Chap 2 ELIMINATION

The solution of simultaneous of two variable depends upon the variable. The process of elimination consists in combining the equations in such manner as to drive a angle equation involving only one of two variables. The elimination may be effected in four was.

1. *Concept of elimination*
2. *Substitution method*
3. *Comparison method*
4. *Application formulae*
5. *Cross multiplication method*

$$\boxed{(a_1b_2 - b_1a_2)(b_1c_2 - c_1b_2) = (c_1a_2 - a_1c_2)^2}$$

The equation (1) $\quad a_1x^2 + b_1x + c_1 = 0$

the equation (2) is: $\quad a_2x^2 + b_2x + c_2 = 0$

We obtain above relation by the cross-multiplication method. Writing the co-efficient of the above equation as:

$$\begin{array}{cccccc} a_1 & b_1 & c_1 & a_1 & b_1 \\ a_2 & b_2 & c_2 & a_2 & b_2 \end{array}$$

Thus,
$$\frac{x^2}{b_1c_2 - c_1b_2} = \frac{x}{c_1a_2 - a_1c_2} = \frac{1}{a_1b_2 - b_1a_2}$$

Hence
$$x^2 = \frac{b_1c_2 - c_1b_2}{a_1b_2 - b_1a_2} \quad \text{and} \quad x = \frac{a_1a_2 - c_1c_2}{a_1b_2 - b_1a_2}$$

80

MULTIPLE CHOICE (MCQ's)

(i) The relation free from 'x' for equations x = a and $x = \frac{1}{b}$ is --------

(a) a – b (b) 3 – b = 2a © ab = 1 (d) a + b = 1

(ii) The relation free from 'y' for equations y = 3t and yt = 1 is --------

(a) 3 +t = 1 (b) 3 – t =1 © $3t^2 = 1$ (d) $\frac{3}{t} = 1$

(iii) The relation free from 't' for equations y = 3t and yt = 1 is --------

(a) 3 +y = 1 (b) 3 – y =1 © $y^2 = 3$ (d) $\frac{3}{y} = 1$

(iv) The relation free from 't' for equations x+t=2a and y–t =3a is ----

(a) x +y = 1 (b) x – y =1 © x+y = 5a (d) x–y = 5a

(v) The relation free from 'x' for $x + \frac{1}{x} = a$ and $x + \frac{1}{x} = b$, we get

(a) a = b (b) $a = b^2$ © $a^2 = b$ (d) $a = \frac{1}{b}$

(vi) The relation free from 'x' for $x^2 + \frac{1}{x^2} = 4$ and $x - \frac{1}{x} = b$ is --------

(a) $a + b^2 = -2$ (b) $b^2 = -2$ (c) $b^2 = 2$ (d) $ab^2 = 2$

(vii) The relation of equations $t^2 = \frac{1}{p}$ and $t^3 = q$ free from 't' is -------

(a) $p^2 + q^2 = 1$ (b) $p^2 q^2 = 1$

© $p^2 q^3 = 1$ (d) $p^3 q^2 = 1$

(viii) Y + 4 = 9 and y – 5 = 6 are ------------ equations.

(a) Linear equation (b) constant

(c) variable (d) Simultaneous equations

(ix) To eliminate any variable from equations is called -----------

(a) square of extremes (b) square of means

(c) variable (d) elimination

(x) The relation obtained any variable from equations is called -------
(a) square of extremes (b) square of means
(c) variable **(d) eliminant**

(xi) If px = q , then x= --------------
(a) $x=\frac{p}{q}$ (b) $x=-\frac{p}{q}$ **(c)** $x=\frac{q}{p}$ (d) $x=-\frac{q}{p}$

(xii) To eliminate one variable, there must be ---------- equations.
(a) One (b) Three **(c) Two** (d) Four

(xiii) If qr – qs = 0, then qr = --------------
(a) qr + qs = 0 (b) qs – qr = 0 **(c)** qr = qs (d) 0 = 0

(xiv) If x = 2m and $x=\frac{1}{3n}$, then relation free from "x" is,
(a) 2mn = 1 (b) m = 3n **(c) 6mn = 1** (d) 2m = n

(xv) Eliminating 't' from $t=\frac{1}{4q^2}$ and $3p^2=\frac{1}{t}$, we get
(a) $12p^2q^2=1$ (b) $3p^2q^2=4$
(c) $4p^2=3q^2$ **(d)** $3p^2=4q^2$

(xvi) Eliminating 'z' from m–z = 2 and n + z =4, we get
(a) m – n = 6 (b) m –n =2 **(c) m +n = 6** (d) m + n =2

(xvii) How many equations are necessary to eliminate are variable?
(a) Three equations (b) Four equations
(c) Five equations **(d) Two equations**

(xviii) The relation obtained as a result of elimination is called,
(a) square of extremes (b) square of means
(c) variable **(d) eliminant**

(xix) In spite of two equations, which thing is necessary in elimination?
(a) Linear equation (b) constant
(c) variable (d) Simultaneous equations

(xx) If $px - q = 0$, then which solution is true?

(a) $x = \frac{p}{q}$ (b) $x = -\frac{p}{q}$ (c) $x = \frac{q}{p}$ (d) $x = -\frac{q}{p}$

(xxi) Eliminating 'm' from $m^3 = 2x$ and $m^2 = \frac{y}{2}$, we get

(a) $y^2 = 32x^3$ (b) $x^3 = 32y^2$ (c) $x^2 = 32y^3$ (d) $y^3 = 32x^2$

(xxii) Eliminating 'z' from $z - \frac{1}{z} = b$ and $z^2 + \frac{1}{z^2} = a^2$, we get

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

(c) $a^2 - b^2 = -2$ (d) $a^2 + b^2 = -2$

(xxiii) Eliminating 'x' from $x^2 + \frac{1}{x^2} = m^2$ and $x + \frac{1}{x} = n$, we get

(a) $m^2 - n^2 = 2$ (b) $m^2 + n^2 = 2$

(c) $m^2 - n^2 = -2$ (d) $m^2 + n^2 = -2$

(xxiv) Eliminating 'x' from $x = a$ and $x = \frac{1}{b}$, we get

(a) $a - b$ (b) $3 - b = 2a$ © $ab = 1$ (d) $a + b = 1$

(xxv) Eliminating 'y' from $y = 3t$ and $yt = 1$, we get

(a) $3 + t = 1$ (b) $3 - t = 1$ © $3t^2 = 1$ (d) $\frac{3}{t} = 1$

(xxvi) Eliminating 'x' from $x + \frac{1}{x} = a$ and $x + \frac{1}{x} = b$, we get

(a) $a = b$ (b) $a = b^2$ © $a^2 = b$ (d) $a = \frac{1}{b}$

(xxvii) Eliminating 't' from $t^2 = \frac{1}{p}$ and $t^3 = q$, we get

(a) $p^2 + q^2 = 1$ (b) $p^2q^2 = 1$

© $p^2q^3 = 1$ (d) $p^3q^2 = 1$

Exercise 2.1

Q.1. Eliminate "a" by substitutions method from the following

(i) $2a+3b-5=0$, $a-2b+1=0$

SOLUTION:

Suppose $2a+3b-5=0$ ------- (1)

$a-2b+1=0$ ------- (2)

From equations (2), we get $a = 2b - 1$

Substituting $a = 2b - 1$ in equation (2),

$2(2b - 1) + 3b - 5 = 0$

$4b - 2 + 3b - 5 = 0$

$\therefore$ $7b - 7 = 0$ **Ans.**

(ii) $4a + 3b + 8 = 0$, $a + 5b - 2 = 0$

SOLUTION:

Suppose $4a + 3b + 8 = 0$ ------- (1)

$a + 5b - 2 = 0$ ------- (2)

from equations (2), we get $a = 2 - 5b$

substitution $a = 2 - 5b$ in equation (1),

$4(2-5b) + 3b + 8 = 0$

$\Rightarrow$ $8 - 20b + 3b + 8 = 0$

$\therefore$ $16 - 17b = 0$ **Ans.**

(iii) $a - 2x + 1 = 0$, $3a + x - 3 = 0$

SOLUTION:

Suppose $a - 2x + 1 = 0$ ------- (1)

$3a + x - 3 = 0$ ------- (2)

From equations (1), we get $a = 2x - 1$

Substituting $a = 2x - 1$ in equations (2),

$3(2x - 1) + x - 3 = 0$

$\Rightarrow \quad 6x - 3 + x - 3 = 0$

$\therefore \quad 7x - 6 = 0$ **Ans.**

(iv) $a^2 + y = 0$, $ap + q = 0$

SOLUTION:

Suppose $a^2 + y = 0$ ------- (1) , $ap + q = 0$ ------- (2)

From equation (2), $a = -\dfrac{q}{p}$

Equation (1) becomes: $\left(-\dfrac{q}{p}\right)^2 + y = 0$

$\therefore \quad \dfrac{q^2}{p^2} + y = 0$ **Ans.**

(v) $a^2 + b^2 = 0$, $a - b = c$

SOLUTION:

Suppose $a^2 + b^2 = 0$ ------- (1)

$a - b = c$ ------- (2)

From equation (2), $a = b + c$

Equation (1) becomes: $(b+c)^2 + b^2 = 0$ **Ans.**

Q.2. Eliminate "t" from the following equations by substitution method:

(i) $y = \dfrac{2}{5}t$, $x = \dfrac{1}{2}t$

SOLUTION:

Suppose $y=\frac{2}{5}t$ ------(1) , $x=\frac{1}{2}t$ -------(2)

From equations (1), we get $t=\frac{5}{2}y$

Substituting $t=\frac{5}{2}y$ in equations (2),

$$x=\frac{1}{2}\times\frac{5}{2}y \quad \Rightarrow \quad 4x=5y$$

$$\therefore \quad 4x-5y=0$$

(ii) $y=2at$, $x=at^2$

SOLUTION:

Suppose $y=2at$ ------- (1)

$x=at^2$ ------- (2)

From equations (1), we get $t=\frac{1}{2a}y$

Substituting $t=\frac{1}{2a}y$ in equations (2),

$$x=a\left(\frac{1}{2a}y\right)^2$$

$$\Rightarrow \quad x=a\times\frac{1}{4a^2}y^2$$

$$\Rightarrow \quad x=\frac{1}{4}y^2$$

$$\therefore \quad 4ax-y^2=0$$

(iii) $ay+t=0$, $bx-at=0$

SOLUTION:

Suppose $ay + t = 0$ -------- (1) , $bx - at = 0$ -------- (2)

From equations (1), we get $t = -ay$

Substituting $t = -ay$ in equations (2)

$$bx - a(-ay) = 0$$

$$\therefore \quad bx + a^2 y = 0$$

(iv) $v_f = v_i + gt$, $s = v_i t + \frac{1}{2}gt^2$

SOLUTION: $v_f = v_i + gt$ -------- (1)

$S = v_i t + \frac{1}{2}gt^2$ -------- (2)

From equations (1), we get $t = \frac{v_f - v_i}{g}$

Substituting $t = \frac{v_f - v_i}{g}$ in equations (2)

$$S = Vi\left(\frac{v_f - v_i}{g}\right) + \frac{1}{2}g\left(\frac{v_f - v_i}{g}\right)^2$$

$$\Rightarrow \quad S = \frac{v_i v_f - v_i^2}{g} + \frac{(v_f - v_i)^2}{2g}$$

$$\Rightarrow \quad S = \frac{2v_i v_f - 2v_i^2 + v_f^2 - 2v_f v_i + v_i^2}{2g}$$

$$\therefore \quad 2gs = v_f^2 - v_i^2$$

3. Eliminate "vi" from the following equations by comparison method:

(I) $v_f = v_i + gt$, $s = v_i t - \frac{1}{2}gt^2$

SOLUTION:

From the given equations,

$v_i = v_f - g_t$

$$v_i = \frac{s + \frac{1}{2}gt^2}{t}$$

comparing these equations,

$$v_f - gt = \frac{s+\frac{1}{2}gt^2}{t}$$

$$\Rightarrow \quad tv_f - gt^2 = s + \frac{1}{2}gt^2$$

$$\Rightarrow \quad S = tv_f - gt^2 - \frac{1}{2}gt^2$$

$$S = tv_f - \frac{3}{2}gt^2$$

$$\therefore \quad 2S = 2tv_f - 3gt^2 \quad \textbf{Ans.}$$

(II) $v_f = v_i = at$, $S = v_i t + \frac{1}{2}at^2$

SOLUTION: $v_i = v_f - at$

$$\Rightarrow \quad v_i = \frac{s - \frac{1}{2}at^2}{t}$$

comparing these equations,

$$v_f - at = \frac{s-\frac{1}{2}at^2}{t}$$

$\Rightarrow \qquad tv_f - at^2 = S - \frac{1}{2}at^2$

$\Rightarrow \qquad S = tv_f - at^2 + \frac{1}{2}at^2$

$\Rightarrow \qquad S = t.\ v_f - \frac{1}{2}at^2$

$\therefore \qquad 2S = 2t.v_f - at^2$ **Ans.**

(iii) $v_f^2 - v_i^2 = 2gs$

$V_f = v_i + gt$

SOLUTION:

Suppose $V_f^2 - V_i^2 = 2gS$ -------- (1)

$V_f = v_i + gt$ -------- (2)

From equations (2), we get $V_i = v_f - gt$

$\Rightarrow \quad v_i^2 = (v_f - gt)^2$ -------- (3)

From equations (1), $V_f^2 = V_i^2 - 2gs$ -------- (4)

Comparing equations (3) and equations (4)

$(v_f - gt)^2 = v_f^2 - 2gs \quad \Rightarrow \quad 2gs = v_f^2 - (v^2 - gt)^2$

$\Rightarrow \quad v_f^2 - (v^2 - 2gt\,v_f + g^2t^2) \quad \Rightarrow \quad v^2_f - v^2_f + 2gtv_f - g^2t^2$

$\therefore \quad 2gs = 2gtv_f - g^2t^2$ **Ans.**

Q.4. Find relations independent of "x" from the following equations by the use of formulae.

(i) $x + \frac{1}{x} = 2p \quad , \quad x - \frac{1}{x} = 2q + 1$

SOLUTION: *Squaring both sides of given equations,*

$$\left(x+\frac{1}{x}=2p\right)^2 \quad \text{and} \quad \left(x-\frac{1}{x}=2q+1\right)^2$$

$$x^2+2+\frac{1}{x^2}=2p^2 \quad \text{and} \quad x^2-2+\frac{1}{x^2}=4q^2+4q+1$$

Subtracting these equation,

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

$$\therefore \quad x^2+2+\frac{1}{x^2}-x^2+2-\frac{1}{x^2}=2p^2-4q^2-4q-1)$$

$$\therefore \quad 2p^2-4q^2-4q=5 \qquad \textbf{Ans.}$$

(ii) $x-\frac{1}{x}=2a$

$$x^2+\frac{1}{x^2}=b^2$$

SOLUTION: *Squaring both the sides of first equation,*

$$x^2-2+\frac{1}{x^2}=4a^2 \quad \text{-------} \; (3)$$

Subtracting this equation from the 2nd equation.

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

$$\Rightarrow \quad x^2+\frac{1}{x^2}-x^2+2-\frac{1}{x^2}=b^2-4a^2$$

$$\Rightarrow \quad 2=b^2-4a^2$$

$$\therefore \quad b^2-4a^2=2 \qquad \textbf{Ans.}$$

(III) $x+\frac{1}{x}=2a$, $x^3+\frac{1}{x^3}=b^3$

SOLUTION:

Suppose $x+\frac{1}{x}=2a$ ------- (1)

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

Cubing both the sides of the equation (1), we get

$$x^3+3x+\frac{3}{x}+\frac{1}{x^3}=8a^3$$

$$\Rightarrow \quad x^3+3\left(x+\frac{1}{x}\right)+\frac{1}{x^3}=8a^3$$

$$\Rightarrow \quad x^3+3(2a)+\frac{1}{x^3}=8a^3$$

$$\therefore \quad x^3+\frac{1}{x^3}=8a^3-6a \quad \text{-----(3)}$$

Subtracting equation (2) from equation (3)

$$x^3+\frac{1}{x^3}-x^3-\frac{1}{x^3}=8a^3-6a-b^3$$

$$\Rightarrow \quad 0=8a^3-6a-b^3 \Rightarrow 6a=8a^3-b^3 \quad \textbf{Ans.}$$

(Iv) $x^2+\frac{1}{x^2}=m^2$, $x^4+\frac{1}{x^4}=b^4$

SOLUTION: $x^2+\frac{1}{x^2}=m^2$ ------ (1)

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

Squaring both the sides of equation (1), we get

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

Subtracting equations (2) from equations (3), we get

$$x^4 + 2 + \frac{1}{x^4} - x^4 - \frac{1}{x^4} = m^4 - b^4$$

$$\Rightarrow \quad 2 = m^4 - b^4$$

$$\therefore \quad m^4 - b^4 = 2 \quad \textbf{Ans.}$$

(v) $ax^2 + bx + c = 0$, $px^2 + qx + r = 0$

SOLUTION: $ax^2 + bx + c = 0$ ---------(1)

$px^2 + qx + r = 0$ ---------(2)

Using quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad x = \frac{-q \pm \sqrt{q^2 - 4pr}}{2p}$$

Combine from these two solutions,

$$\therefore \quad \frac{-b \pm \sqrt{b^2 - 4ac}}{a} = \frac{-q \pm \sqrt{q^2 - 4pr}}{p} \qquad \textbf{Ans.}$$

(vi) $10x^2 - 6x - c = 0$

$12x^2 - 10x + d = 0$

SOLUTION: Using quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$10x^2 - 6x + c = 0$$

Here $a = 10$, $b = -6$, $c = c$

$$x = \frac{-(-6) \pm \sqrt{(6)^2 - 4(10)(c)}}{2(10)} = \frac{6 \pm \sqrt{36 - 40c}}{20}$$

$$12x^2 - 10x + d = 0$$

Here $a = 12$, $b = -10$, $c = d$

and $$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(12)(d)}}{2(12)} = \frac{10 \pm \sqrt{100 - 48d}}{24}$$

Combine from these two solutions:

$$\frac{6 \pm \sqrt{36-40c}}{20} = \frac{10 \pm \sqrt{100-48d}}{24}$$

$$\therefore \quad \frac{6 \pm \sqrt{36-40c}}{5} = \frac{10 \pm \sqrt{100-48d}}{6} \quad \textbf{Ans.}$$

Q.5. Eliminate "t" from the following with the formulae.

(i) $$\frac{x}{p} = \frac{1+t^2}{2t}$$

$$\frac{y}{q} = \frac{1-t^2}{2t}$$

SOLUTION:

Suppose $$\frac{x}{p} = \frac{1+t^2}{2t} \quad \text{-------- (1)}$$

$$\frac{y}{q} = \frac{1-t^2}{2t} \quad \text{-------- (2)}$$

Squaring both sides of equation (1) and equation (2),

$$\frac{x^2}{p^2} = \frac{1+2t^2+t^4}{4t^2} \quad \text{-----------(3)}$$

$$\frac{y^2}{q^2} = \frac{1-2t^2+t^4}{4t^2} \qquad \text{----------} (4)$$

Subtracting equation (4) and equation (3),

$$\frac{x^2}{p^2} - \frac{y^2}{q^2} = \frac{1+2t^2+t^4}{4t^2} - \frac{1-2t^2+t^4}{4t^2}$$

$$= \frac{1+2t^2+t^4-1+2t^2-t^4}{4t^2}$$

$$= \frac{4t^2}{4t^2} \quad = 1$$

$$\therefore \qquad \frac{x^2}{p^2} - \frac{y^2}{q^2} = 1 \quad \textbf{Ans.}$$

(ii) $x = \dfrac{a(1-t^2)}{a+t^2}$, $y = \dfrac{b(1-t^2)}{2t^2}$

SOLUTION: *From the given equations,*

$$\frac{x}{a} = \frac{1-t^2}{1+t^2} \quad , \qquad \frac{y}{b} = \frac{1-t^2}{2t^2}$$

$$\Rightarrow \frac{a}{x} = \frac{1+t^2}{1-t^2} \quad \text{-------} (1), \qquad \frac{b}{y} = \frac{2t^2}{1-t^2} \quad \text{-------} (2)$$

Subtracting equation (2) from equation (1),

$$\frac{a}{x} - \frac{b}{y} = \frac{1+t^2}{1-t^2} - \frac{2t^2}{1-t^2}$$

$$= \frac{1+t^2-2t^2}{1-t^2}$$

$$= \frac{1-t^2}{1-t^2}$$

$\therefore \quad \frac{a}{x} - \frac{b}{y} = 1$ **Ans.**

Q6. eliminate "x" from the following By the method of cross multiplication.

(i) $px^2 + qx - r = 0$

$ax^2 + bx - c = 0$

SOLUTION:

Writing the coefficients of the given equations as:

$$\begin{array}{ccccc} p & q & r & p & q \\ a & b & c & a & b \end{array}$$

Now $$\frac{x^2}{-qc+br} = \frac{x}{-ra+pc} = \frac{1}{pb-aq}$$

$$\Rightarrow \quad \frac{x^2}{br-qc} = \frac{1}{bp-aq} \quad \text{and} \quad \frac{x}{pc-ar} = \frac{1}{bp-aq}$$

$$\Rightarrow \quad x^2 = \frac{br-qc}{bp-aq} \text{ ------(1)} \quad \text{and} \quad x = \frac{pc-ar}{bp-aq} \text{ --------(2)}$$

Squaring both the sides of equation (2),

$$x^2 = \frac{(pc-ar)^2}{(bp-aq)^2} \text{ ---------(3)}$$

From equation (1) and equation (3), we get

$$\frac{br-qc}{bp-aq} = \frac{(pc-ar)^2}{(bp-aq)^2}$$

$$\therefore \quad (br-qc)(bp-aq) = (pc-ar)^2$$

(II) $2x^2 - x + l = 0$, $x^2 - 3x - m = 0$

SOLUTION:

The required relation is :

$(a_1b_2 - b_1a_2)\ (b_1c_2 - c_1b_2) = (c_1a_2 - a_1c_2)^2$

Here $a_1 = 2$, $b_1 = -1$, $c_1 = l$

$a_2 = 1$, $b_2 = -3$, $c_2 = -m$

$\{(2)(3) - (-1)(1)\}\{(-1)(-m) - (l)(-3)\} = \{(l)(1) - (2)(-m)\}^2$

$\Rightarrow$ $(-6+1)(m+3l) = (l+2m)^2$

$\therefore$ $-5(m+3l) = (l+2m)^2$

(III) $3x + 4y = 22$, $-4x + 5y = 43$

SOLUTION:

The required relation is:

$$y = \frac{c_1a_2 - a_1c_2}{a_1b_2 - b_1a_2} = \frac{(-22)(-4) - (3)(-43)}{(3)(5) - (-4)(4)}$$

$$= \frac{88 + 129}{15 + 16} = \frac{217}{31} = 7$$

$y = 7$ **Ans.**

7. Eliminate "a" from the following:

(i) $x = 2a$, $y = a^2 2at - 3$

SOLUTION:

Suppose $x = 2a$ ---------(1)

$y = a^2 - 2at - 3$ ---------(2)

From (1), we get $a = \frac{x}{2}$

Substituting $a=\frac{x}{2}$ in (2),

$$y=\left(\frac{x}{2}\right)^2-2\left(\frac{x}{2}\right)t-3 \quad =\frac{x^2}{4}-xt-3$$

$$=\frac{x^2-4xt-12}{4}$$

$\therefore \quad 4y=x^2-4xt-12$ **Ans.**

(II) $4a+3x=22$, $5a-4x=43$

SOLUTION:

Suppose $4a+3x=22$ -----------(1)

$5a-4x=43$ -----------(2)

From equation (1), $a=\frac{22-3x}{4}$ -----------(3)

From equation (2), $a=\frac{43+4x}{5}$ ----------- (4)

Comparing equation (3) and equation (4), we get

$$\frac{22-3x}{4}=\frac{43+4x}{5}$$

$$110-15x=172+16x$$

$$110-172=16x+15x$$

$$-62=31x$$

$$x=-2$$

(III) $x=3a$, $y=2a$

SOLUTION:

Suppose $x=3a$ ---------- (1)

$Y=2a$ ---------- (2)

From equation (1), we get $a=\frac{x}{3}$ ----------- (3)

From equation (2), we get $a=\frac{y}{2}$ ----------- (4)

Comparing equation (3) and equation (4), we get

$$\frac{x}{3}=\frac{y}{2} \quad \Rightarrow \quad 2x = 3y$$

$\therefore$ $2x - 3y = 0$ **Ans.**

Q8. Eliminate "y" from the following equations.

(i) $x = 2c$, $\frac{y^2}{b^2}+\frac{b^2}{y^2}=a^2$

SOLUTION:

Squaring both the sides of first equation,

$$\frac{y^2}{b^2}+2\frac{b^2}{y^2}=4c^2$$

Subtracting second equation from this equation,

$$\frac{y^2}{b^2}+2+\frac{b^2}{y^2}-\frac{y^2}{b^2}-\frac{b^2}{y^2}=4c-a^2$$

$$2=4c^2-a^2 \quad \textbf{Ans.}$$

(ii) $y+\frac{1}{y}=a$, $y^2+\frac{1}{y^2}=4a^2$

SOLUTION:

Squaring both the sides of first equation,

$$y^2+2+\frac{1}{y^2}=a^2$$

Subtracting second equation from this equation,

$$y^2+2+\frac{1}{y^2}-y^2-\frac{1}{y^2}=a^2-4a^2$$

$\therefore \quad 3a^2 + 2 = 0$ **Ans.**

(iii) $\dfrac{1}{y} + y = 2l \quad , \quad y - \dfrac{1}{y} = 2m + 1$

SOLUTION:

Squaring both the sides of the given equations,

$$\frac{1}{y^2} + 2 + y^2 = 4l^2 \quad \text{and} \quad y^2 - 2 + \frac{1}{y^2} = (2m+1)^2$$

Subtracting these equations,

$$\frac{1}{y^2} + 2 + y^2 - y^2 + 2 - \frac{1}{y^2} = 4l^2 - (2m+l)^2$$

$$\therefore \quad 4 = 4l^2 - (2m+1)$$

(iv) $y + \dfrac{1}{y} = b \quad , \quad y^3 + \dfrac{1}{y^3} = a^3$

SOLUTION: Cubing first equation,

$$y^3 + 3y + \frac{3}{y} + \frac{1}{y^3} = b^3 \quad \Rightarrow \quad y^3 + 3\left(y + \frac{1}{y}\right) + \frac{1}{y^3} = b^3$$

$$\Rightarrow \quad y^3 + 3b + \frac{1}{y^3} = b^3$$

Subtracting second equation from this,

$$y^3 + 3b + \frac{1}{y^3} - y^3 - \frac{1}{y^3} = b^3 - a^3$$

$\therefore \quad 3b = b^3 - a^3$ **Ans.**