GR: 9   MATHEMATICS

ALGEBRAIC EQUATIONS

SOLVE EQUATIONS

1. Use inverse operations: a) add $\leftrightarrow$ subtract

   b) multiply $\leftrightarrow$ divide

   c) square $\leftrightarrow$ square root.

eg: a) $5(x-1) = x+3$

$$5x - 5 = x + 3$$

$$5x - x = 3 + 5$$

$$4x = 8$$

$$x = \frac{8}{4}$$

$$x = 2$$

b) $\frac{x}{3} + \frac{2x-1}{4} = 1$ LCM = 12

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

$$4x + 3(2x-1) = 12$$

$$4x + 6x - 3 = 12$$

$$10x = 12 + 3$$

$$10x = 15$$

$$x = \frac{15}{10} = 1,5$$

Exercise

1. a)   What number divided by 12 gives an answer of 72?
    b)   What number must be added to 8 to get an answer of –23?
    c)   What number when multiplied by 15 gives –90?

2. Solve the following equations:
    a) $x + 7 = 15$ b) $m - 2 = 17$ c) $5y = 3y + 12$
    d) $13p - 6 = 33$ e) $5a - 22 = a - 2$ f) $n - 4 = -6$

3. Solve for x:
    a) $\frac{x}{2} = 25$ b) $\frac{x}{-3} = 12$

    c) $\frac{x}{7} + 2 = -5$ d) $\frac{x-6}{2} = -1$

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

4. Solve for x:
    a) $3(x - 2) = 2(x - 4)$ b) $2(2x - 4) = 3(3x + 4)$
    c) $6 - 2(x - 1) = 4x - 16$ d) $2(2x + 9) - 2(x + 3) = x + 11 - 5(4 - x)$

5. Solve the following equations:
    a) $4(7x + 6) = 3(9x + 8)$ b) $\frac{x}{6} + x + 2 = x + \frac{5}{2}$

    c) $\frac{x+3}{4} - \frac{x}{2} = \frac{x+2}{8} - 1$ d) $\frac{3}{4}(3x - 5) - \frac{9}{4} = \frac{1}{2}(2x + 4)$

2

EQUATIONS WITH EXPONENTS

1. Solve for x:
   a) $2^{x+1} = 16$
   b) $3^x = \frac{1}{27}$
   c) $2^{-x} = 32$
   d) $8^x = 16$
   e) $2^{2x-1} = 0,008$
   f) $10^x = 0,0001$

2. Solve for x
   a) $x^3 = 8$
   b) $2x^3 = 32$
   c) $\frac{1}{3}x^5 = 81$
   d) $2x^3 - 4 = 246$

3. If $5^{-2} \times 5^x = 1$, solve for x.

4. The product of the square of a number and the cube of the same number is equal to 32. Find the number.

5. Find the value of x if $\frac{a \times a^3}{\sqrt{a^2}} = a^x$

WORD PROBLEMS

1. A farmer sells a certain number of chickens at R20 each and double the number of chickens at R30 each. If his total income is R1 280, how many chickens did he sell at each price?

2. A father is now 38 years older than his son. Ten years ago he was twice as old as his son. How old are the father and son now?

3. Chad is training for a swimming gala by swimming 40 lengths a day.
   He worked out that if he doubled the lengths he has swum so far and then added six, he would have swum the 40 lengths.
   a) Write an equation using the variable x showing the information given.
   b) Solve the equation to find the value of x.

4. Find three consecutive numbers that add up to –54.

EQUATIONS WITH FRACTIONS

1. Denominator cannot be zero.

EXERCISE 17.2

Solve for x:

1. a) $\frac{6}{x} = 18 \; ; x \neq 0$

   b) $\frac{3}{4x} = 2 \; ; x \neq 0$

   c) $\frac{4}{5x} = -1 \; ; x \neq 0$

   d) $\frac{2}{x} + \frac{1}{x} = 6 \; ; x \neq 0$

   e) $\frac{1}{x} + \frac{1}{2x} = -1 \; ; x \neq 0$

   f) $\frac{2}{x} + \frac{1}{4x} = -9 \; ; x \neq 0$

2. a) $\frac{1}{x} + \frac{4}{3} = \frac{1}{2x} + \frac{3}{2} ; x \neq 0$

   b) $\frac{2}{3x} - \frac{5}{6} = \frac{-1}{x} ; x \neq 0$

   c) $\frac{2x+5}{3x} - \frac{6-x}{3x} + \frac{3x+2}{3x} = \frac{3}{2} ; x \neq 0$

   d) $\frac{3}{x-2} - \frac{x}{x-2} = -4 ; x \neq 2$

3

FACTORISE EQUATIONS

1. Difference of squares : $x^2 - 9 = 0$

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

$$x+3 = 0 \quad OR \quad x-3 = 0$$

$$x = -3 \qquad\qquad x = 3$$

* Find the square root of the terms.

* One bracket has + sign, other bracket – sign.

2. Trinomial : $x^2 + x - 20 = 0$

$$(x-4)(x+5) = 0$$

$$x-4 = 0 \quad OR \quad x+5 = 0$$

$$x = 4 \qquad\qquad x = -5$$

$$x - 4 = -4x$$
$$x + 5 = \dfrac{5x}{x}$$

3. Factorised brackets : $(x+6)(x-7) = 0$

$$x+6 = 0 \quad OR \quad x-7 = 0$$

$$x = -6 \qquad\qquad x = 7$$

4. Common factor : $2x^2 + 16x + 30 = 0$

$$2(x^2 + 8x + 15) = 0$$

$(\div 2):$ $x^2 + 8x + 15 = 0$

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

$$x+5 = 0 \quad OR \quad x+3 = 0$$

$$x = -5 \qquad\qquad x = -3$$

$$x + 5 = 5x$$
$$x + 3 = \dfrac{3x}{8x}$$

EXERCISE 17.4

Solve for x:

1.
a) $(x-1)(x-4) = 0$
b) $(x+7)(x-2) = 0$
c) $(x-3)(x+5) = 0$
d) $(x+2)(x-8) = 0$
e) $(x+12)(x+6) = 0$
f) $(x-10)(x-7) = 0$

2.
a) $x^2 - 3x = 0$
b) $2x^2 - 4x = 0$
c) $x^2 - 121 = 0$
d) $4x^2 - 9 = 0$
e) $2x^2 - 32 = 0$
f) $18x^2 - 2 = 0$
g) $3x^2 - \frac{1}{3} = 0$
h) $5x^2 - 125 = 0$

3.
a) $x^2 - 5x - 6 = 0$
b) $x^2 - 15x + 36 = 0$
c) $x^2 + x - 12 = 0$
d) $x^2 - 3x - 18 = 0$
e) $x^2 - 6x = 7$
f) $3x^2 + 6x - 9 = 0$
g) $2x^2 - 2x = 24$
h) $4x^2 + 32x = -48$

4.
a) $(x+2)^2 + (x+2) = 0$
b) $(x-1)^2 = x + 5$

4

GENERATE TABLES

EXERCISE 17.5

1. a) Write the pairs of coordinates from the tables below in the form $(x; y)$:

x	-3	-2	0	2	3
y	6	4	0	-4	-6

b)

x	-3	-2	-1	0	2
y	9	4	1	0	4

2. a) Complete the table below for x- and y-values for the equation $y = 6x - 3$:

x	-4	-2	0		
y				9	21

b) Complete the table below for x- and y-values for the equation $y = x^2 - 4$:

x	-3	-1	0	1	3
y					

3. a) Complete the table below for x- and y-values for the equation $2y = 4x + 6$:

x	-10	-5	0	5	10
y					

b) Complete the table below for x- and y-values for the equation $y = 2x^2 + 1$:

x	-3	-1	0	1	3
y					

SIMULTANEOUS EQUATIONS

1. Substitution :

$$x - y = 2 \rightarrow (1)$$
$$x + y = 14 \rightarrow (2)$$

From eq. (1) we get : $\quad x = y + 2 \rightarrow (3)$

Sub. eq (3) into eq. (2): $\quad y + 2 + y = 14$

$$2y = 14 - 2$$
$$2y = 12$$
$$y = \frac{12}{2}$$
$$y = 6$$

Sub $y = 6$ in eq. (1): $\quad x - 6 = 2$

$$x = 6 + 2$$
$$x = 8$$

5

2. Elimination :

$$x + 2y = 1 \quad \longrightarrow \quad (1)$$

$$2x + 3y = 6 \quad \longrightarrow \quad (2)$$

eq(1)×2 : $\quad \overline{2x + 4y = 2} \quad \longrightarrow \quad (3)$

eq(2) − eq(3) : $\qquad -y = 4$

$$y = -4$$

* Make the coefficient of one of the variables the same.
* Add if the signs are different.
* Subtract if the signs are the same.

Sub y = −4 in eq.(1) : $\quad x + 2(-4) = 1$

$$x - 8 = 1$$

$$x = 8 + 1$$

$$x = 9$$

EXERCISE 17.6

Solve the following simultaneous equations:

(a) $x - y = -5$ and $x + y = -1$

(b) $x - y = -1$ and $2x - y = 0$

(c) $x + 3y = 6$ and $-x + 8y = 5$

(d) $x + y = -1$ and $2x - y = -3$

(e) $3x + y = 2$ and $6x - y = 25$

(f) $2x - 3y = 5$ and $3x - 2y = 20$

(g) $3x + 2y = 8$ and $2x - y = 3$

(h) $2y + 3x = 7$ and $4x + 3y = 15$