



# Equations, Inequalities, Perimeter, Area and Volume

# 7

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**Focus:** A set of questions and solutions for Year 7 students focused on 'Equations, Inequalities, Perimeter, Area, and Volume' under the "Algebra, and Measurement and Space" strand, tailored to the Australian Curriculum:

## 1. Understanding Equations:

a) Define what an equation is. Give an example.

**Solution:**

An equation is a mathematical statement that two expressions are equal.

Example:  $2x + 3 = 7$ .

b) What does it mean to solve an equation?

**Solution:**

Solving an equation means finding the value(s) of the variable(s) that make the equation true.

## 2. Solving Simple Linear Equations:

a) Solve for  $x$  in the equation  $x + 5 = 12$ .

**Solution:**

Subtract 5 from both sides:

$$x + \cancel{5} = 12 - 5,$$

$$x = 7.$$



**b) Solve  $3y - 4 = 8$ .**

**Solution:**

Add 4 to both sides, then divide by 3:

$$3y - \cancel{4} = 8 + 4,$$

$$\cancel{3}y = \frac{12}{\cancel{3}},$$

$$y = \frac{12}{3}$$

$$= 4.$$

### 3. Understanding Inequalities:

**a) Explain the difference between an equation and an inequality.**

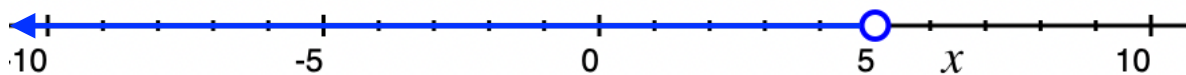
**Solution:**

An equation states that two expressions are equal, while an inequality states that one expression is less than, greater than, less than or equal to, or greater than or equal to another expression.

**b) What does  $x < 5$  mean on a number line?**

**Solution:**

All numbers less than 5 (open circle on 5, arrow pointing left).



### 4. Solving Inequalities:

**a) Solve the inequality  $x - 3 > 2$ .**

**Solution:**

Add 3 to both sides:

$$x - 3 > 2$$

$$\rightarrow x - \cancel{3} + \cancel{3} > 2 + 3,$$

$$x > 5.$$



**b) Solve  $2y \leq 0$ .**

**Solution:**

Divide both sides by 2:

$$\frac{2y}{2} \leq \frac{0}{2}$$

$$y \leq 0.$$

## 5. Word Problems Involving Equations:

**a) If 5 books cost \$60, how much does one book cost?**

**Solution:**

Set up the equation  $5x = 60$ , solve for  $x$ :

$$\frac{5x}{5} = \frac{60}{5}$$

$$x = 12.$$

$\therefore$  One book costs \$12.

**b) Sarah has \$20. She wants to buy pencils that cost \$2 each. How many pencils can she buy?**

**Solution:**

Solve:

$$\frac{2x}{2} \leq \frac{20}{2}$$

$$\rightarrow x \leq 10.$$

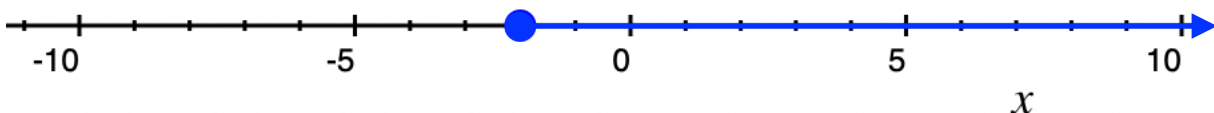
$\therefore$  Sarah can buy at most 10 pencils.

## 6. Graphing Inequalities:

**Graph  $x \geq -2$  on a number line.**

**Solution:**

Draw a closed circle at  $-2$  and extend the line to the right to show all values greater than or equal to  $-2$ .





## 7. Combining Equations and Inequalities:

If  $x + 4 = 9$ , what is the value of  $x$ ? Is this value also a solution to  $x > 5$ ?

**Solution:**

Solve the equation:

$$x + 4 = 9$$

$$x = 9 - 4$$

$$x = 5$$

Since 5 is *not* greater than 5,

$\therefore x = 5$  is *not* a solution to  $x > 5$ .

## 8. Understanding Perimeter:

a) Define perimeter. How is it different from area?

**Solution:**

Perimeter is the distance around the outside of a shape. It differs from area, which is the measure of the space inside a shape.

b) Find the perimeter of a rectangle with length 5 cm and width 3 cm.

**Solution:**

$$\begin{aligned} \text{Perimeter} &= 2 \times (\text{length} + \text{width}) \\ &= 2 \times (5 + 3) \\ &= 16 \text{ cm} . \end{aligned}$$

## 9. Calculating Area:

a) What is area? Give an example of an area calculation for a square.

**Solution:**

Area is the amount of space inside a two-dimensional shape. For a square with side length of 4 cm, the area is  $4 \times 4 = 4^2 = 16 \text{ cm}^2$ .

b) Calculate the area of a triangle with base 6 cm and height 4 cm.

**Solution:**

$$\begin{aligned} \text{Area of a triangle} &= \frac{1}{2} \times \text{base} \times \text{height} \\ &= \frac{1}{2} \times 6 \times 4 \\ &= 12 \text{ cm}^2 . \end{aligned}$$



## 10. Volume of Prisms:

a) Define volume. How do you find the volume of a rectangular prism?

**Solution:**

Volume is the measure of the space inside a three-dimensional shape. For a rectangular prism,  
volume = length  $\times$  width  $\times$  height.

b) Calculate the volume of a rectangular prism with dimensions  $5\text{ cm}$ ,  $3\text{ cm}$ , and  $2\text{ cm}$ .

**Solution:**

$$\begin{aligned}\text{Volume} &= 5 \times 3 \times 2 \\ &= 30\text{ cm}^3.\end{aligned}$$

## 11. Perimeter and Area of Composite Shapes:

a) Find the perimeter of a shape made from a rectangle (length  $8\text{ cm}$ , width  $3\text{ cm}$ ) with a semi-circle on one end (diameter equal to the width of the rectangle).

**Solution:**

Perimeter = Two sides of rectangle + arc of semi-circle:

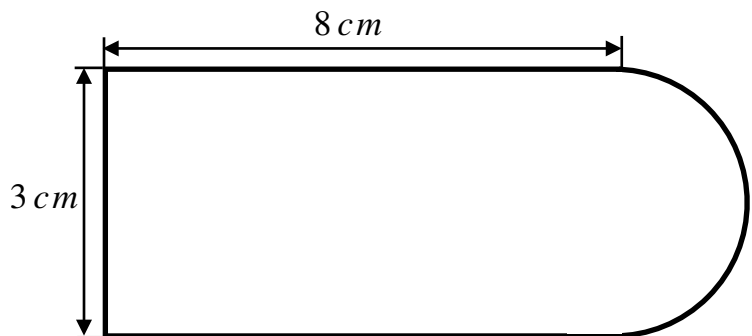
Rectangle part:  $8 + 3 = 11\text{ cm}$ ,

Semi-circle arc:

$$\frac{1}{2} \times \pi \times 3 = \frac{3\pi}{2}\text{ cm},$$

Total perimeter:

$$\begin{aligned}&\approx 11 + \frac{3\pi}{2} \\ &\approx 11 + 4.71 \\ &= 15.71\text{ cm}.\end{aligned}$$





**b) Calculate the area of the same composite shape.**

**Solution:**

Rectangle area:

$$8 \times 3$$

$$= 24 \text{ cm}^2,$$

Semi-circle area :

$$\frac{1}{2} \times \pi \times \left(\frac{3}{2}\right)^2$$

$$= \frac{\pi \times 9}{8}$$

$$= \frac{9\pi}{8} \text{ cm}^2,$$

Total Area :

$$\approx 24 + \frac{9\pi}{8}$$

$$\approx 24 + 3.53$$

$$= 27.53 \text{ cm}^2.$$

## 12. Word Problems Involving Volume:

**A fish tank has dimensions 60 cm by 30 cm by 40 cm . How many litres of water can it hold?**

**Solution:**

Volume in  $\text{cm}^3$ :

$$= 60 \times 30 \times 40$$

$$= 72000 \text{ cm}^3.$$

Since, 1 litre = 1,000  $\text{cm}^3$

(Remember, 1 L = 10 cm × 10 cm × 10 cm = 1000  $\text{cm}^3$ )

$$\rightarrow 72,000 \text{ cm}^3$$

$$= \frac{72,000 \cancel{\text{cm}^3}}{1,000 \cancel{\text{cm}^3}}$$

$$= \frac{72}{1}$$

$$= 72 \text{ litres}.$$



### 13. Conversion between Units:

Convert an area from  $500 \text{ cm}^2$  to  $\text{m}^2$ .

**Solution:**

Since,  $1 \text{ m}^2 = 10,000 \text{ cm}^2$  (Remember :  $1 \text{ m}^2 = 100 \text{ cm} \times 100 \text{ cm} = 10,000 \text{ cm}^2$ )

$$\begin{aligned} &\rightarrow 500 \text{ cm}^2 \\ &= \frac{500}{10,000} \text{ m}^2 \\ &= 0.05 \text{ m}^2. \end{aligned}$$

### 14. Practical Application:

If you need to cover a floor with tiles, each tile covering  $0.25 \text{ m}^2$ , how many tiles are needed for a room that is  $4 \text{ m}$  by  $5 \text{ m}$ ?

**Solution:**

$$\begin{aligned} \text{Room area:} \\ &= 4 \times 5 \\ &= 20 \text{ m}^2. \end{aligned}$$

$$\begin{aligned} \text{Number of tiles:} \\ &= \frac{20}{0.25} \\ &= 80 \text{ tiles.} \end{aligned}$$



## Additional Notes for Teachers:

**Learning Outcomes:** Students should be able to solve simple linear equations, understand and solve basic inequalities, and apply these concepts to real-world problems. Students should be proficient in calculating perimeters, areas, and volumes of basic shapes, understanding the relationship between these measurements, and applying them in real-life contexts.

**Teaching Strategies:** Use physical models or digital tools to visualise shapes and their measurements. Engage students in hands-on activities like measuring classroom objects or designing their own spaces. Encourage students to compare and estimate measurements to check the reasonableness of their calculations. Use balance scales to visually represent how operations maintain equality in equations. Use number lines for graphing inequalities to help visualise solutions. Encourage students to check their solutions by substituting back into the original equation or inequality.

**Assessment:** Evaluate students' understanding through practical tasks, problem-solving, and accuracy in measurement conversions.

**Resources:** Use geometric sets, 3D models, or area and volume apps to aid in teaching these concepts. Employ algebra balance scales, number line tools, or digital graphing apps to make concepts more tangible.

This question set aligns with the Australian Curriculum for Year 7, focusing on the key proficiencies of understanding, fluency, problem-solving, and reasoning in the context of measurement and geometry.

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