TEST 9	Algebraic Manipulation and Formulae	Marks: /80
		Time: 1 hour 30 minutes

Name: .... Date: ....

INSTRUCTIONS TO CANDIDATES

Section A (40 marks) **Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may **not** be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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1 Make x the subject of the formula.

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

Answer .... [2]

2 **(a)** Given that $\frac{3u - 2v}{u - 4v} = \frac{4}{5}$, find the value of $\frac{u}{v}$.

(b) **(i)** Find the HCF of $20a^2b^3$ and $5a^5b^2$.

(ii) Find the LCM of $12pq^2r^3$ and $21p^2qr^4$.

Answer (a) .... [2]

(b) (i) HCF = ... [1]

(ii) LCM = ... [1]

3 Simplify each of the following.

(a) $\dfrac{2x^2y \times 6xy^2}{18xy}$

(b) $\dfrac{8x^3y}{5(x + 2)} \div \dfrac{10xy^3}{(x + 2)^2}$

Answer (a) .... [1]

(b) .... [2]

4 (a) Express $\frac{5}{3x-2} - \frac{3}{x+3}$ as a single fraction in its simplest form.

(b) Solve the equation $x + 4 = \frac{x+4}{x-2}$.

Answer (a) .... [2]

(b) .... [3]

5

5 **(a)** Find the **(i)** HCF and the **(ii)** LCM of $2x^2y^2z^3$, $6x^2yz$ and $8x^3y$.

(b) Given that $k = \dfrac{g^2h - h^2}{g^2 - k}$, express g in terms of k and h.

Answer (a) (i) HCF = ... [1]

(ii) LCM = ... [1]

(b) .... [2]

6 (a) Simplify $\dfrac{x^2 - 4xy + 4y^2}{x^2 - 2xy}$.

(b) Express $\dfrac{3}{x - y} - \dfrac{2}{x + y}$ as a single fraction in its lowest term.

Answer (a) .... [2]

(b) .... [2]

7 (a

(b

7 **(a)** Simplify $\dfrac{a^2 + ab + ac + bc}{a^2 + ab - ac - bc}$.

(b) Solve the equation $\dfrac{x}{x-1} + x = \dfrac{x-2}{1-x} - 2$.

Answer (a) .... [2]

(b) .... [3]

8 Solve the following equations.

(a) $5 + \frac{7}{x - 2} = 4x$

(b) $\frac{4}{3x - 3} + \frac{3}{1 - x} = 2$

Answer (a) .... [2]

(b) .... [2]

9 Solve the following equations.

(a) $\frac{1}{3x - 12} - \frac{x^2 - 1}{4 + 3x - x^2} = 0$

(b) $\frac{5}{2 - x} - \frac{3}{4 - 2x} + \frac{1}{x - 2} = 2$

Answer (a) .... [3]

(b) .... [2]

10 The area of a rectangle is $\frac{45x^2}{14y^2}$ cm^2 and its breadth is $\frac{5x}{7y}$ cm.

Find an expression in terms of x and y for

(a) the length of the rectangle,

(b) the perimeter of the rectangle.

Answer (a) .... cm [2]

(b) .... cm [2]

INSTRUCTIONS TO CANDIDATES

Section B (40 marks) **Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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11 **(a)** Given that $\frac{a}{3} = \sqrt{\frac{b+1}{b-1}}$, express b in terms of a.

(b) Simplify $\frac{6a^2b - 15a^3b^3 + 21a^3b}{3ab}$.

(c) When x^2 is divided by $(x - 5)$, the quotient is 20 and the remainder is 1. Find the possible values of x.

Answer (a) .... [2]

(b) .... [2]

(c) .... [3]

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12 **(a)** Given that $a = \frac{1}{b} - \frac{1}{c}$, $b = d^2 - 1$ and $c = 1 + d$, express a in terms of d in its simplest form.

(b) Find the number which, increased by its reciprocal is equal to $\frac{37}{6}$.

Answer (a) .... [3]

(b) .... [5]

13 (a

(b

13 (a) Express the following as a single fraction in its lowest terms.

(i) $\dfrac{2}{x+2y} - \dfrac{x-6y}{x^2-4y^2}$

(ii) $x + y - \dfrac{2xy}{x+y}$

(b) Solve the equation $\dfrac{x}{x-2} + \dfrac{x-2}{x} = \dfrac{5}{2}$.

Answer *(a)* (i) .... [3]

(ii) .... [2]

(b) .... [3]

14 Benjamin can buy x pens for \$30.

(a) Write down, an expression in terms of x, for the cost of each pen.

He could also buy 5 more rulers than pens using the same amount of money.

(b) Write down, an expression in terms of x, for the cost of each ruler.

10 rulers will cost \$3 less than 10 pens.

(c) Write down an equation in terms of x to represent the information given and show that it reduces to $x^2 + 5x - 500 = 0$. [3]

(d) Hence solve the equation $x^2 + 5x - 500 = 0$ to find the values of x.

(e) Find the cost of each ruler.

Answer (a) \$ .... [1]

(b) \$ .... [1]

(d) .... [2]

(e) \$ .... [1]

15 A fruitseller bought some durians for \$300. He paid \$$x$ for each kilogram of durians.

(a) Find, in terms of x, an expression for the number of kilograms of durians he bought.

(b) The fruitseller had to throw away 3 kg of durians that were rotten and sold the remainder for \$2 per kg more than he paid for it. Write down, an expression in terms of x, for the sum of money he received.

(c) He made a profit of \$132. Write down, an equation in terms of x, to represent this information and show that it reduces to $x^2 + 46x - 200 = 0$. [3]

(d) Hence solve the equation $x^2 + 46x - 200 = 0$ for the values of x.

(e) How many kilograms of durians did he sell altogether?

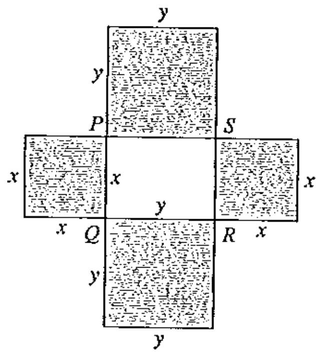
Answer (a) .... kg [1]

(b) \$ .... [2]

(d) .... [2]

(e) .... kg [1]

(b)



Let x cm and y cm be the lengths of PQ and QR respectively.

Perimeter of $PQRS$ = 26 cm (Given)

$2(x + y) = 26$ Divide both sides by 2.

$x + y = 13$

Area of the 4 squares = 178 cm^2 (Given)

$x^2 + x^2 + y^2 + y^2 = 178$

$2x^2 + 2y^2 = 178$ Divide both sides by 2.

$x^2 + y^2 = 89$

$(x + y)^2 = x^2 + 2xy + y^2$ Use $(a + b)^2 = a^2 + 2ab + b^2$.

$(x + y)^2 = (x^2 + y^2) + 2xy$ Substitute $x + y = 13$ and $x^2 + y^2 = 89$.

$(13)^2 = 89 + 2xy$

$2xy = 169 - 89 = 80$

$xy = \frac{80}{2} = 40$

Area of $PQRS = xy$

$= \mathbf{40\ cm^2}$

15. (a) Time taken $= \frac{80 \text{ km}}{x \text{ km/h}}$ Use Total time taken $= \frac{\text{Total distance travelled}}{\text{Average speed}}$

$= \left(\frac{80}{x}\right)$h

(b) Time taken $= \frac{30 \text{ km}}{(x - 15) \text{ km/h}}$ Average speed is 15 km/h slower. ∴ average speed $= (x - 15)$ km/h

$= \left(\frac{30}{x - 15}\right)$h

(c) Total time taken = 10 30 – 07 30 = 3 h

Rest ↓

$\frac{80}{x} + 1 + \frac{30}{x - 15} = 3$

$\frac{80}{x} + \frac{30}{x - 15} = 2$

$\frac{80(x - 15) + 30x}{x(x - 15)} = 2$

$80(x - 15) + 30x = 2x(x - 15)$ Multiply both sides by $x(x - 15)$.

$80x - 1200 + 30x = 2x^2 - 30x$

$2x^2 - 140x + 1200 = 0$ Divide both sides by 2.

$\mathbf{x^2 - 70x + 600 = 0}$ Shown

(d) $x^2 - 70x + 600 = 0$

$(x - 60)(x - 10) = 0$

$\therefore x - 60 = 0$ or $x - 10 = 0$

$\mathbf{x = 60}$ **or** $\mathbf{x = 10}$

(e) $x = 60$ Reject $x = 10$.

Time taken $= \frac{80 + 30}{60}$ Total time taken $= \frac{\text{Total distance travelled}}{\text{Average speed}}$

$= 1\frac{5}{6}$ h

$= 1$ h 50 min

07 30 + 1 h 50 min = 09 20

∴ the motorist will reach Town B at **09 20.**

Test 9: Algebraic Manipulation

Section A

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

$x\left(\frac{1}{a} + \frac{1}{3b}\right) = c$ Extract common factor, x.

$x\left(\frac{3b + a}{3ab}\right) = c$ The LCM of a and $3b$ is $3ab$.

$x = \frac{3abc}{3b + a}$ Cross multiply and express x in terms of the other variables.

2. (a) $\frac{3u - 2v}{u - 4v} = \frac{4}{5}$ Cross-multiply.

$5(3u - 2v) = 4(u - 4v)$

$15u - 10v = 4u - 16v$

$11u = -6v$ Divide both sides by $11v$.

$\frac{u}{v} = -\frac{6}{11}$

(b) (i) $20a^2b^3 = 2^2 \times 5 \times a^2 \times b^3$

$5a^5b^2 = 5 \times a^5 \times b^2$

$\therefore$ HCF $= 5 \times a^2 \times b^2$

$= 5a^2b^2$

Teacher's Tip

To obtain the **Highest Common Factor (HCF)**, find the largest number of factors which are common to both expressions.

(ii) $12pq^2r^3 = 2^2 \times 3 \times p \times q^2 \times r^3$

$21p^2qr^4 = 3 \times 7 \times p^2 \times q \times r^4$

$\therefore$ LCM $= 2^2 \times 3 \times 7 \times p^2 \times q^2 \times r^4$

$= 84p^2q^2r^4$

Teacher's Tip

To obtain the **Least Common Multiple (LCM)**, find the smallest group of factors which contain all the factors of the two expressions.

3. (a) $\frac{2x^2y \times 6xy^2}{18xy}$

$= \frac{2x^2y^2}{3}$

(b) $\frac{8x^3y}{5(x+2)} \div \frac{10xy^3}{(x+2)^2}$ Change ÷ to × by inverting the divisor.

$= \frac{8x^3y}{5(x+2)} \times \frac{(x+2)^2}{10xy^3}$

$= \frac{4x^2(x+2)}{25y^2}$

4. (a) $\frac{5}{3x-2} - \frac{3}{x+3}$

$= \frac{5(x+3)-3(3x-2)}{(3x-2)(x+3)}$ The LCM of $(3x-2)$ and $(x+3)$ is $(3x-2)(x+3)$.

$= \frac{5x+15-9x+6}{(3x-2)(x+3)}$

$= \frac{21-4x}{(3x-2)(x+3)}$

Teacher's Tip
Do not expand the denominator since the question requires the answer in its simplest form, i.e. the factorised form.

(b) $x+4 = \frac{x+4}{x-2}$

$(x-2)(x+4) = x+4$ Multiply both sides by $(x-2)$.
$x^2+4x-2x-8 = x+4$
$x^2+x-12 = 0$
$(x-3)(x+4) = 0$
$\therefore x-3 = 0$ or $x+4=0$
$x = 3$ or $x = -4$

5. (a) $2x^2y^2z^3 = 2 \quad \times x^2 \times y^2 \times z^3$
$6x^2yz = 2 \times 3 \times x^2 \times y \times z$
$8x^3y = 2^3 \quad \times x^3 \times y$

(i) HCF $= 2 \times x^2 \times y = 2x^2y$
(ii) LCM $= 2^3 \times 3 \times x^3 \times y^2 \times z^3 = 24x^3y^2z^3$

(b) $k = \frac{g^2h-h^2}{g^2-k}$ Cross-multiply and express g in terms of other variables.

$k(g^2-k) = g^2h-h^2$
$kg^2-k^2 = g^2h-h^2$ Collect all terms containing g to the left-hand side and then factorise.
$kg^2-g^2h = k^2-h^2$
$g^2(k-h) = k^2-h^2$

$g^2 = \frac{k^2-h^2}{k-h}$ Use $a^2-b^2=(a+b)(a-b)$.

$= \frac{(k+h)(k-h)}{(k-h)}$

$= k+h$

$g = \pm\sqrt{k+h}$ Take square root on both sides.

6. (a) $\frac{x^2-4xy+4y^2}{x^2-2xy}$

$= \frac{(x-2y)(x-2y)}{x(x-2y)}$

$= \frac{x-2y}{x}$

Teacher's Tip
Factorise both the numerator and denominator completely before cancelling common factors.

(b) $\frac{3}{x-y} - \frac{2}{x+y}$ The LCM is $(x-y)(x+y)$.

$= \frac{3(x+y)-2(x-y)}{(x-y)(x+y)}$

$= \frac{3x+3y-2x+2y}{(x-y)(x+y)}$

$= \frac{x+5y}{(x-y)(x+y)}$

7. (a) $\frac{a^2+ab+ac+bc}{a^2+ab-ac-bc}$

$= \frac{a(a+b)+c(a+b)}{a(a+b)-c(a+b)}$ Factor out $(a+b)$, the common factor of the numerator and denominator.

$= \frac{(a+b)(a+c)}{(a+b)(a-c)}$

$= \frac{a+c}{a-c}$

(b) $\frac{x}{x-1} + x = \frac{x-2}{1-x} - 2$ Note: $1-x = -(x-1)$

$\frac{x}{x-1} + x = -\left(\frac{x-2}{x-1}\right) - 2$ $\therefore \frac{x-2}{1-x} = -\left(\frac{x-2}{x-1}\right)$

$\frac{x}{x-1} + x + \frac{x-2}{x-1} + 2 = 0$
$x + x(x-1) + (x-2) + 2(x-1) = 0$
$x + x^2 - x + x - 2 + 2x - 2 = 0$
$x^2 + 3x - 4 = 0$
$(x-1)(x+4) = 0$
$\therefore x-1 = 0$ or $x+4=0$
$x = 1$ (rejected) or $x = -4$

$x-1 \neq 0$
$\therefore x \neq 1$

Teacher's Tip
$x = 1$ is rejected because division by 0 is undefined.
$\therefore x = 1$ is not a solution.

8. (a) $5 + \dfrac{7}{x-2} = 4x$

$5(x-2) + 7 = 4x(x-2)$
$5x - 10 + 7 = 4x^2 - 8x$ — Multiply throughout by the LCM, $(x-2)$.
$4x^2 - 13x + 3 = 0$
$(4x-1)(x-3) = 0$
$\therefore 4x - 1 = 0 \quad \text{or} \quad x - 3 = 0$

$$x = \frac{1}{4} \quad \text{or} \quad x = 3$$

(b) $\dfrac{4}{3x-3} + \dfrac{3}{1-x} = 2$ — Factorise the denominator first before finding the LCM.

$$\frac{4}{3(x-1)} + \left(-\frac{3}{x-1}\right) = 2$$

$$\frac{4}{3(x-1)} - \frac{3}{x-1} - 2 = 0$$

$4 - 3(3) - 2[3(x-1)] = 0$ — Multiply throughout by the LCM, $3(x-1)$.
$4 - 9 - 6x + 6 = 0$
$6x = 1$

$$x = \frac{1}{6}$$

9. (a) $\dfrac{1}{3x-12} - \dfrac{x^2-1}{4+3x-x^2} = 0$

$\dfrac{1}{3(x-4)} - \dfrac{x^2-1}{(4-x)(1+x)} = 0$ — Factorise each of the denominators first.

$$\frac{1}{3(x-4)} + \frac{x^2-1}{(x-4)(x+1)} = 0$$

$(x+1) + 3(x^2-1) = 0$ — Multiply throughout by the LCM, $3(x+1)(x-4)$.
$x + 1 + 3x^2 - 3 = 0$
$3x^2 + x - 2 = 0$
$(3x-2)(x+1) = 0$
$\therefore 3x - 2 = 0 \quad \text{or} \quad x + 1 = 0$

$$x = \frac{2}{3} \quad \text{or} \quad x = -1 \text{ (rejected)}$$

(b) $\dfrac{5}{2-x} - \dfrac{3}{4-2x} + \dfrac{1}{x-2} = 2$

$$\frac{5}{2-x} - \frac{3}{2(2-x)} - \frac{1}{2-x} = 2$$

$2(5) - 3 - 2(1) = 2[2(2-x)]$ — Multiply throughout by the LCM, $2(2-x)$.
$10 - 3 - 2 = 8 - 4x$
$4x = 3$

$$x = \frac{3}{4}$$

10. (a) Area of rectangle $= \dfrac{45x^2}{14y^2}$ (Given) — Area of rectangle = Length × Breadth

$(\text{Length}) \times \left(\dfrac{5x}{7y}\right) = \dfrac{45x^2}{14y^2}$ — Breadth $= \dfrac{5x}{7y}$ (Given)

$$\text{Length} = \frac{45x^2}{14y^2} \times \frac{7y}{5x}$$

$$= \frac{9x}{2y} \text{ cm}$$

(b) Perimeter of rectangle
$= 2(\text{Length} + \text{Breadth})$

$$= 2\left(\frac{9x}{2y} + \frac{5x}{7y}\right)$$

$$= 2\left[\frac{7(9x) + 2(5x)}{14y}\right]$$ — The LCM of $2y$ and $7y$ is $14y$.

$$= \frac{63x + 10x}{7y}$$

$$= \frac{73x}{7y} \text{ cm}$$

Section B

11. (a) $\dfrac{a}{3} = \sqrt{\dfrac{b+1}{b-1}}$

$\left(\dfrac{a}{3}\right)^2 = \dfrac{b+1}{b-1}$ — Square both sides.

$\dfrac{a^2}{9} \times \dfrac{b+1}{b-1}$ — Cross-multiply.

$a^2(b-1) = 9(b+1)$
$a^2b - a^2 = 9b + 9$
$a^2b - 9b = a^2 + 9$
$b(a^2 - 9) = a^2 + 9$

$$b = \frac{a^2+9}{a^2-9}$$

(b) $\dfrac{6a^2b - 15a^3b^3 + 21a^3b}{3ab}$

$= \dfrac{3a^2b(2 - 5ab^2 + 7a)}{3ab}$ — Extract common factor of numerator, $3a^2b$.

$= a(2 - 5ab^2 + 7a)$

(c) $\dfrac{x^2}{x-5} = 20 + \dfrac{1}{x-5}$ (Quotient: 20; Remainder: 1) — Given that when x^2 is divided by $(x-5)$, the quotient is 20 and the remainder is 1.

$x^2 = 20(x-5) + 1$ — Multiply throughout by the LCM, $(x-5)$.
$x^2 = 20x - 100 + 1$
$x^2 - 20x + 99 = 0$
$(x-9)(x-11) = 0$
$\therefore x - 9 = 0 \quad \text{or} \quad x - 11 = 0$
$x = 9 \quad \text{or} \quad x = 11$

Check answer:

When $x = 9$: $\dfrac{9^2}{9-5} = \dfrac{81}{4} = 20$ remainder 1.

When $x = 11$: $\dfrac{11^2}{11-5} = \dfrac{121}{6} = 20$ remainder 1.

12. (a) $a = \frac{1}{b} - \frac{1}{c}$

$= \frac{1}{d^2 - 1} - \frac{1}{1 + d}$ *Given that $b = d^2 - 1$ and $c = 1 + d$.*

$= \frac{1}{(d+1)(d-1)} - \frac{1}{d+1}$

$= \frac{1-(d-1)}{(d+1)(d-1)}$ *Use $a^2 - b^2 = (a+b)(a-b)$. $d^2 - 1 = d^2 - 1^2 = (d+1)(d-1)$*

$= \frac{1-d+1}{(d+1)(d-1)}$

$a = \frac{2-d}{(d+1)(d-1)}$ *The LCM is $(d+1)(d-1)$.*

(b) Let x be the number.
Then $\frac{1}{x}$ is the reciprocal. *The reciprocal of a number A is the number $\frac{1}{A}$.*

$x + \frac{1}{x} = \frac{37}{6}$ *Given the number added to its reciprocal is equal to $\frac{37}{6}$.*

$6x^2 + 6 = 37x$

$6x^2 - 37x + 6 = 0$ *Multiply throughout by the LCM, $6x$.*

$(6x - 1)(x - 6) = 0$

$\therefore 6x - 1 = 0$ or $x - 6 = 0$

$x = \frac{1}{6}$ or $x = 6$

$\therefore$ the number may be taken as $\frac{1}{6}$ and the reciprocal 6 or the number can be taken as 6 and the reciprocal as $\frac{1}{6}$.

Check answer: $6 + \frac{1}{6} = \frac{37}{6}$

13. (a) (i) $\frac{2}{x+2y} - \frac{x-6y}{x^2-4y^2}$

$= \frac{2}{x+2y} - \frac{x-6y}{(x+2y)(x-2y)}$

$= \frac{2(x-2y)-(x-6y)}{(x+2y)(x-2y)}$ *Use $a^2 - b^2 = (a+b)(a-b)$ on $x^2 - 4y^2$. $x^2 - 4y^2 = x^2 - (2y)^2 = (x+2y)(x-2y)$*

$= \frac{2x-4y-x+6y}{(x+2y)(x-2y)}$

$= \frac{\cancel{(x+2y)}}{\cancel{(x+2y)}(x-2y)}$ *The LCM is $(x+2y)(x-2y)$.*

$= \frac{1}{x-2y}$

(ii) $x + y - \frac{2xy}{x+y}$

$= \frac{x(x+y)+y(x+y)-2xy}{x+y}$ *The LCM is $(x+y)$.*

$= \frac{x^2+xy+xy+y^2-2xy}{x+y}$

$= \frac{x^2+y^2}{x+y}$

(b) $\frac{x}{x-2} + \frac{x-2}{x} = \frac{5}{2}$

$2x^2 + 2(x-2)^2 = 5x(x-2)$ *Multiply throughout by the LCM, $2x(x-2)$.*

$2x^2 + 2(x^2 - 4x + 4) = 5x^2 - 10x$

$2x^2 + 2x^2 - 8x + 8 = 5x^2 - 10x$

$x^2 - 2x - 8 = 0$

$(x+2)(x-4) = 0$ *Use $(a-b)^2 = a^2 - 2ab + b^2$ to expand $(x-2)^2$.*

$\therefore x + 2 = 0$ or $x - 4 = 0$

$x = -2$ or $x = 4$

14. (a) Cost of each pen $= \$\left(\frac{30}{x}\right)$

(b) Cost of each ruler $= \$\left(\frac{30}{x+5}\right)$

(c) $10\left(\frac{30}{x+5}\right) = 10\left(\frac{30}{x}\right) - 3$ *10 rulers cost \$3 less than 10 pens. (Given)*

$\frac{300}{x+5} - \frac{300}{x} + 3 = 0$ *Multiply throughout by the LCM, $x(x+5)$.*

$300x - 300(x+5) + 3x(x+5) = 0$

$300x - 300x - 1500 + 3x^2 + 15x = 0$

$3x^2 + 15x - 1500 = 0$ *Divide throughout by 3.*

$x^2 + 5x - 500 = 0$ Shown

(d) $x^2 + 5x - 500 = 0$

$(x - 20)(x + 25) = 0$

$\therefore x - 20 = 0$ or $x + 25 = 0$

$x = 20$ or $x = -25$

(e) $\therefore x = 20$ *Reject $x = -25$.*

Cost of each ruler $= \$\left(\frac{30}{20+5}\right)$

$= \$1.20$

15. (a) No. of kilograms of durians bought

$= \frac{300}{x}$

(b) Sum of money received *Sum of money received = (No. of kg left) × (Selling price of each kg)*

$= \$\left[\left(\frac{300}{x} - 3\right) \times (x+2)\right]$

$= \$\left[\left(\frac{300-3x}{x}\right)(x+2)\right]$

$= \$\left[\frac{3(100-x)(x+2)}{x}\right]$

Sum of money − \$300 = Profit

(c) $\frac{3(100-x)(x+2)}{x} - 300 = 132$

$\frac{\cancel{3}^{1}(100-x)(x+2)}{x} = \cancel{432}^{144}$ *Divide both sides by 3.*

$(100-x)(x+2) = 144x$ *Multiply throughout by x.*

$100x + 200 - x^2 - 2x = 144x$

$x^2 + 46x - 200 = 0$ Shown

(d) $x^2 + 46x - 200 = 0$

$(x - 4)(x + 50) = 0$

$\therefore x - 4 = 0$ or $x + 50 = 0$

$x = 4$ **or** $x = -50$

(e) $\therefore x = 4$ Reject $x = -50$.

No. of kilograms of durians sold

$= \frac{300}{4} - 3$

$= 72$

Test 10: Simultaneous Linear Equations

Section A

1. **Method 1: Elimination Method**

$2x + 3y = 12$ —— (1)

$x - 4y = -5$ —— (2)

(2) × 2: $2x - 8y = -10$ —— (3)

(1) – (3): $3y - (-8y) = 12 - (-10)$

$3y + 8y = 12 + 10$

$11y = 22$

$y = \frac{22}{11} = 2$

To eliminate x, make the coefficients of x to be equal by multiplying (2) by 2.

Substitute $y = 2$ into (2):

$x - 4(2) = -5$

$x - 8 = -5$

$x = -5 + 8$

$= 3$

Substitute the value of y into any of the original equations to find the value of x.

$\therefore$ the solution set is $x = 3, y = 2$.

Teacher's Tip

1) In this method, we first eliminate one of the two unknowns. Either of the unknowns may be eliminated first. In the above question, it is easier to eliminate x.

2) Make a habit of checking your answer either mentally or by writing down.

Check: Substitute $x = 3$, $y = 2$ into (1):

LHS = 2(3) + 3(2) = 6 + 6 = 12 = RHS

Method 2: Substitution Method

$2x + 3y = 12$ —— (1)

$x - 4y = -5$ —— (2)

From (2): $x = -5 + 4y$ —— (3)

Make x the subject of the equation.

Substitute (3) into (1):

$2(-5 + 4y) + 3y = 12$

$-10 + 8y + 3y = 12$

$11y = 22$

$y = \frac{22}{11} = 2$

Substitute (3) into (1) to obtain an equation with only the y variable.

Substitute $y = 2$ into (3):

$x = -5 + 4(2)$

$= -5 + 8$

$= 3$

$\therefore$ the solution set is $x = 3, y = 2$.

Teacher's Tip

In this method, we solve one of the equations for one unknown and substitute this expression into the other equation to solve for the remaining unknown.

2. $4x - 3y = 18$ —— (1)

$7x + 5y = 11$ —— (2)

(1) × 5: $20x - 15y = 90$ —— (3)

(2) × 3: $21x + 15y = 33$ —— (4)

(4) + (3): $41x = 123$

$x = \frac{123}{41} = 3$

To eliminate y, make the coefficients of y to be equal by multiplying (1) by 5 and (2) by 3.

Substitute $x = 3$ into (1):

$4(3) - 3y = 18$

$12 - 3y = 18$

$-3y = 6$

$y = \frac{6}{-3} = -2$

$\therefore$ the solution set is $x = 3, y = -2$.

3. $2x - y = 11$ —— (1)

$-2x + 5y = -7$ —— (2)

Rewrite $-2x + 5y + 7 = 0$ as $-2x + 5y = -7$.

(1) + (2): $4y = 4$

$y = \frac{4}{4} = 1$

Substitute $y = 1$ into (1):

$2x - 1 = 11$

$2x = 12$

$x = \frac{12}{2} = 6$

$\therefore$ the solution set is $x = 6, y = 1$.

Teacher's Tip

Note that the coefficients of x are equal but one is positive and the other is negative. To eliminate x, add the two equations.

4. $h - 5k = -3$ —— (1)

$h + 3k = 1$ —— (2)

Since the coefficients of h are equal, subtract (1) from (2) to eliminate h.

(2) – (1): $3k - (-5k) = 1 - (-3)$

$3k + 5k = 1 + 3$

$8k = 4$

$k = \frac{4}{8} = \frac{1}{2}$