SCALE DIAGRAMS

A DEFINITIONS

A.1 FINDING THE SCALE

Ex 1: For the scale 1:200, find the scale factor.

$\boxed{200}$

Answer:

- A scale is a ratio expressed as 1:scale factor.
- Therefore, the scale factor is 200.

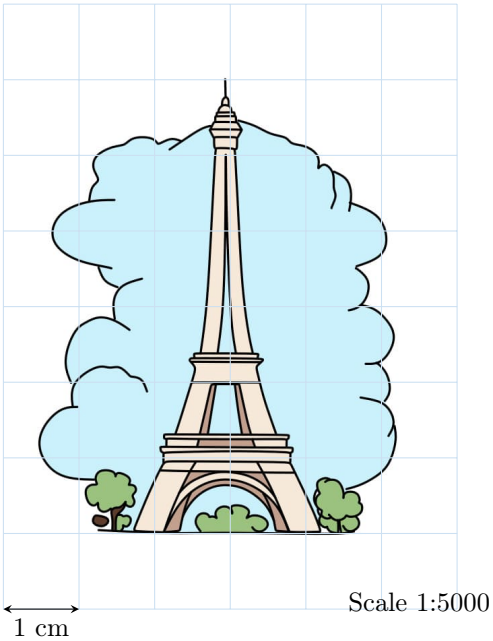
Ex 2: For the scale 1:500, find the scale factor.

$\boxed{500}$

Answer:

- A scale is a ratio expressed as 1:scale factor.
- Therefore, the scale factor is 500.

Ex 3:



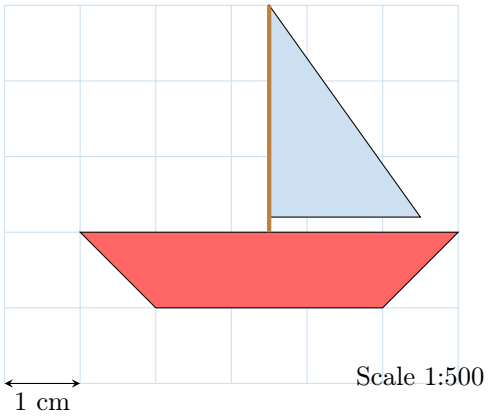
For this scale diagram, find the scale factor.

$\boxed{5000}$

Answer:

- A scale is a ratio expressed as 1:scale factor.
- Therefore, the scale factor is 5000.

Ex 4:



For this scale diagram, find the scale factor.

$\boxed{500}$

Answer:

- A scale is a ratio expressed as 1:scale factor.
- Therefore, the scale factor is 500.

B FORMULAE

B.1 FINDING LENGTHS USING FORMULAE

Ex 5: For the scale 1:200, 6 m of actual length represents $\boxed{3}$ cm of drawn length.

Answer:

$$\begin{aligned}\text{Drawn length} &= \frac{\text{Actual length}}{\text{Scale factor}} \\ &= \frac{6\text{ m}}{200} \\ &= \frac{600\text{ cm}}{200} \quad \text{(unit conversion)} \\ &= 3\text{ cm}\end{aligned}$$

Ex 6: For the scale 1:500, a drawn length of 4 cm represents an actual length of $\boxed{20}$ meters.

Answer:

$$\begin{aligned}\text{Actual length} &= \text{Drawn length} \times \text{Scale factor} \\ &= 4\text{ cm} \times 500 \\ &= 2000\text{ cm} \quad \text{(unit conversion)} \\ &= 20\text{ m}\end{aligned}$$

Ex 7: For the scale 1:1000, a drawn length of 2 cm represents an actual length of $\boxed{20}$ meters.

Answer:

$$\begin{aligned}\text{Actual length} &= \text{Drawn length} \times \text{Scale factor} \\ &= 2\text{ cm} \times 1000 \\ &= 2000\text{ cm} \quad \text{(unit conversion)} \\ &= 20\text{ m}\end{aligned}$$

Ex 8: A drawn length of 4 cm represents an actual length of 8 m. Find the scale.

1:$\boxed{200}$

Answer:

$$\begin{aligned}\text{Scale factor} &= \frac{\text{Actual length}}{\text{Drawn length}} \\ &= \frac{8\text{ m}}{4\text{ cm}} \\ &= \frac{800\text{ cm}}{4\text{ cm}} \quad \text{(converting to the same units)} \\ &= 200\end{aligned}$$

Ex 9: For the scale 1:500, 10 m of actual length represents $\boxed{2}$ cm of drawn length.

Answer:

$$\begin{aligned}\text{Drawn length} &= \frac{\text{Actual length}}{\text{Scale factor}} \\ &= \frac{10\text{ m}}{500} \\ &= \frac{1000\text{ cm}}{500} \quad \text{(unit conversion)} \\ &= 2\text{ cm}\end{aligned}$$

Ex 10: For the scale 1:1000, 5 m of actual length represents $\boxed{0.5}$ cm of drawn length.

Answer:

$$\begin{aligned}\text{Drawn length} &= \frac{\text{Actual length}}{\text{Scale factor}} \\ &= \frac{5\text{ m}}{1000} \\ &= \frac{500\text{ cm}}{1000} \quad \text{(unit conversion)} \\ &= 0.5\text{ cm}\end{aligned}$$

Ex 11: For the scale 1:100 000, a drawn length of 5 cm represents an actual length of $\boxed{5}$ kilometers.

Answer:

$$\begin{aligned}\text{Actual length} &= \text{Drawn length} \times \text{Scale factor} \\ &= 5\text{ cm} \times 100\,000 \\ &= 500\,000\text{ cm} \\ &= \frac{500\,000}{100\,000}\text{ km} \quad \text{(unit conversion)} \\ &= 5\text{ km}\end{aligned}$$

Ex 12: A drawn length of 3 cm represents an actual length of 9 m. Find the scale.

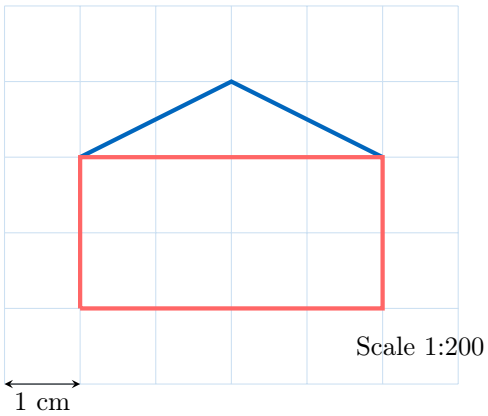
1:$\boxed{300}$

Answer:

$$\begin{aligned}\text{Scale factor} &= \frac{\text{Actual length}}{\text{Drawn length}} \\ &= \frac{9\text{ m}}{3\text{ cm}} \\ &= \frac{900\text{ cm}}{3\text{ cm}} \quad \text{(converting to the same units)} \\ &= 300\end{aligned}$$

B.2 FINDING THE ACTUAL LENGTHS IN SCALE DIAGRAMS

Ex 13:



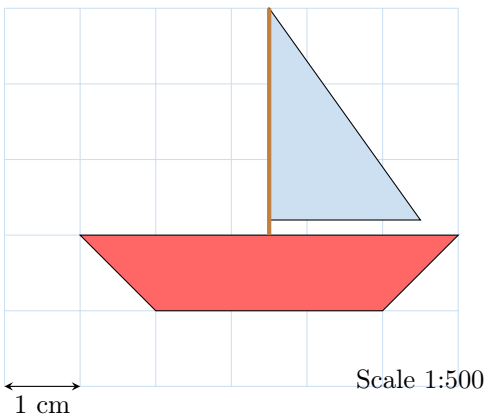
Find the actual width of the house.

$\boxed{8}$ m

Answer:

- The drawn width of the house is 4 cm.
- $\begin{aligned}\text{Actual width} &= \text{Drawn width} \times \text{Scale factor} \\ &= 4\text{ cm} \times 200 \\ &= 800\text{ cm} \\ &= 8\text{ m}\end{aligned}$
- The actual width of the house is 8 meters.

Ex 14:



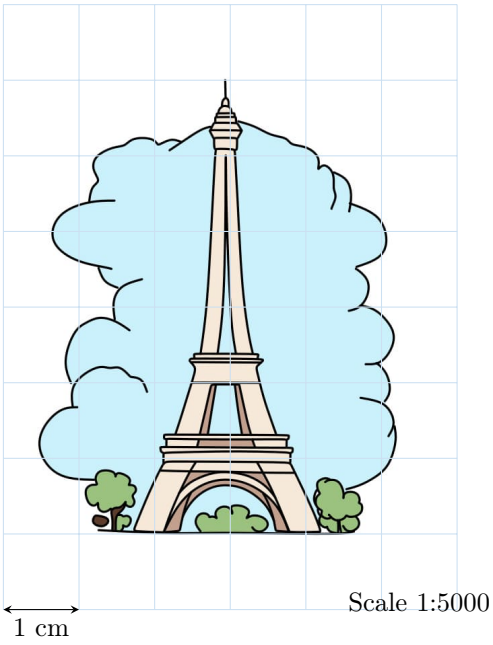
Find the actual length of the boat.

$\boxed{25}$ m

Answer:

- The drawn length of the boat is 5 cm.
- Actual length = Drawn length × Scale factor
  = 5 cm × 500
  = 2500 cm
  = 25 m
- The actual length of the boat is 25 meters.

Ex 15:



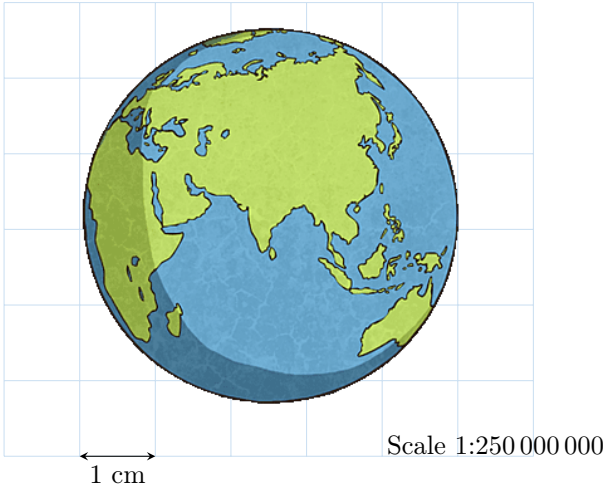
Find the actual height of the Eiffel Tower.

$\boxed{300}$ m

Answer:

- The drawn height of the Eiffel Tower is 6 cm.
- Actual height = Drawn height × Scale factor
  = 6 cm × 5000
  = 30 000 cm
  = 300 m
- The actual height of the Eiffel Tower is 300 meters.

Ex 16:



Find the actual diameter of the Earth.

$\boxed{12500}$ km

Answer:

- The drawn diameter of the Earth is 5 cm.
- Actual diameter = Drawn diameter × Scale factor
  = 5 cm × 250 000 000
  = 1 250 000 000 cm
  $= \frac{1\,250\,000\,000}{100\,000}$ km
  = 12 500 km
- The actual diameter of the Earth is 12 500 km.

B.3 CHOOSING THE BEST SCALE FOR A DIAGRAM

MCQ 17: You want to draw a scale diagram of your bedroom, which measures 5 m by 5 m, on a piece of white paper. The paper is 20 cm by 30 cm. Which of the following scales would be the best choice to fit your entire bedroom on the paper?

☐ 1:10

☒ 1:100

☐ 1:1000

Answer:

- Convert the actual room dimensions to the drawn dimensions for each scale.
  - **Scale** 1:10**:**
    $$\text{Drawn length} = \frac{5\text{ m}}{10} = 0.5\text{ m} = 50\text{ cm}$$
  - **Scale** 1:100**:**
    $$\text{Drawn length} = \frac{5\text{ m}}{100} = 0.05\text{ m} = 5\text{ cm}$$
  - **Scale** 1:1000**:**
    $$\text{Drawn length} = \frac{5\text{ m}}{1000} = 0.005\text{ m} = 0.5\text{ cm}$$
- Compare the drawn dimensions with the paper size (20 cm by 30 cm).
  - 1:10 is too large to fit on the paper (50 cm by 50 cm).
  - 1:100 fits easily (5 cm by 5 cm).
  - 1:1000 also fits, but it would be too small (0.5 cm by 0.5 cm).
- The best scale to choose is 1:100.

MCQ 18: You want to draw a scale diagram of your square garden, which measures 10 m by 10 m, on a piece of white paper. The paper is 20 cm by 30 cm. Which of the following scales would be the best choice to fit your entire garden on the paper?

☐ 1:20

☒ 1:200

☐ 1:2000

Answer:

- Convert the actual garden dimensions to the drawn dimensions for each scale.
  - **Scale** 1:20**:**

$$\text{Drawn length} = \frac{10 \text{ m}}{20} = 0.5 \text{ m} = 50 \text{ cm}$$

  - **Scale** 1:200**:**

$$\text{Drawn length} = \frac{10 \text{ m}}{200} = 0.05 \text{ m} = 5 \text{ cm}$$

  - **Scale** 1:2000**:**

$$\text{Drawn length} = \frac{10 \text{ m}}{2000} = 0.005 \text{ m} = 0.5 \text{ cm}$$

- Compare the drawn dimensions with the paper size (20 cm by 30 cm).
  - 1:20 is too large to fit on the paper (50 cm by 50 cm).
  - 1:200 fits easily (5 cm by 5 cm).
  - 1:2000 also fits, but it would be too small (0.5 cm by 0.5 cm).
- The best scale to choose is 1:200.

MCQ 19: You want to draw a scale diagram of a swimming pool that measures 50 m by 20 m on a piece of white paper. The paper is 25 cm by 35 cm. Which of the following scales would be the best choice to fit the entire swimming pool on the paper?

☐ 1:50

☒ 1:200

☐ 1:500

Answer:

- Convert the actual pool dimensions to the drawn dimensions for each scale.
  - **Scale** 1:50**:**

$$\text{Drawn length} = \frac{50 \text{ m}}{50} = 1 \text{ m} = 100 \text{ cm}$$

$$\text{Drawn width} = \frac{20 \text{ m}}{50} = 0.4 \text{ m} = 40 \text{ cm}$$

  - **Scale** 1:200**:**

$$\text{Drawn length} = \frac{50 \text{ m}}{200} = 0.25 \text{ m} = 25 \text{ cm}$$

$$\text{Drawn width} = \frac{20 \text{ m}}{200} = 0.1 \text{ m} = 10 \text{ cm}$$

  - **Scale** 1:500**:**

$$\text{Drawn length} = \frac{50 \text{ m}}{500} = 0.1 \text{ m} = 10 \text{ cm}$$

$$\text{Drawn width} = \frac{20 \text{ m}}{500} = 0.04 \text{ m} = 4 \text{ cm}$$

- Compare the drawn dimensions with the paper size (25 cm by 35 cm).
  - 1:50 is too large to fit on the paper (100 cm by 40 cm).
  - 1:200 fits easily (25 cm by 10 cm).
  - 1:500 also fits, but it would be small (10 cm by 4 cm).
- The best scale to choose is 1:200.