

## Year 9 Term 2 Homework Worked Solutions

<b>Student Name:</b> _____	<b>Grade:</b> _____
<b>Date:</b> _____	<b>Score:</b> _____

### Table of contents

<b>10</b>	<b>Year 9 Term 2 Week 10 Homework Worked Solutions</b>	<b>1</b>
10.1	Equations and inequations . . . . .	1
10.1.1	Equations with pronumerals on both sides . . . . .	1
10.1.2	Equations with grouping symbols . . . . .	2
10.1.3	Equations with one fraction . . . . .	3
10.1.4	Equations with more than one fraction . . . . .	4
10.1.5	Inequations . . . . .	5
10.2	Formulae . . . . .	6
10.2.1	Evaluate the subject of a formula . . . . .	6
10.2.2	Changing the subject of a formula . . . . .	7
10.3	Miscellaneous Exercises . . . . .	8
10.4	Maths Challenge . . . . .	10

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## 10 Year 9 Term 2 Week 10 Homework Worked Solutions

### 10.1 Equations and inequations

#### 10.1.1 Equations with pronumerals on both sides

Exercise 10.1.1 Solve each of the following equations:

1.  $3x + 12 = 5x - 24$

**Solution:**  $3x - 5x = -24 - 12 \Rightarrow -2x = -36 \Rightarrow x = 18.$

2.  $4x - 9 = 2x + 15$

**Solution:**  $4x - 2x = 15 + 9 \Rightarrow 2x = 24 \Rightarrow x = 12.$

3.  $7x - 26 = 2 + 19x$

**Solution:**  $7x - 19x = 2 + 26 \Rightarrow -12x = 28 \Rightarrow x = -\frac{28}{12} = -2\frac{1}{3}.$

4.  $15 + 3a = 35 + 10a$

**Solution:**  $3a - 10a = 35 - 15 \Rightarrow -7a = 20 \Rightarrow a = -2\frac{6}{7}.$

5.  $4a + 14 = 52 - 5a$

**Solution:**  $4a + 5a = 52 - 14 \Rightarrow 9a = 38 \Rightarrow a = 4\frac{2}{9}.$

6.  $23 - 7b = 13 - 2b$

**Solution:**  $-7b + 2b = 13 - 23 \Rightarrow -5b = -10 \Rightarrow b = 2.$

7.  $9b + 2 = 7b + 12$

**Solution:**  $9b - 7b = 12 - 2 \Rightarrow 2b = 10 \Rightarrow b = 5.$

8.  $-6 - 2c = 3 + 25c$

**Solution:**  $-2c - 25c = 3 + 6 \Rightarrow -27c = 9 \Rightarrow c = -\frac{1}{3}.$

**10.1.2 Equations with grouping symbols****Exercise 10.1.2 Solve the following equations:**

1.  $-3(x - 5) = 24$

**Solution:**

$$x - 5 = 8 \Rightarrow x = -3.$$

2.  $-5(y + 2) = 60$

**Solution:**

$$y + 2 = -12 \Rightarrow y = -14.$$

3.  $11(3 - 2x) = 121$

**Solution:**

$$3 - 2x = 11 \Rightarrow -2x = 8 \Rightarrow x = -4.$$

4.  $-2(6 - 5y) = 38$

**Solution:**

$$6 - 5y = -19 \Rightarrow -5y = -25 \Rightarrow y = 5.$$

5.  $6(a - 2) = 5(a + 1)$

**Solution:**

$$6a - 12 = 5a + 5 \Rightarrow 6a - 5a = 5 + 12 \Rightarrow a = 17.$$

6.  $9(2b - 3) = 3(b + 6)$

**Solution:**

$$18b - 27 = 3b + 18 \Rightarrow 15b = 18 + 27 \Rightarrow 15b = 45 \Rightarrow b = 3.$$

7.  $8(3c - 2) - 2(5 - 4c) - 58 = 0$

**Solution:**

$$24c - 16 - 10 + 8c - 58 = 0 \Rightarrow 32c = 84 \Rightarrow c = 2\frac{5}{8}.$$

8.  $25d - 4(2d - 7) = 3(3d + 5) + 90$

**Solution:**

$$25d - 8d + 28 = 9d + 15 + 90 \Rightarrow 8d = 77 \Rightarrow d = 9\frac{5}{8}.$$

**10.1.3 Equations with one fraction****Exercise 10.1.3 Solve the following equations:**

1.  $\frac{5a}{6} - 3 = 12$

**Solution:**  $5a - 18 = 72 \Rightarrow 5a = 90 \Rightarrow a = 18.$

2.  $3 + \frac{5b}{6} = 4$

**Solution:**  $18 + 5b = 24 \Rightarrow 5b = 6 \Rightarrow b = 1\frac{1}{5}.$

3.  $\frac{4-5c}{3} = 9$

**Solution:**  $4 - 5c = 27 \Rightarrow -5c = 23 \Rightarrow c = -4\frac{3}{5}.$

4.  $\frac{12-5d}{6} = 12$

**Solution:**  $12 - 5d = 72 \Rightarrow -5d = 60 \Rightarrow d = -12.$

5.  $\frac{2a+4}{3} - 2 = 8$

**Solution:**  $2a + 4 - 6 = 24 \Rightarrow 2a = 26 \Rightarrow a = 13.$

6.  $\frac{2b-12}{12} + 3 = -15$

**Solution:**  $2b - 12 + 36 = -180 \Rightarrow 2b = -204 \Rightarrow b = -102.$

7.  $\frac{4c-2}{6} = 9 - 2c$

**Solution:**  $4c - 2 = 54 - 12c \Rightarrow 4c + 12c = 54 + 2 \quad 16c = 56 \Rightarrow c = 3\frac{1}{2}.$

8.  $\frac{5}{3}(d - 3) = d + 4$

**Solution:**  $5d - 15 = 3d + 12 \Rightarrow 2d = 27 \Rightarrow d = 13\frac{1}{2}.$

**10.1.4 Equations with more than one fraction****Exercise 10.1.4 Solve the following:**

1.  $\frac{x}{3} + \frac{x}{4} = 6$

**Solution:**  $4x + 3x = 72 \Rightarrow 7x = 72 \Rightarrow x = 10\frac{2}{7}$ .

2.  $\frac{2y}{3} + \frac{3y}{4} = 5$

**Solution:**  $8y + 9y = 60 \Rightarrow 17y = 60 \Rightarrow y = 3\frac{9}{17}$ .

3.  $\frac{7a}{8} - \frac{4a}{5} = 6$

**Solution:**  $35a - 32a = 240 \Rightarrow 3a = 240 \Rightarrow a = 80$ .

4.  $\frac{2b}{5} = 11 - \frac{b}{3}$

**Solution:**  $6b = 165 - 5b \Rightarrow 11b = 165 \Rightarrow b = 15$ .

5.  $\frac{3c}{8} + \frac{2c}{5} = \frac{c}{4} + 21$

**Solution:**  $15c + 16c = 10c + 840 \Rightarrow 21c = 840 \Rightarrow c = 40$ .

6.  $\frac{4-7d}{5} = \frac{2-11d}{7}$

**Solution:**  $7(4 - 7d) = 5(2 - 11d) \Rightarrow 28 - 49d = 10 - 55d$   
 $6d = -18 \Rightarrow d = -3$ .

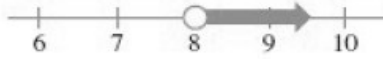
## 10.1.5 Inequalities

Exercise 10.1.5 State the inequality that has been graphed on each of the number lines.

1. [Answer:  $x < 3$ ].



2. [Answer:  $x > 8$ ].



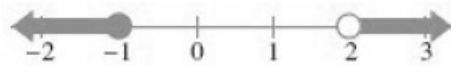
3. [Answer:  $x \leq -6$ ].



4. [Answer:  $-3 < x \leq 0$ ].



5. [Answer:  $x \leq -1, x > 2$ ].



## Exercise 10.1.6

1.  $\frac{3x+7}{4} \leq 5$  [Answer:  $3x + 7 \leq 20 \Rightarrow 3x \leq 13 \Rightarrow x \leq 4\frac{1}{3}$ ].

2.  $2(7x - 6) \geq 8$  [Answer:  $14x \geq 20 \Rightarrow x \geq 1\frac{3}{7}$ ].

3.  $-9(3x - 2) \geq -36$

**Solution:**

$$-27x + 18 \geq -36 \Rightarrow -27x \geq -54 \Rightarrow x \leq 2.$$

4.  $\frac{2-a}{2} - \frac{a-3}{3} \leq 8$

**Solution:**

$$3(2-a) - 2(a-3) = 48 \Rightarrow 6 - 3a - 2a + 6 = 48$$

$$-5a \leq 36 \Rightarrow a \geq -7\frac{1}{5}.$$

5.  $15 \leq \frac{b}{2} + \frac{b}{3} \leq 20$

**Solution:**

$$90 \leq 3b + 2b \leq 120 \Rightarrow 90 \leq 5b \leq 120 \Rightarrow 18 \leq b \leq 24.$$

## 10.2 Formulae

### 10.2.1 Evaluate the subject of a formula

#### Exercise 10.2.1

1. If  $F = \frac{mv^2}{r}$ , find the value of:

(a)  $m$  when  $F = 20$ ,  $v = 5$  and  $r = 20$ .

**Solution:** 
$$m = \frac{rF}{v^2} = \frac{20 \times 20}{5^2} = 16.$$

(b)  $r$  when  $F = 56.32$ ,  $v = -12.8$  and  $m = 22$ .

**Solution:** 
$$r = \frac{mv^2}{F} = \frac{22 \times (-12.8)^2}{56.32} = 64.$$

(c)  $v$  when  $F = 49$ ,  $m = 10$ ,  $r = 2.5$  and  $v > 0$ .

**Solution:** 
$$v = \sqrt{\frac{rF}{m}} = \sqrt{\frac{2.5 \times 49}{10}} = 3.5.$$

2. If  $m = \frac{y_2 - y_1}{x_2 - x_1}$

(a)  $y_2$  when  $m = 4$ ,  $y_1 = 5$ ,  $x_2 = 8$  and  $x_1 = 4$

**Solution:**

$$\begin{aligned} y_2 - y_1 &= m(x_2 - x_1) \\ y_2 &= m(x_2 - x_1) + y_1 \\ &= 4(8 - 4) + 5 = 21. \end{aligned}$$

(b)  $y_1$  when  $m = -3$ ,  $y_2 = 13$ ,  $x_2 = -5$  and  $x_1 = 42$

**Solution:**

$$\begin{aligned} y_2 - y_1 &= m(x_2 - x_1) \\ y_1 &= y_2 - m(x_2 - x_1) \\ &= 13 - (-3)(-5 - 42) = -128. \end{aligned}$$

(c)  $x_2$  when  $m = \frac{3}{4}$ ,  $y_2 = 21$ ,  $y_1 = 6$  and  $x_1 = 4$

**Solution:**

$$\begin{aligned} y_2 - y_1 &= m(x_2 - x_1) \\ m(x_2 - x_1) &= y_2 - y_1 \\ mx_2 &= y_2 - y_1 + mx_1 \\ x_2 &= \frac{21 - 6 + \frac{3}{4} \times 4}{\frac{3}{4}} = 24. \end{aligned}$$

## 10.2.2 Changing the subject of a formula

## Exercise 10.2.2 Make x the subject of each formula:

1.  $\frac{x}{3} + \frac{x}{7} = y$

**Solution:**  $7x + 3x = 21y \quad 10x = 21y \Rightarrow \therefore x = \frac{21y}{10}$ .

2.  $\frac{x-a}{2} = \frac{b+c}{3}$

**Solution:**  $3(x-a) = 2(b+c) \Rightarrow 3x - 3a = 2b + 2c \Rightarrow 3x = 2b + 2c + 3a$   
 $\therefore x = \frac{2b + 2c + 3a}{3}$ .

3.  $\frac{x^2}{4} = \frac{9}{a^2}$

**Solution:**  $a^2x^2 = 36 \Rightarrow x^2 = \frac{36}{a^2} \Rightarrow \therefore x = \pm \frac{6}{a}$ .

4.  $b = \frac{a-c}{x-b}$

**Solution:**  $bx - b^2 = a - c \Rightarrow bx = a - c + b^2$   
 $\therefore x = \frac{a - c + b^2}{b}$ .

5.  $b = \frac{x-1}{x+1}$

**Solution:**  $bx + b = x - 1 \Rightarrow bx - x = -b - 1 \Rightarrow x(b-1) = -b-1$   
 $\therefore x = \frac{-b-1}{b-1} \text{ or } x = \frac{1+b}{1-b}$ .

6.  $4(2x - 3y) = 3(4x + 2y)$

**Solution:**  $8x - 12y = 12x + 6y \Rightarrow 8x - 12x = 6y + 12y \Rightarrow -4x = 18y$   
 $\therefore x = -\frac{9y}{2}$ .



### 10.3 Miscellaneous Exercises

**Exercise 10.3.1** Change one number in the equation  $5x + 6 = 2x + 21$  so that the solution is:

1.  $x = 14$

**Solution:**

$$5x - 2x = 21 - 6 \Rightarrow 3x = 15 \therefore x = 5,$$

$$\text{Required } x = 14 \quad 3x = 42, \Rightarrow 42 + 6 = 48,$$

$$\therefore \text{Change } 21 \text{ to } 48, \text{ or change } 6 \text{ to } -21.$$

2.  $x = 0$

**Solution:**

$$5x + 6 = 2x + 6 \text{ or } 5x + 21 = 2x + 21.$$

$$\therefore \text{Change } 6 \text{ to } 21 \text{ or change } 21 \text{ to } 6.$$

3.  $x = -7$

**Solution:**

$$5x + 42 = 2x + 21 \Rightarrow 3x = -21 \Rightarrow x = -7.$$

$$\therefore \text{Change } 6 \text{ to } 42 \text{ or change } 21 \text{ to } -15.$$

**Exercise 10.3.2** If  $p = 2q + 9$ , find the values for  $p$  and  $q$  given that  $p$  is 5 more than  $q$ .

**Solution:**

$$\begin{cases} p = 2q + 9 \dots (1) \\ p = q + 5 \dots (2) \end{cases} \Rightarrow q + 5 = 2q + 9$$

$$\therefore q = -4, p = 1.$$

**Exercise 10.3.3** If  $x = 11 - 3y$ , find the values for  $x$  and  $y$  given that  $x$  is equal to 25 more than the product of 4 and  $y$ .

**Solution:**

$$\begin{cases} x = 11 - 3y \dots (1) \\ x = 4y + 25 \dots (2) \end{cases} \Rightarrow 11 - 3y = 4y + 25$$

$$\therefore -7y = 14 \Rightarrow y = -2, x = 11 - (3 \times (-2)) \Rightarrow x = 17.$$

**Exercise 10.3.4 Further applications:**

1.  $\frac{2x+1}{3} - \frac{x-8}{5} = 8$

**Solution:**

$$5(2x+1) - 3(x-8) = 120 \Rightarrow 10x+5-3x+24=120$$

$$7x=91 \Rightarrow \therefore x=13.$$

2.  $\frac{1}{3}y - \frac{3}{4}(y-2) = \frac{5}{6}y$

**Solution:**

$$4y - 9(y-2) = 10y \Rightarrow 4y - 9y + 18 = 10y$$

$$-15y = -18 \Rightarrow \therefore y = \frac{18}{15} = 1\frac{1}{5}.$$

3.  $\frac{5}{2x} + \frac{3}{x} = \frac{1}{3}$

**Solution:**

$$\frac{5}{2x} + \frac{6}{2x} = \frac{1}{3} \Rightarrow \frac{11}{2x} = \frac{1}{3}$$

$$2x = 33 \Rightarrow \therefore x = \frac{33}{2} = 16\frac{1}{2}.$$

4.  $\frac{x+1}{4x} = 7 + \frac{1}{x}$

**Solution:**

$$\frac{x+1}{4x} - \frac{1}{x} = 7 \Rightarrow \frac{x+1}{4x} - \frac{4}{4x} = 7$$

$$\frac{x-3}{4x} = 7 \Rightarrow x-3 = 28x \Rightarrow -27x = 3$$

$$\therefore x = \frac{3}{-27} = -\frac{1}{9}.$$

5.  $\frac{x-1}{x+5} = \frac{x-2}{x+3}$

**Solution:**

$$(x-1)(x+3) = (x+5)(x-2)$$

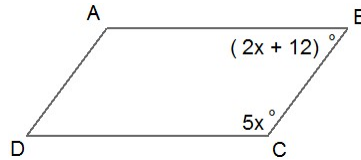
$$x^2 + 3x - x - 3 = x^2 + 5x - 2x - 10$$

$$2x - 3 = 3x - 10 \Rightarrow \therefore x = 7.$$

## 10.4 Maths Challenge

### Exercise 10.4.1

1. In a parallelogram ABCD,  $\angle C = 5x^\circ$ ,  $\angle B = (2x + 12)^\circ$ . Find the number of degrees in  $\angle D$ .



**Solution:**

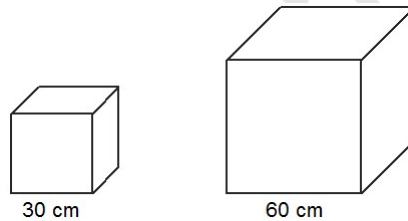
$$5x^\circ + (2x^\circ + 12^\circ) = 180^\circ$$

$$5x^\circ + 2x^\circ = 180^\circ - 12^\circ$$

$$7x^\circ = 168^\circ$$

$$x^\circ = 24^\circ. \Rightarrow \therefore \angle D = 2 \times 24^\circ + 12^\circ = 60^\circ.$$

2. Tracy has two empty cube-shaped containers with sides of 30 cm and 60 cm. She fills the large container with water and then pours some of the water into the small container until it is full. What is the water level of the remaining water in the large container?



**Solution:**

The size ratio is 1:2  $\Rightarrow$  Area ratio is 1: 4 and the volume ratio is 1: 8

$$\therefore \text{Remaining water is: } \frac{7}{8} \times 60 = 52.5 \text{ cm}$$

3. Adam, Bonnie and Carl work in the same office. Adam age is 4 years more than twice Carl's age. Bonnie is 5 year younger than Carl. The average of the three ages is 41. Find the age of each person.

**Solution:**

$$\begin{cases} A = 2C + 4 \dots (1) \\ B = C - 5 \dots (2) \\ \frac{A+B+C}{3} \dots (3) \end{cases} \Rightarrow A + B + C = 123 \dots (4)$$

$$\text{sub (1) and (2) into (4)} \Rightarrow 2C + 4 + C - 5 + C = 123,$$

$$4C - 1 = 123 \Rightarrow 4C = 124 \Rightarrow \begin{cases} C = 31, \\ B = 26, \\ A = 66. \end{cases}$$