Pan Lloyds Junior Secondary Mathematics New Syllabus Exercises (Book 1)
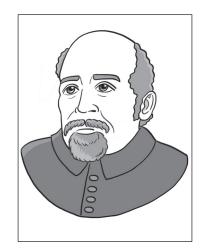
4. Using Algebra to Solve Problems

Name: _____ Class: _____

� Mathematics Corner

The origin of the equality sign

The equality sign '=' was invented by Welsh mathematician Robert Recorde in 1557 in his book 'The Whetstone of Witte'. To avoid the tedious repetition of the word 'equal to', Recorde created two wide horizontal parallel lines to denote mathematical equivalence. Over time, these two lines evolved into the equality sign we use today. Robert Recorde's introduction of the equality sign was a major contribution to mathematical notation and symbolism.

Robert Recorde

Key Notes

1. Equations

(a) An **equation**（方程）is an algebraic expression which contain an **unknown**（未知數）and an equality sign '='. For example,

$$3x - 2 = 7$$

is an equation in the unknown x.

(b) The value of the unknown that satisfies an equation is called the **solution/root**（解/根）of the equation.

2. Techniques for Solving Equations

(a) Reversing operations

For each of the equations below, the solution is worked out by 'undoing' whatever has been done to the unknown. Equation (i) has an addition '+ 5', to 'undo it' we perform subtraction '− 5' on both sides of the equation.

(i) $\quad x + 5 = 6$

$\quad x + 5 - 5 = 6 - 5$

(ii) $\quad x - 4 = 6$

$\quad x - 4 + 4 = 6 + 4$

(iii) $3x = 6$

$$\dfrac{3x}{3} = \dfrac{6}{3}$$

(iv) $\quad \dfrac{x}{2} = 6$

$$\dfrac{x}{2} \times 2 = 6 \times 2$$

(b) Transposing terms

For example, $\quad x + 2 = 6 \qquad\qquad 5x = 4x + 7$

$\qquad\qquad\qquad x = 6 - 2 \qquad 5x - 4x = 7$

(c) Combining terms with the same unknown

For example, $6x - 5x = 9$

$\qquad\qquad x = 9$

(d) Removing brackets

For example, $\quad 4(x - 2) = 8$

$\qquad\quad 4 \times x - 4 \times 2 = 8$

$\qquad\qquad\quad 4x - 8 = 8$

(e) Eliminating denominators

For example, $\quad \dfrac{x}{2} - \dfrac{x}{3} = 4$

$\left(\dfrac{x}{2} - \dfrac{x}{3} \right) \times 6 = 4 \times 6$ ◄ Multiply both sides by the L.C.M. of the denominators 2 and 3.

$\qquad\quad 3x - 2x = 24$

3. Applications of Algebraic Equations

Guidelines for solving word problems:

Step 1   Identify and represent the unknown quantity by a letter.

Step 2   Set up an algebraic equation that models the problem.

Step 3   Solve the equation and check the solution.

Step 4   Answer the question.

Concept Check

Match the equations on the left with the solutions on the right.

(a) $x - 5 = 0$ •   • $x = 2$

(b) $x + 2 = 6$ •   • $x = 4$

(c) $\dfrac{x}{2} = 3$ •   • $x = 5$

(d) $4x = 8$ •   • $x = 6$

Step–by–Step Example

Example 1

Solve each of the following equations.

(a) $x + 4 = 7$ (b) $x - 11 = 12$

(c) $11x = 132$ (d) $\dfrac{x}{11} = 9$

Solution

(a) $x + 4 = 7$ (b) $x - 11 = 12$

   $x = 7 - 4$ $x = 12 + 11$

   $x = \underline{3}$ $x = \underline{23}$

(c) $11x = 132$

   $x = \dfrac{132}{11}$ (d) $\dfrac{x}{11} = 9$

   $x = \underline{12}$ $x = 9 \times 11$

                                             $x = \underline{99}$

Instant Practice 1

Solve each of the following equations.

(a) $x + 13 = 22$ (b) $x - 18 = 16$

   $x = 22 -$ $x = 16 +$

   $x =$ $x =$

Exercise

Level 0

7.1   Percentage, Part and Whole

1.   What percentage of 280 cm is 70 cm?

2.   Find the result of 55% of 80.

3.   Ivy's pocket money this month is $260. If she saves $39, what percentage of her pocket money this month does she save?

7.2   Percentage Change

4.   Complete the following table.

	Original value	New value	Increase	Percentage increase
(a)		120	40	
(b)	600			35%
(c)			120	60%
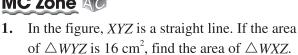
5.   Complete the following table.
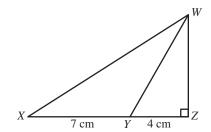
	Original value	New value	Decrease	Percentage decrease
(a)		75	25	
(b)	700			50%
(c)			20	10%

Revision

MC Zone

1. In the figure, XYZ is a straight line. If the area of $\triangle WYZ$ is 16 cm^2, find the area of $\triangle WXZ$.
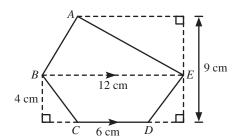
A. 28 cm^2

B. 33 cm^2

C. 44 cm^2

D. 55 cm^2
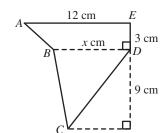
2. Find the area of polygon $ABCDE$ in the figure.
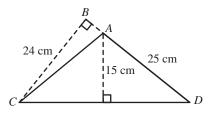
A. 54 cm^2

B. 66 cm^2

C. 70 cm^2

D. 72 cm^2

3. In the figure, if the area of trapezium $ABDE$ is the same as that of $\triangle BCD$, then $x =$
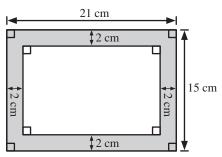
A. 6.

B. 7.

C. 8.

D. 9.

4. In the figure, BAD is a straight line. $\triangle ACD$ is an isosceles triangle with $AC = AD$. Find the perimeter of $\triangle ACD$.
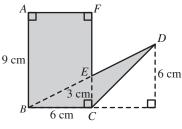
A. 40 cm

B. 86 cm

C. 90 cm

D. 98 cm

5. Find the area of the shaded region in the figure.

A. 68 cm^2

B. 106 cm^2

C. 128 cm^2

D. 187 cm^2

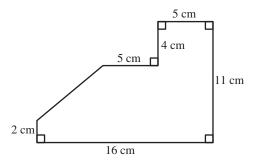**6.** In the figure, BED and CEF are straight lines. Find the area of the shaded region.

Hint

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A. 63 cm^2

B. 72 cm^2

C. 81 cm^2

D. 90 cm^2

CQ Zone 🖩

1. Find the area of the polygon in the figure.

5 cm

4 cm

5 cm

11 cm

2 cm

16 cm

2. The shaded region in the figure shows the floor plan of a theatre.

(a) Express the area of the theatre in terms of x.

(b) If the area of the theatre is 116 m^2, find the value of x.

19 m

9 m

x m

4 m

16 m