

# Percentage Error

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Error in relation to the true value

$$\text{Relative Error} = \frac{\text{Error}}{\text{True Value}}$$

the error is always positive.

$$\text{Percentage Error} = \frac{\text{Error}}{\text{True Value}} \times 100 = \%$$

$$\text{Error} = \text{Estimated value (incorrect value)} - \text{True value (accurate value)}$$



T&T3 5.4



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**PROJECT MATHS**

# Text & Tests

Leaving **3** Certificate

chapter

**5**

**Arithmetic**

**Section 5.4 Percentage error**

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### Example 1

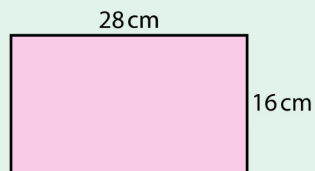
To calculate the value of  $121 + 46 + 37 + 26$ , Robbie made a rough estimate of the answer by rounding each number to the nearest 10 and adding the results. Calculate his percentage error.

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### Example 2

The length and breadth of this rectangle are measured to the nearest centimetre.

- Find (i) the maximum perimeter of the rectangle  
(ii) the minimum perimeter of the rectangle.



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#### Exercise 5.4

- Eq. 1. The length of a metal bar was estimated to be 50 cm.  
If the true length was 46 cm, calculate the percentage error, correct to one decimal place.

$$\text{Est value} = 50 \text{ cm}$$

$$\text{True value} = 46 \text{ cm}$$

$$\begin{aligned} \text{Error} &= \text{Est} - \text{True} \\ 50 - 46 &= 4 \text{ cm} \end{aligned}$$

$$\% \text{ Error} = \frac{\text{Error}}{\text{True value}} \times 100 \Rightarrow \frac{4}{46} \times 100 = 8.\overset{\circ}{6}9$$

8.7%

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#### Exercise 5.4

2. The estimate to repair a car was €600. If the final cost was €650, calculate the percentage error, correct to one decimal place.

$$\text{Est} = 600$$

$$\text{True} = 650$$

$$\text{Error} = 650 - 600 = 50$$

$$\% \text{ Error} = \frac{50}{650} \times 100 = 7.7\%$$

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### Exercise 5.4

3. The attendance at a football match was estimated to be 8000.  
If the true attendance was 7640, calculate the percentage error, correct to one decimal place.

$$\begin{array}{r} \text{Est } 8000 \\ - \text{True } 7640 \\ \hline \text{Error } 360 \end{array}$$

$$\begin{aligned} \% \text{ Error } &= \frac{360}{7640} \times 100 \\ &= 4.7\% \end{aligned}$$

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### Exercise 5.4

4. The answer to  $3.58 + 2.47$  was given as <sup>est</sup>6.5.  
What was the percentage error, correct to one decimal place?

$$\begin{array}{r} 3.58 \\ + 2.47 \\ \hline 6.05 \text{ True value} \end{array}$$

$$\begin{aligned} \% \text{ Error} &= \frac{.45}{6.05} \times 100 \\ &= 7.4\% \end{aligned}$$

$$\begin{aligned} \text{Est} - \text{True} &= \text{Error} \\ 6.5 - 6.05 &= .45 \end{aligned}$$

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### Exercise 5.4

5. A person used 300 as an approximation for  $\frac{89.37 \times 3.05}{0.92}$ . *Calc.*

Find the percentage error, correct to one decimal place.

$$296.28 \text{ True}$$

$$300 \text{ Est}$$

$$\text{Error } 300 - 296.28 = 3.72$$

$$\frac{3.72}{296.28} \times 100 = 1.3\%$$

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### Exercise 5.4

6. Four items in a supermarket cost €3.70, €5.45, €7.40 and €12.10.
- Barry estimates the total cost by ignoring the cent part in the cost of each item. Calculate the percentage error in his estimate, correct to one decimal place.
  - Ann estimates the total cost by rounding the cost of each item to the nearest euro. Calculate the percentage error in her estimate, correct to one decimal place.

$$\text{Est } 3 + 5 + 7 + 12 = 27$$

$$\text{True } 28.65$$

$$\text{Error} = \text{True} - \text{Est}$$

$$28.65 - 27 = 1.65$$

$$\frac{1.65}{28.65} \times 100 = 5.8\%$$

$$\text{ii) } 4 + 5 + 7 + 12 = 28$$

$$\text{Error} = 28.65 - 28 = 0.65$$

$$\frac{0.65}{28.65} \times 100 = 2.3\%$$

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### Exercise 5.4

7. The area of a circle of diameter 14 cm is estimated to be  $150 \text{ cm}^2$ .  
Taking  $\pi = \frac{22}{7}$ , find the true value of the area of the circle.  $\pi r^2$   
Hence find the percentage error in the estimate, correct to one decimal place.

$$\text{Diameter} = 14$$

$$\text{Radius} = \frac{14}{2} = 7$$

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### Exercise 5.4

8. A temperature can be measured as °Fahrenheit ( $F$ ) or °Celsius ( $C$ ).  
The exact relationship between  $F$  and  $C$  is given by

$$F = \frac{9}{5}C + 32$$

An approximate relationship between  $F$  and  $C$  is given by the following rule:

'To find  $F$ , add 15 to  $C$  and double your answer.'

- Find the value of  $F$  when  $C$  is 20 using the exact relationship formula.
- If the approximate relationship is used when  $C = 20$ , calculate the percentage error correct to one decimal place.

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#### Exercise 5.4

9. Garry measured the length of a basketball court to be 28 m and the width of the court to be 15 m, both correct to the nearest metre.
- (i) Write down the maximum length the court could be.
  - (ii) Write down the minimum length the court could be.
  - (iii) Calculate the maximum area the court could be.

#### Exercise 5.4

10. Richard measured the length and breadth of his back garden, correct to the nearest metre.
- He found the length was 27 metres and the breadth was 16 metres.
- (i) Find the maximum perimeter of the garden.
  - (ii) Find the minimum area of the garden.



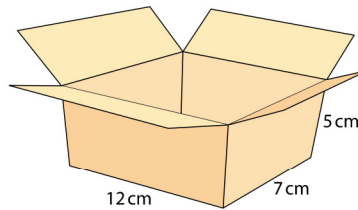
### Exercise 5.4

11. David picks strawberries at the rate of 2.8 kg per minute, correct to one decimal place.
- Write down the maximum possible weight that David picks every minute.
  - Find the minimum possible weight that David picks in one **hour**.
  - One day David worked for 3 hours 15 minutes.  
Find the maximum possible weight of strawberries that David could have picked in that time.

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### Exercise 5.4

12. The length, width and height of this box are measured to the nearest centimetre.
- Write down the maximum length of the box.
  - Calculate the maximum volume of the box.
  - Calculate the difference between the maximum and minimum volumes of the box.  
Give your answer correct to the nearest  $\text{cm}^3$ .
  - The correct volume of the box is  $450 \text{ cm}^3$ .  
Find the percentage error in the volume of the box if the maximum possible volume is taken.  
Give your answer correct to 1 decimal place.



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Answers 5.4

1. 8.7%                      2. 7.7%                      3. 4.7%
4. 7.4%                      5. 1.3%
6. (i) 5.8%                      (ii) 2.3%
7. 2.6%
8. (i)  $F = 68^\circ$                       (ii) 2.9%
9. (i) 28.5 m                      (ii) 27.5 m                      (iii)  $441\frac{3}{4} \text{ m}^2$
10. (i) 88 m                      (ii)  $410\frac{3}{4} \text{ m}^2$
11. (i) 2.85 kg                      (ii) 165 kg                      (iii)  $555\frac{3}{4} \text{ kg}$
12. (i) 12.5 cm                      (ii)  $515\frac{5}{8} \text{ cm}^3$
- (iii)  $179\frac{1}{4} \text{ cm}^3$                       (iv) 14.6%