.		

So, 4.2 km = 4 200 m.
Now, compare:

- Louis: 5 000 m

- Hugo: 4 200 m

Option 2: Convert to kilometers (Hugo's unit)
Louis walks 5 000 m. Using the conversion table:

km			m		cm	mm
5.	0	0	0			

So, 5 000 m = 5.0 km.
Now, compare:

- Louis: 5.0 km

- Hugo: 4.2 km

In both cases, since 5 000 m (or 5.0 km) is more than 4 200 m (or 4.2 km), **Louis** did the longest walk.
Why choose kilometers? For large distances, like walks between places, using kilometers often gives smaller numbers that are easier to compare.

MCQ 25: A giraffe is 5.1 meters tall, and a horse is 200 centimeters tall. Which animal is taller?

⊠ Giraffe

☐ Horse

Answer: Let's convert the horse's height to meters to compare with the giraffe.
The horse is 200 cm tall. Using the conversion table:

km			m		cm	mm
			2	0	0	

So, 200 cm = 2 m.
Now, compare:

- Giraffe: 5.1 m

- Horse: 2 m

Since 5.1 m is more than 2 m, the **giraffe** is taller.

MCQ 26: A snake is 3.8 meters long, and a crocodile is 400 centimeters long. Which animal is longer?

☐ Snake

⊠ Crocodile

Answer: Let's convert the crocodile's length to meters to compare with the snake.
The crocodile is 400 cm long. Using the conversion table:

km			m		cm	mm
			4	0	0	

So, 400 cm = 4 m.
Now, compare:

- Snake: 3.8 m

- Crocodile: 4 m

Since 4 m is more than 3.8 m, the **crocodile** is longer.

MCQ 27: Emma walks 2.7 km to school, and Liam walks 3 000 meters to school. Who walks farther?

☐ Emma

☒ Liam

Answer: Let's convert Liam's distance to kilometers to compare with Emma, since kilometers are more convenient for these distances.
Liam walks 3 000 m. Using the conversion table:

km			m		cm	mm
3	0	0	0			

So, 3 000 m = 3 km.
Now, compare:

- Emma: 2.7 km

- Liam: 3 km

Since 3 km is more than 2.7 km, **Liam** walks farther.

C PERIMETER

C.1 FINDING PERIMETER OF A SHAPE

Ex 28: What is the perimeter of the shaded figure?

1 unit
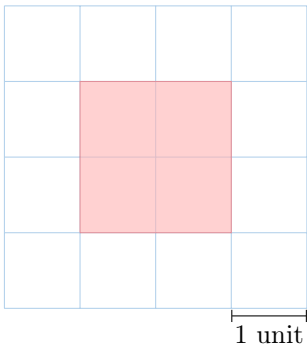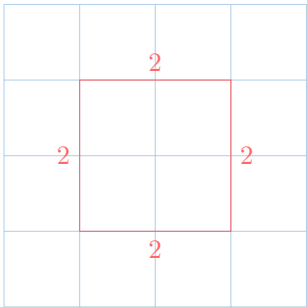
$$P = \boxed{8} \text{ units}$$

Answer:

To find the perimeter, we add the lengths of all 4 sides: $2 + 2 + 2 + 2$.
The perimeter is 8 units.

Ex 29: What is the perimeter of the shaded figure?

1 unit
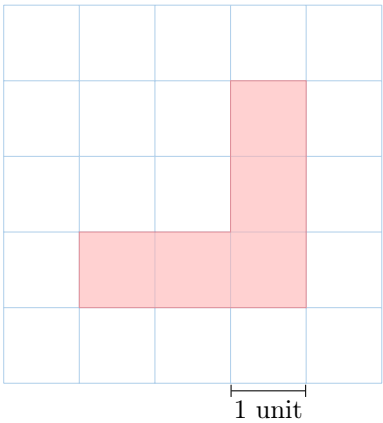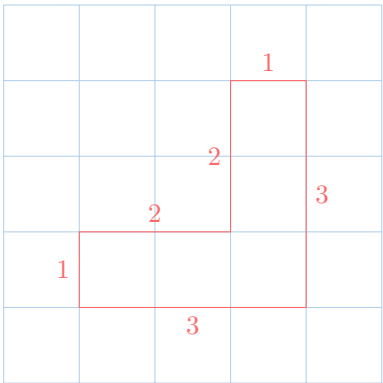
$$P = \boxed{12} \text{ units}$$

Answer:

To find the perimeter, we add the length of all sides: $3 + 3 + 1 + 2 + 2 + 1$.
The perimeter is 12 units.

Ex 30: What is the perimeter of the shaded figure?

1 unit

$$P = \boxed{10} \text{ units}$$

Answer:

1 unit
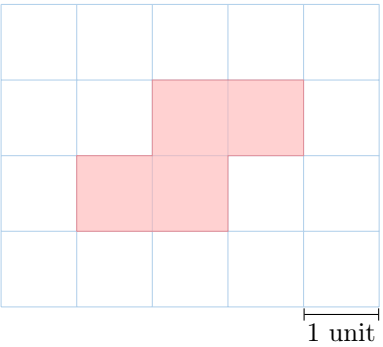
To find the perimeter, we add the lengths of all sides: $2 + 1 + 1 + 1 + 2 + 1 + 1 + 1$.
The perimeter is 10 units.

Ex 31: What is the perimeter of the shaded figure?
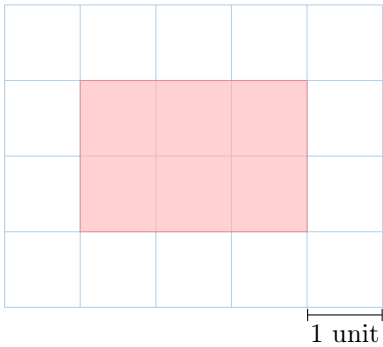
$$P = \boxed{10} \text{ units}$$

Answer:
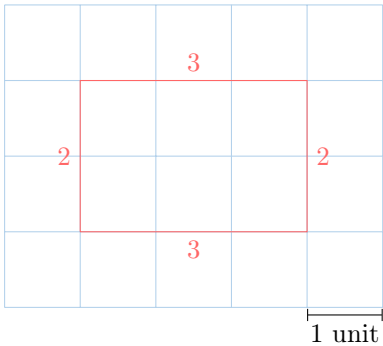
To find the perimeter, we add the lengths of all sides: $3 + 2 + 3 + 2$.
The perimeter is 10 units.

C.2 FINDING PERIMETER WHEN GIVEN SIDE LENGTHS

Ex 32: What is the perimeter of the right angle triangle?
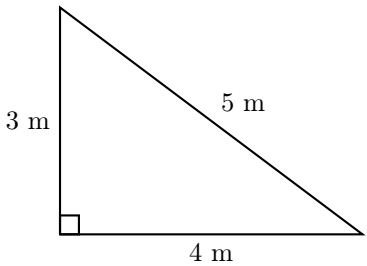
$$P = \boxed{12} \text{ m}$$

Answer: We find the perimeter by adding all of the side lengths.
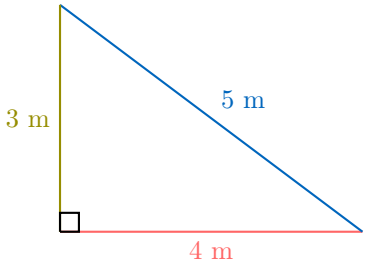
Perimeter $= 4 \text{ m} + 5 \text{ m} + 3 \text{ m}$
$= 12 \text{ m}$

Ex 33: What is the perimeter of the rectangle?
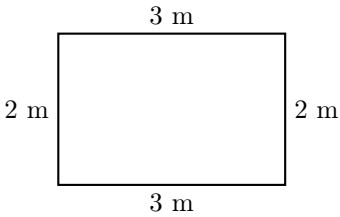
$$P = \boxed{10} \text{ m}$$

Answer: We find the perimeter by adding all of the side lengths.
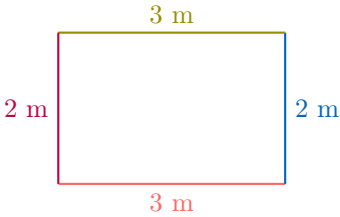
Perimeter $= 3 \text{ m} + 2 \text{ m} + 3 \text{ m} + 2 \text{ m}$
$= 10 \text{ m}$

Ex 34: What is the perimeter of the triangle?
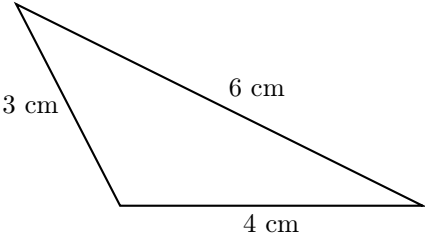
$$P = \boxed{13} \text{ cm}$$

Answer: We find the perimeter by adding all of the side lengths.
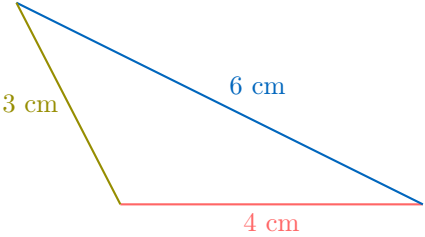
Perimeter $= 4 \text{ cm} + 6 \text{ cm} + 3 \text{ cm}$
$= 13 \text{ cm}$

Ex 35: What is the perimeter of the parallelogram?
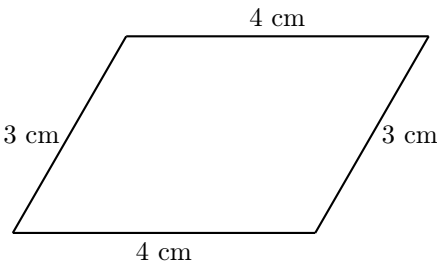
$$P = \boxed{14} \text{ cm}$$

Answer: We find the perimeter by adding all of the side lengths.
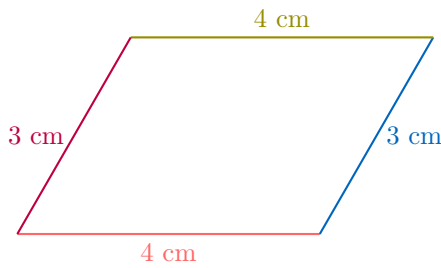
$$\text{Perimeter} = 4 \text{ cm} + 3 \text{ cm} + 4 \text{ cm} + 3 \text{ cm}$$
$$= 14 \text{ cm}$$

C.3 BUILDING EXPRESSIONS

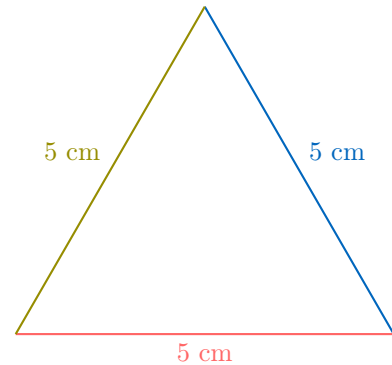**MCQ 36:** Which of the following expressions can be used to find the perimeter of the square?
All sides are the same length.
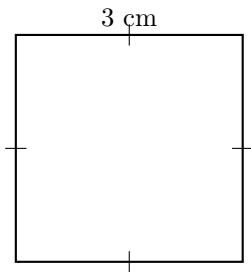
Choose 2 answers:

☒ 4×3

☐ $4 + 3$

☒ $3 + 3 + 3 + 3$

☐ $3 + 3$

Answer: In the square, all sides are the same length.
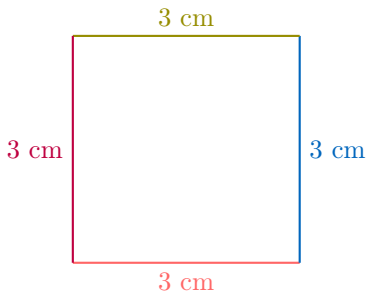
$$\text{Perimeter} = 3 + 3 + 3 + 3$$
$$= 4 \times 3$$

So, the correct expressions are 4×3 and $3 + 3 + 3 + 3$, both equal to 12 cm.

MCQ 37: Which of the following expressions can be used to find the perimeter of the equilateral triangle?
All sides are the same length.
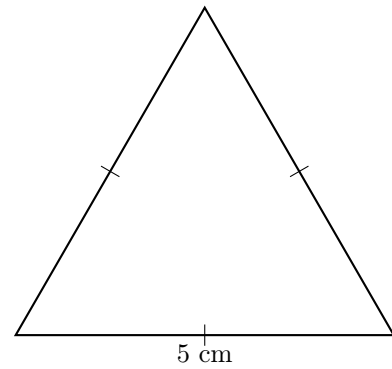
Choose 2 answers:

☐ $5 + 3$

☒ 3×5

☒ $5 + 5 + 5$

☐ $5 + 5$

Answer: In the equilateral triangle, all sides are the same length.

$$\text{Perimeter} = 5 + 5 + 5$$
$$= 3 \times 5$$

So, the correct expressions are 3×5 and $5 + 5 + 5$, both equal to 15 cm.

MCQ 38: Which of the following expressions can be used to find the perimeter of the rectangle?
Opposite sides are the same length.
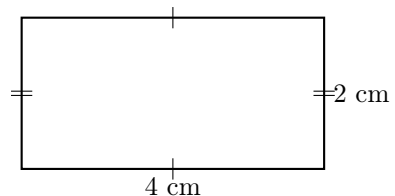
Choose 2 answers:

☐ $2 + 4$

☒ $(2 \times 2) + (2 \times 4)$

☒ $4 + 4 + 2 + 2$

☐ 4×2

Answer: In the rectangle, opposite sides are the same length.

4 cm

2 cm   2 cm

4 cm
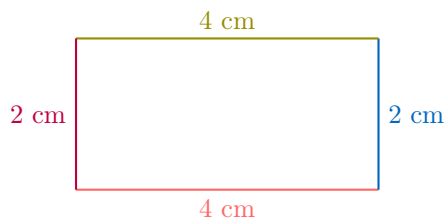
$$\text{Perimeter} = 4 + 4 + 2 + 2$$
$$= (2 \times 4) + (2 \times 2)$$

So, the correct expressions are $(2 \times 2) + (2 \times 4)$ and $4 + 4 + 2 + 2$, both equal to 12 cm.

C.4 FINDING PERIMETER WHEN GIVEN SIDE LENGTHS USING CONVERSION UNIT LENGTHS

Ex 39: What is the perimeter of the rectangle?

3 m

200 cm   200 cm

3 m
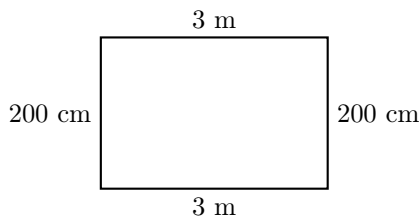
$$P = \boxed{10} \text{ m}$$

Answer:

- **Convert to the same unit:**

  - *Division Method:*

    $$200 \,\text{cm} = 200 \div 100 \,\text{m}$$
    $$= 2 \,\text{m}$$

  - *Conversion Table Method:*

km			m		cm	mm
			2	0	0	

  So,
  $$200 \,\text{cm} = 2 \,\text{m}$$

- **Add all the side lengths:**

3 m

200 cm = 2 m   200 cm = 2 m

3 m
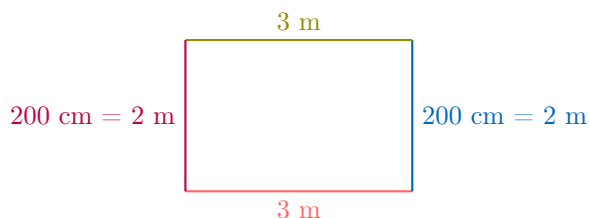
$$\text{Perimeter} = 3 \text{ m} + 2 \text{ m} + 3 \text{ m} + 2 \text{ m}$$
$$= (3 + 2 + 3 + 2) \,\text{m}$$
$$= 10 \,\text{m}$$

So, the perimeter of the rectangle is 10 meters.

Ex 40: What is the perimeter of the triangle?

6 m   4 m
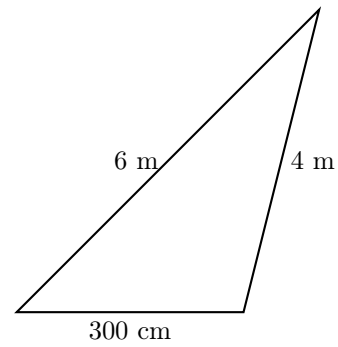
300 cm

$$P = \boxed{13} \text{ m}$$

Answer:

- **Convert to the same unit:**

  - *Division Method:*

    $$300 \,\text{cm} = 300 \div 100 \,\text{m}$$
    $$= 3 \,\text{m}$$

  - *Conversion Table Method:*

km			m		cm	mm
			3	0	0	

  So,
  $$300 \,\text{cm} = 3 \,\text{m}$$

- **Add all the side lengths:**

6 m   4 m

300 cm = 3 m
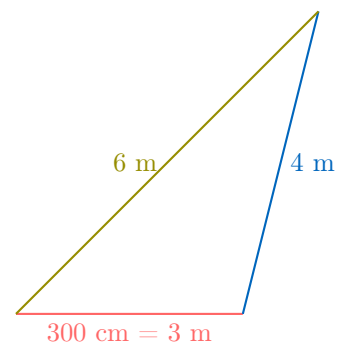
$$\text{Perimeter} = 3 \text{ m} + 4 \text{ m} + 6 \text{ m}$$
$$= (3 + 4 + 6) \,\text{m}$$
$$= 13 \,\text{m}$$

So, the perimeter of the triangle is 13 meters.

Ex 41: What is the perimeter of the parallelogram?

4 km

3 000 m   3 000 m

4 km
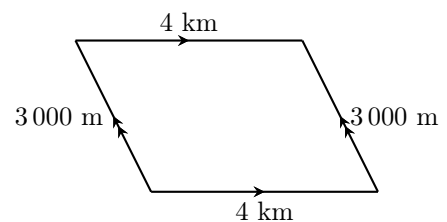
$$P = \boxed{14} \text{ km}$$

Answer:

- **Convert to the same unit:**

– *Division Method:*

$$3\,000\,\text{m} = 3\,000 \div 1\,000\,\text{km}$$
$$= 3\,\text{km}$$

– *Conversion Table Method:*

km			m		cm	mm
3	0	0	0			

So,

$$3\,000\,\text{m} = 3\,\text{km}$$
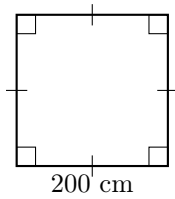
- **Add all the side lengths:**
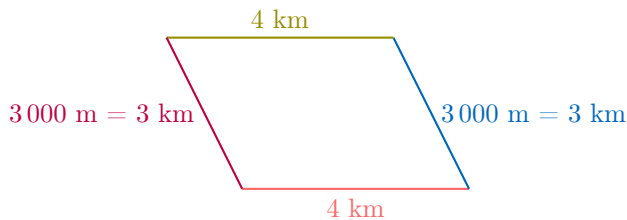
$$\text{Perimeter} = 4\,\text{km} + 3\,\text{km} + 4\,\text{km} + 3\,\text{km}$$
$$= (4 + 3 + 4 + 3)\,\text{km}$$
$$= 14\,\text{km}$$

So, the perimeter of the parallelogram is 14 kilometers.

Ex 42: What is the perimeter of the square in meters?

$$P = \boxed{8}\,\text{m}$$

Answer:

- **Convert to the same unit:**

    – *Division Method:*

    $$200\,\text{cm} = 200 \div 100\,\text{m}$$
    $$= 2\,\text{m}$$

    – *Conversion Table Method:*

km			m		cm	mm
			2	0	0	

So,

$$200\,\text{cm} = 2\,\text{m}$$

- **Add all the side lengths:** The square has 4 sides, each 2 m.

D PERIMETER OF COMMON SHAPES

D.1 FINDING PERIMETERS OF SQUARES AND RECTANGLES

Ex 43: What is the perimeter of the square?
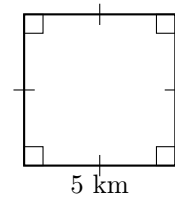
$$P = \boxed{20}\,\text{km}$$

Answer:

- **Method 1: Use the formula**

$$\text{Perimeter} = 4 \times s$$
$$= 4 \times 5$$
$$= 20\,\text{km}$$

- **Method 2: Add all the side lengths**
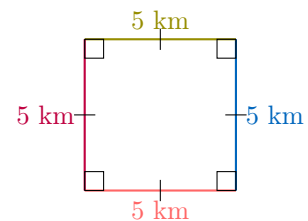
$$\text{Perimeter} = 5 + 5 + 5 + 5$$
$$= 4 \times 5$$
$$= 20\,\text{km}$$

Ex 44: What is the perimeter of the square?
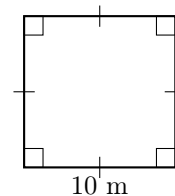
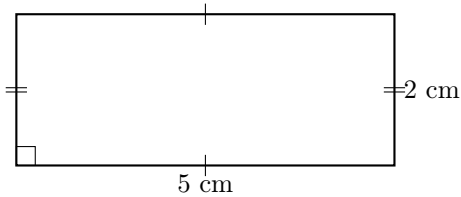$$P = \boxed{40}\,\text{m}$$

Answer:

- **Method 1: Use the formula**

$$\text{Perimeter} = 4 \times c$$
$$= 4 \times 10$$
$$= 40\,\text{m}$$

At top of right column (continuation):

$$\text{Perimeter} = 2\,\text{m} + 2\,\text{m} + 2\,\text{m} + 2\,\text{m}$$
$$= (2 + 2 + 2 + 2)\,\text{m}$$
$$= 4 \times 2\,\text{m}$$
$$= 8\,\text{m}$$

So, the perimeter of the square is 8 meters.

- **Method 2: Add all the side lengths**

10 m

10 m ┤   ├ 10 m

10 m
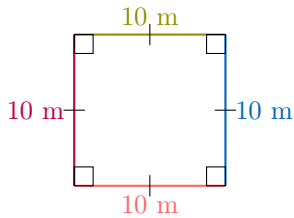
$$\text{Perimeter} = 10 + 10 + 10 + 10$$
$$= 4 \times 10$$
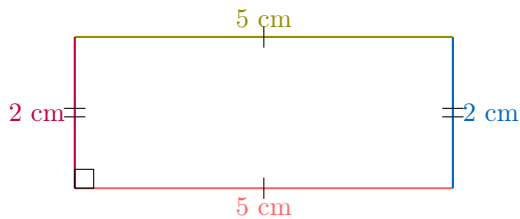$$= 40 \, \text{m}$$

Ex 45: What is the perimeter of the rectangle?

2 cm

5 cm

$$P = \boxed{14} \, \text{cm}$$

- **Method 1: Use the formula**

$$\text{Perimeter} = (2 \times l) + (2 \times w)$$
$$= (2 \times 5) + (2 \times 2)$$
$$= 10 + 4$$
$$= 14 \, \text{cm}$$

- **Method 2: Add all the side lengths**

5 cm

2 cm ┤   ├ 2 cm

5 cm

$$\text{Perimeter} = 5 + 2 + 5 + 2$$
$$= 14 \, \text{cm}$$

Ex 46: What is the perimeter of the rectangle?

4 km

6 km
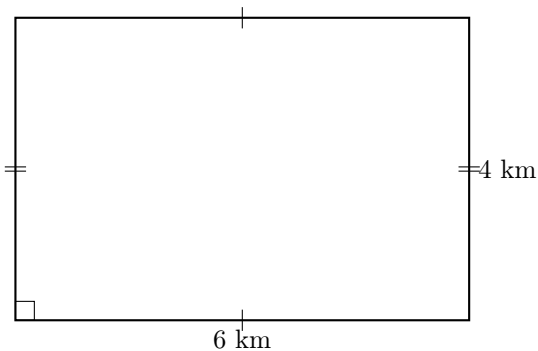
$$P = \boxed{20} \, \text{km}$$

- **Method 1: Use the formula**

$$\text{Perimeter} = (2 \times l) + (2 \times w)$$
$$= (2 \times 6) + (2 \times 4)$$
$$= 12 \, \text{km} + 8 \, \text{km}$$
$$= 20 \, \text{km}$$

- **Method 2: Add all the side lengths**

6 km

4 km ┤   ├ 4 km

6 km
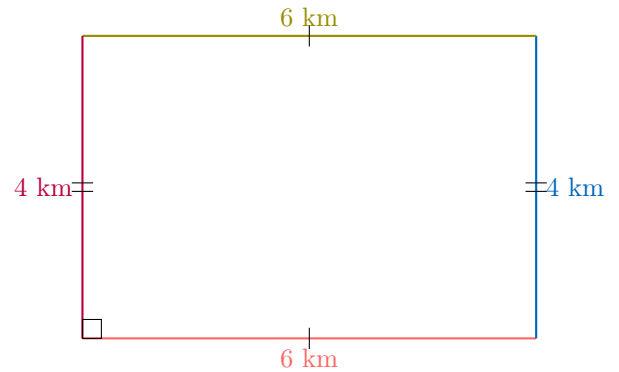
$$\text{Perimeter} = 6 + 4 + 6 + 4$$
$$= 20 \, \text{km}$$

D.2 FINDING CIRCUMFERENCES

Ex 47: What is the circumference of the circle?

3 m
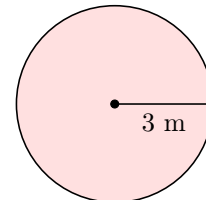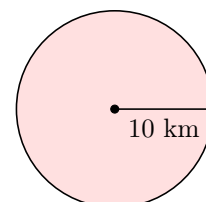
$\boxed{18.8}$ meters (round to 1 decimal place)

Using the formula for the perimeter (circumference) of a circle:

$$P = 2 \times \pi \times r$$
$$= 2 \times \pi \times 3$$
$$\approx 18.8496... \quad (\text{use calculator})$$
$$\approx 18.8 \, \text{m} \quad (\text{round to 1 decimal place})$$

So, the circumference is approximately 18.8 meters.
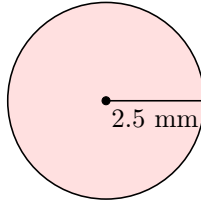
Ex 48: What is the circumference of the circle?

10 km

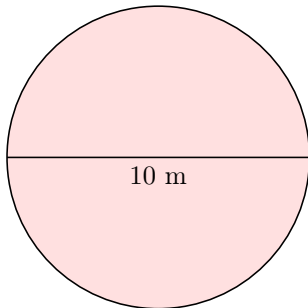$\boxed{62.8}$ kilometers (round to 1 decimal place)

Answer: Using the formula for the perimeter (circumference) of a circle:

$$P = 2 \times \pi \times r$$
$$= 2 \times \pi \times 10$$
$$\approx 62.8319... \quad \text{(use calculator)}$$
$$\approx 62.8 \, \text{km} \quad \text{(round to 1 decimal place)}$$

So, the circumference is approximately 62.8 kilometers.

Ex 49: What is the circumference of the circle?

2.5 mm

$\boxed{15.7}$ millimeters (round to 1 decimal place)

Answer: Using the formula for the perimeter (circumference) of a circle:

$$P = 2 \times \pi \times r$$
$$= 2 \times \pi \times 2.5$$
$$\approx 15.7079... \quad \text{(use calculator)}$$
$$\approx 15.7 \, \text{mm} \quad \text{(round to 1 decimal place)}$$

So, the circumference is approximately 15.7 millimeters.

Ex 50: What is the circumference of the circle with a diameter of 10 meters?

10 m

$\boxed{31.4}$ meters (round to 1 decimal place)

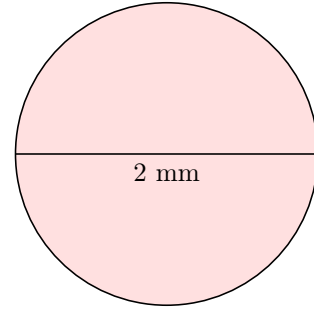*Answer:*

- The radius r is half of the diameter:

$$r = \frac{d}{2}$$
$$= \frac{10}{2}$$
$$= 5 \, \text{m}$$

- Using the formula for the perimeter (circumference) of a circle:

$$P = 2 \times \pi \times r$$
$$= 2 \times \pi \times 5$$
$$\approx 31.4159... \quad \text{(use calculator)}$$
$$\approx 31.4 \, \text{m} \quad \text{(round to 1 decimal place)}$$

So, the circumference is approximately 31.4 meters.

Ex 51: What is the circumference of the circle with a diameter of 2 millimeters?

2 mm

$\boxed{6.3}$ millimeters (round to 1 decimal place)

Answer:

- The radius r is half of the diameter:

$$r = \frac{d}{2}$$
$$= \frac{2}{2}$$
$$= 1 \, \text{mm}$$

- Using the formula for the perimeter (circumference) of a circle:

$$P = 2 \times \pi \times r$$
$$= 2 \times \pi \times 1$$
$$\approx 6.2832... \quad \text{(use calculator)}$$
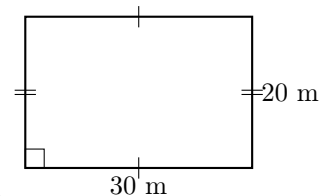$$\approx 6.3 \, \text{mm} \quad \text{(rounded to 1 decimal place)}$$

So, the circumference is approximately 6.3 millimeters.

D.3 SOLVING PROBLEMS

Ex 52: A farmer wants to build a fence around a rectangular field that measures 30 m by 20 m. The cost of the fence is 10 dollars per meter. What is the total cost to build the fence around the field?

$\boxed{1000}$ dollars

Answer:

20 m
30 m

- **Find the perimeter of the rectangular field:** Using the formula for the perimeter of a rectangle:

$$\text{Perimeter} = (2 \times l) + (2 \times w)$$
$$= (2 \times 30) + (2 \times 20)$$
$$= 60 \, \text{m} + 40 \, \text{m}$$
$$= 100 \, \text{m}$$

- **Calculate the cost of the fence:** The cost is 10 dollars per meter, and the perimeter is 100 m:

$$\text{Total cost} = \text{Perimeter} \times \text{Cost per meter}$$
$$= 100 \times 10$$
$$= 1\,000 \text{ dollars}$$

So, the total cost to build the fence is $1\,000$ dollars.

Ex 53: [calculator icon] A park manager wants to install a pathway of lights around a square park that has a side length of 50 m. The cost of installing the lights is 15 dollars per meter. What is the total cost to install the lights around the park?

$\boxed{3000}$ dollars

Answer:
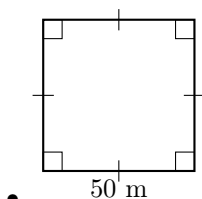
50 m

- **Find the perimeter of the square park:** Using the formula for the perimeter of a square:

$$\text{Perimeter} = 4 \times s$$
$$= 4 \times 50$$
$$= 200 \text{ m}$$

- **Calculate the cost of the lights:** The cost is 15 dollars per meter, and the perimeter is 200 m:

$$\text{Total cost} = \text{Perimeter} \times \text{Cost per meter}$$
$$= 200 \times 15$$
$$= 3\,000 \text{ dollars}$$

So, the total cost to install the lights is $3\,000$ dollars.

Ex 54: [calculator icon] A school wants to create a border of flowers around a rectangular garden that measures 40 m by 25 m. The cost of planting the flowers is 8 dollars per meter. What is the total cost to create the flower border around the garden?

$\boxed{1040}$ dollars

Answer:

25 m

40 m
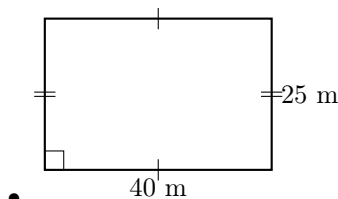
- **Find the perimeter of the rectangular garden:** Using the formula for the perimeter of a rectangle:

$$\text{Perimeter} = (2 \times l) + (2 \times w)$$
$$= (2 \times 40) + (2 \times 25)$$
$$= 80 \text{ m} + 50 \text{ m}$$
$$= 130 \text{ m}$$

- **Calculate the cost of the flower border:** The cost is 8 dollars per meter, and the perimeter is 130 m:

$$\text{Total cost} = \text{Perimeter} \times \text{Cost per meter}$$
$$= 130 \times 8$$
$$= 1\,040 \text{ dollars}$$

So, the total cost to create the flower border is $1\,040$ dollars.

Ex 55: [calculator icon] To celebrate a community event, children form a human chain to surround a square park with a side length of 50 m. If 2 children are needed per meter, how many children are required to surround the park?

$\boxed{400}$ children

Answer:
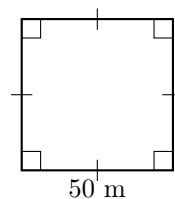
50 m

- **Find the perimeter of the square park:** Using the formula for the perimeter of a square:

$$\text{Perimeter} = 4 \times s$$
$$= 4 \times 50$$
$$= 200 \text{ m}$$

- **Calculate the number of children needed:** There are 2 children per meter, and the perimeter is 200 m:

$$\text{Total children} = \text{Perimeter} \times \text{Children per meter}$$
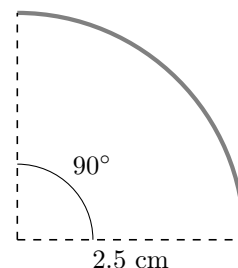$$= 200 \times 2$$
$$= 400 \text{ children}$$

So, the total number of children needed to surround the park is 400 children.

E LENGTH OF AN ARC

E.1 FINDING THE LENGTH OF ARCS

Ex 56: [calculator icon] Find the length of the arc:

90°

2.5 cm

$\boxed{3.9}$ cm (round to 1 decimal place)

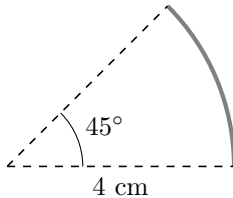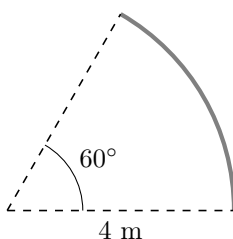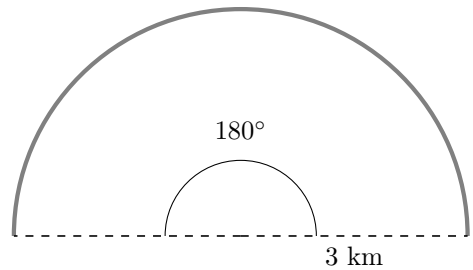*Answer:*

- Determine the fraction of the circle that the arc represents:

$$\text{Fraction} = \frac{\text{central angle}}{360}$$
$$= \frac{90}{360}$$
$$= \frac{1}{4}$$

- Multiply the full circumference by the fraction to find the arc length:

$$\text{Arc length} = \text{Fraction} \times \text{Circumference}$$
$$= \frac{1}{4} \times 2 \times \pi \times 2.5$$
$$\approx 3.9 \,\text{cm} \quad (\text{use calculator})$$

Ex 57: [calculator] Find the length of the arc:

45°

4 cm

$\boxed{3.1}$ cm (round at 1 decimal place)

Answer:

- Determine the fraction of the circle that the arc represents:

$$\text{Fraction} = \frac{\text{central angle}}{360}$$
$$= \frac{45}{360}$$
$$= \frac{1}{8}$$

- Multiply the full circumference by the fraction to find the arc length:

$$\text{Arc length} = \text{Fraction} \times \text{Circumference}$$
$$= \frac{1}{8} \times 2 \times \pi \times 4$$
$$\approx 3.1 \,\text{cm} \quad (\text{use calculator})$$

Ex 58: [calculator] Find the length of the arc:

60°

4 m

$\boxed{4.2}$ m (round to 1 decimal place)

Answer:

- Determine the fraction of the circle that the arc represents:

$$\text{Fraction} = \frac{\text{central angle}}{360}$$
$$= \frac{60}{360}$$
$$= \frac{1}{6}$$

- Multiply the full circumference by the fraction to find the arc length:

$$\text{Arc length} = \text{Fraction} \times \text{Circumference}$$
$$= \frac{1}{6} \times 2 \times \pi \times 4$$
$$\approx 4.2 \,\text{m} \quad (\text{use calculator})$$

Ex 59: [calculator] Find the length of the arc:

180°

3 km

$\boxed{9.4}$ km (round to 1 decimal place)

Answer:

- Determine the fraction of the circle that the arc represents:

$$\text{Fraction} = \frac{\text{central angle}}{360}$$
$$= \frac{180}{360}$$
$$= \frac{1}{2}$$

- Multiply the full circumference by the fraction to find the arc length:

$$\text{Arc length} = \text{Fraction} \times \text{Circumference}$$
$$= \frac{1}{2} \times 2 \times \pi \times 3$$
$$= \frac{1}{2} \times 6\pi$$
$$\approx 9.4 \,\text{km} \quad (\text{use calculator})$$

E.2 FINDING PERIMETER OF CIRCULAR SECTORS

Ex 60: [calculator] Find the perimeter of the quarter circle:

3 cm
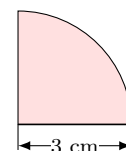
$P = \boxed{10.7}$ cm (round at 1 decimal place)

Answer:
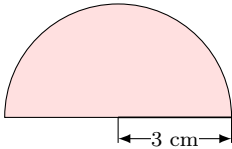

$P =$ quarter of the circle's circumference $+$ two radii

$= \dfrac{1}{4} \times 2 \times \pi \times 3 + 2 \times 3$

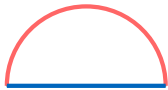$\approx 10.7 \, \text{cm}$ (rounded to 1 decimal place)

So, the perimeter of the quarter circle is approximately 10.7 cm.

Ex 61: Find the perimeter of the half circle:

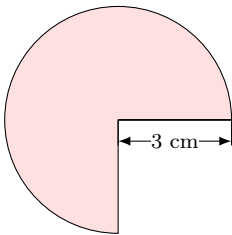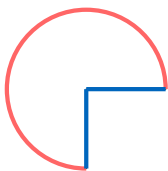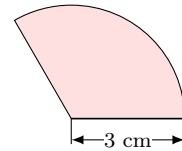
$P = \boxed{15.4}$ cm (round to 1 decimal place)

Answer:

$P =$ half of the circle's circumference $+$ diameter

$= \dfrac{1}{2} \times 2 \times \pi \times 3 + 2 \times 3$

$\approx 15.4 \, \text{cm}$ (rounded to 1 decimal place)

So, the perimeter of the half circle is approximately 15.4 cm.

Ex 62: Find the perimeter of the three-quarter circle:

$P = \boxed{20.1}$ cm (round to 1 decimal place)

Answer:

$P =$ three quarters of the circle's circumference $+$ two radii

$= \dfrac{3}{4} \times 2 \times \pi \times 3 + 2 \times 3$

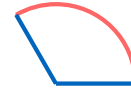$\approx 20.1 \, \text{cm}$ (rounded to 1 decimal place)

So, the perimeter of the three-quarter circle is approximately 20.1 cm.

Ex 63: Find the perimeter of the one-third circle:

$P = \boxed{12.3}$ cm (round to 1 decimal place)

Answer:

$P =$ one third of the circle's circumference $+$ two radii

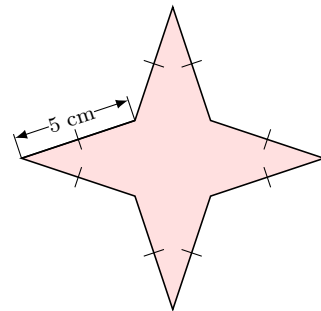$= \dfrac{1}{3} \times 2 \times \pi \times 3 + 2 \times 3$

$\approx 12.3 \, \text{cm}$ (rounded to 1 decimal place)

So, the perimeter of the one-third circle is approximately 12.3 cm.

F PERIMETER OF COMPOSITE FIGURES

F.1 FINDING THE PERIMETER OF COMPOSITE FIGURES: LEVEL 1

Ex 64: Find the perimeter of the star:

$P = \boxed{40}$ cm

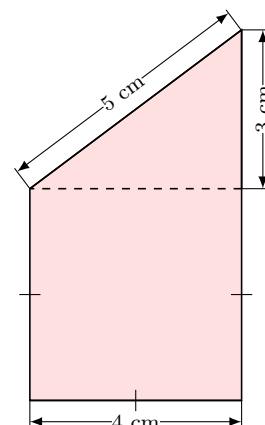*Answer:* The star has 8 equal outer sides, each measuring 5 cm, as shown by the marks.
To find the perimeter, add the lengths of all outer sides:
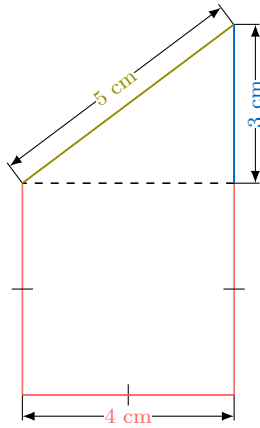
$$P = 8 \times 5$$
$$= 40 \, \text{cm}$$

So, the perimeter of the star is 40 cm.

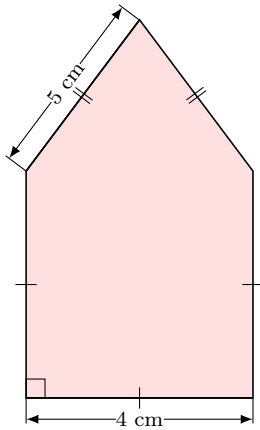**Ex 65:** Find the perimeter of the composite figure:
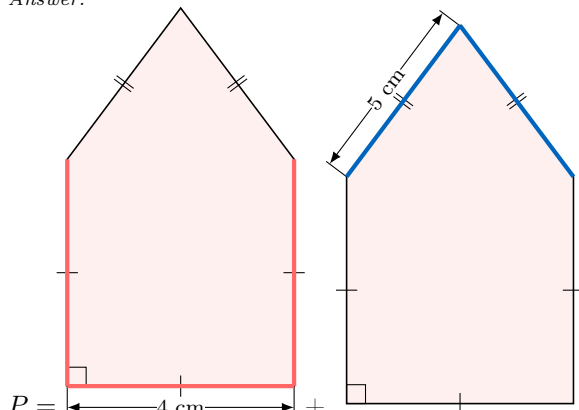
$$P = \boxed{20} \text{ cm}$$

Answer:

$$P = 3 \times 4 + 3 + 5$$
$$= 20 \text{ cm}$$

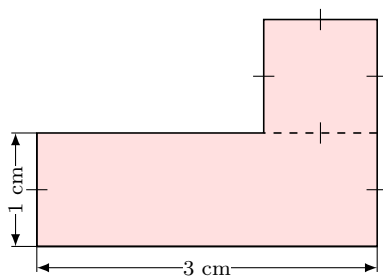**Ex 66:** Find the perimeter of the composite figure :
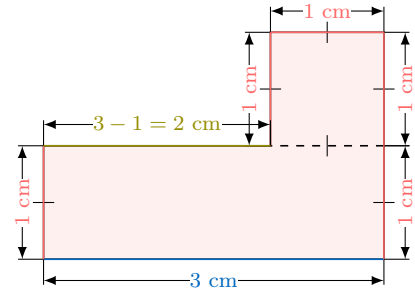

$$P = \boxed{22} \text{ cm}$$

Answer:

$$P = \underbrace{}_{4 \text{ cm}} +$$
$$P = 3 \times 4 \text{ cm} + 2 \times 5 \text{ cm}$$
$$P = 22 \text{ cm}$$

Ex 67: Find the perimeter of the figure:

$$P = \boxed{10} \text{ cm}$$

Answer:

$$P = 5 \times 1 + 3 + 2$$
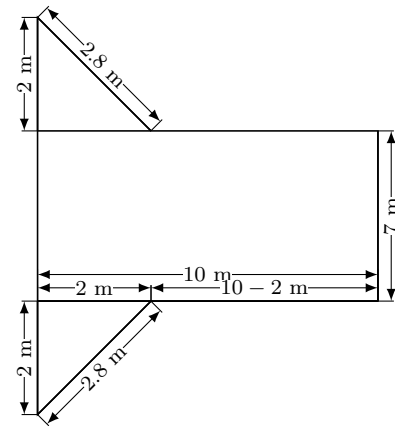$$= 10 \text{ cm}$$

So, the perimeter of the composite figure is 10 cm.

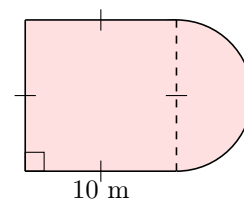**Ex 68:** Find the perimeter of the figure
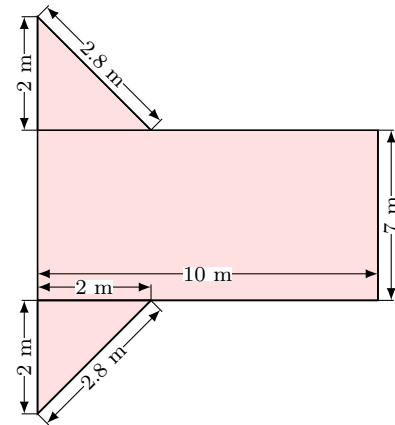
$$P = \boxed{39.6} \text{ m}$$

Answer:

$$P = 2 + 2.8 + (10 - 2) + 7 + (10 - 2) + 2.8 + 2 + 7$$
$$= 39.6 \text{ m}$$

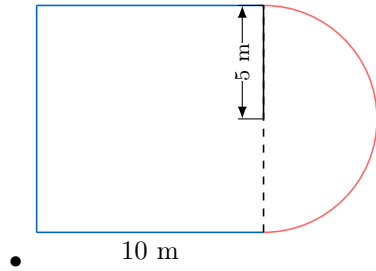**F.2 FINDING THE PERIMETER OF COMPOSITE FIGURES: LEVEL 2**

Ex 69: Find the perimeter of the composite figure:
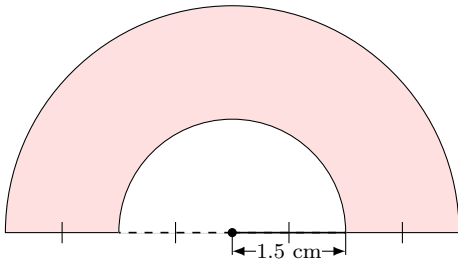
$P = \boxed{45.7}$ m (round to 1 decimal place)

Answer:

- The diameter of the circle is 10 m. So the radius is $10 \div 2 = 5$ m.

10 m

-

-

$$P = \text{three sides} + \text{length of semicircle}$$
$$= 3 \times 10 + \frac{1}{2} \times 2 \times \pi \times 5$$
$$\approx 45.7 \text{ m}$$

So, the perimeter of the composite figure is approximately 45.7 m.
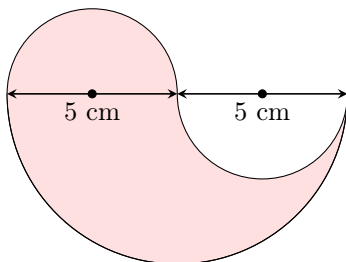
Ex 70: Find the perimeter of the composite figure:

←1.5 cm→

$P = \boxed{17.1}$ cm (round to 1 decimal place)

Answer: Radius of the large circle $= 2 \times 1.5 = 3$ cm.

$$P = \text{half the perimeter of the large circle}$$
$$+ \text{ half the perimeter of the small circle} + 2 \times 1.5$$
$$= \frac{2\pi \times 3}{2} + \frac{2\pi \times 1.5}{2} + 2 \times 1.5 \text{ cm}$$
$$\approx 17.1 \text{ cm}$$
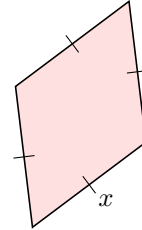
Ex 71: Find the perimeter of the composite figure:

5 cm   5 cm

$P = \boxed{31.4}$ cm (round to 1 decimal place)

Answer: Radius of the small circle $= 5 \div 2 = 2.5$ cm.

$$P = \text{half the perimeter of the large circle}$$
$$+ 2 \times \text{half the perimeter of the small circle}$$
$$= \frac{1}{2} \times 2\pi \times 5 + 2 \times \frac{1}{2} \times 2\pi \times 2.5$$
$$\approx 31.4 \text{ cm}$$

F.3 BUILDING EXPRESSIONS

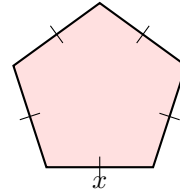**MCQ 72:** Write a formula for the perimeter of the figure:

x

☒ $P = 4x$

☐ $P = x$

☐ $P = 3x$

☐ $P = 2$ cm

Answer:

$$\text{P} = x + x + x + x$$
$$= 4x$$

MCQ 73: Write a formula for the perimeter of the figure:

x

☐ $P = 4x$

☐ $P = x$

☒ $P = 5x$

☐ $P = 2$ cm

Answer:

$$\text{P} = x + x + x + x + x$$
$$= 5x$$

MCQ 74: Write a formula for the perimeter of the figure:

$2x$

x
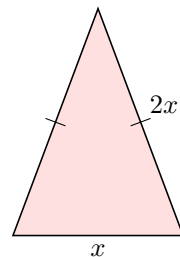
☐ $P = x$

☒ $P = 5x$

☐ $P = 3x$

☐ $P = 2$ cm

Answer:

$$P = 2x + 2x + x$$
$$= 5x$$

MCQ 75: Write a formula for the perimeter of the figure:
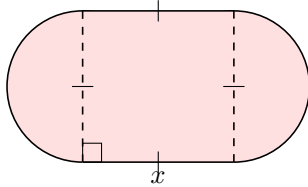
☐ $P = 3.14$

☐ $P = 2\pi x$

☐ $P = 2x + 2\pi x$

☒ $P = 2x + \pi x$

Answer: The radius of each circle is $\frac{x}{2}$.

$$P = \text{two sides} + \text{perimeter of two semicircles}$$
$$= 2x + 2 \times \left(\frac{1}{2} \times 2 \times \pi \times \frac{x}{2} \right)$$
$$= 2x + \pi x$$

So, the correct answer is $P = 2x + \pi x$.