Equations

Linear Equation — Quadratic Eqⁿ — Cubic Eqⁿ

- One Variable
- Two Variable
- Three Variable

Linear Eqⁿ with One variable

If $ax+b=0$ $\quad x=\frac{-b}{a}$

If $ax+b=c$ $\quad x=\frac{c-b}{a}$

If $ax+b=cx+d$ $\quad x=\frac{d-b}{a-c}$

Eg 1:- find the value of x in the following cases

Case 1:- $2x+3=0$ $\quad x=-3/2$

Case 2 :- $4x+5=0$ $\quad x=-5/4$

Case 3 :- $3x+6=8$ $\quad 3x=2$ $\quad x=2/3$

Case 4 :- $13x+3=10x+27$ $\quad (13-10)x=27-3$ $\quad x=\frac{27-3}{13-10}$

Step 1 :- $13-10=$ M+

Step 2 :- $27-3=$:- MRC $=8$

Case 5 :- $127x+1080=89x+1688$

Step 1 :- $127x-89x$ M+

Step 2 :- $1688-1080=$:- MRC $=16$

Case 6 :- $12.6x+13.2=9.7x+8.85$

Case 7 :- $642x-1491=429x-213$

$=6$

Case 8 :- $355x-247=175x+195.8=12.25$

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Linear Eqn With Two Variable.

$3x+2y=12$
$5x+4y=22$

Substitution Method Elemination Method Cross Multiplication Method

- Cross Multiplication Method.

$3x+2y=12$
$5x+4y=22$

step 1 $(+3)\times(+4) - (+2)\times(+5)$
$12-10=2$.

$3\times4 = M+$]
forward $2\times5 = M-$] MRC MRC 2

step 2 Value of x

backward $12\times4 = M+$
$2\times22 = M-$ MRC MRC $\div 2 = 2$

Step 3 Value of y

forward ~~12×4~~

3

Eg 2:- find the value of x and y in the following Cases

Case 1:- $13x+34=28$
$7x+12y=67$

Step 1: $13\times2 = M+$
$3\times7 = M-$ MRC MRC 135

Step 2 Value of x
$2\times12 = M+$
$3\times67 = M-$ MRC MRC $\div 135 = 1$

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step 3 value of y

13 x 67 = M+

28 x 7 = M-

MRC MRC :- 135 = 5

Case 2:- 4x + 3y = 6

11x + 12y = 9 -2

Case 3:- 3x + 2y = 13

7x + 3y = 17

step 2:- 13 x 3 = M+ , 17 x 2 = M-

step :- 3 3x17 = M+ 13x7 = M-

MRC MRC :- 5 +/= = 8

14

Case 4:- 32x - 19y = 6.1

17x + 3y = 25.5

Case 5:- 11x - 5y = 17

3x + 2y = 8 step 1 = 37 x = 2 y = 1

Case 6:- 2x + 5y + 29 = 0

3x + 2y + 5 = 0

2x + 5y = -29

3x + 2y = -5

step 1 :- -11 x = 3 y = -7

Case 7:- x + 3y - 16.2 = 0

5y + 3x = 30.2

x + 3y = 16.2

3x + 5y = 30.2

step 1 :- -4 , x = 2.4 , y = 4.6

Case 8:- 3x + 2y = 7

6x + 4y = 14

step 1 :- 0 , x =

a) 0, 0 b) 1, 2

c) Not determine

d) None of these

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$\frac{a_1}{a_2} = \frac{3}{6} = 0.5$ $\frac{b_1}{b_2} = \frac{2}{4} = 0.5$ $\frac{c_1}{c_2} = \frac{7}{14} = 0.5$

Infinite sol^n.

x	0	1	2	3
y	3.5	2	0.5	-1

Put

Given $a_1x + b_1y = 0$

$a_2x + b_2y = 0$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$a_1b_2 - b_1a_2 \neq 0$

Unique solution

$\frac{a_1}{a_2} = \frac{b_1}{b_2}$

$a_1b_2 - b_1a_2 = 0$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Infinite Sol^n.

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

No Solution

Case 9:- $3x + 2y = 7$

$6x + 4y = 21$

step 1 = 1

$2 = \frac{a_1}{a_2} = \frac{3}{6} = 0.5$ $\frac{b_1}{b_2} = \frac{2}{4} = 0.5$ $\frac{c_1}{c_2} = \frac{7}{21} = 0.333$

No Solution

Linear Eq^n with Three Variable.

Such equation can be solved through Matrices and determenant, However Since exam is objective, it is advisable to put options to get answer

Eg:- $x + y + 3 = 9$

$2x - y + 3 = 5$

$3x + 2y - 3 = 8$

a) 4,3,2 b) 4,4,1 c) 5,1,3 d) 2,3,4

Let quadratic eqⁿ be

$$ax^2+bx+c=0$$

then the roots of this eqⁿ i.e α & β are as follow

$$\alpha, \beta = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

Eg :- $x^2-5x+6=0$ $\quad a=1, b=-5, c=6$

$$= \frac{-(-5) \pm \sqrt{-5^2-4(1)(6)}}{2(1)}$$

$$= \frac{-5 \pm \sqrt{1}}{2} = \frac{5+1}{2}, \frac{5-1}{2}$$

3 or 2

$$\alpha+\beta = \frac{-b}{a}$$

$$\alpha\beta = \frac{c}{a}$$

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

Eg :- find $\alpha+\beta$ and $\alpha\beta$ from the following.

Case 1 :- $x^2-5x+6=0$ $\quad a=1, b=-5, c=6$

$\alpha+\beta=5$ $\quad = \alpha\beta = \frac{6}{1} = 6$

Case 2 :- $2x^2+5x+6=0$ $\quad a=2, b=5, c=6$

$\alpha+\beta = \frac{-5}{2}$, $\alpha\beta = 3$

Case 3 :- $3x^2-7x+11=0$ $\quad a=3, b=-7, c=11$

$\alpha+\beta = \frac{7}{3}$, $\alpha\beta = \frac{11}{3}$

Case 4 :- $\sqrt{2}x^2+3x-\sqrt{5}x+13=0$ $\quad a=\sqrt{2}$

$\alpha+\beta = \frac{\sqrt{5}-3}{\sqrt{2}}$, $\alpha\beta = \frac{13}{\sqrt{2}}$ $\quad b=3-\sqrt{5}$

$c=13$

$D = b^2-4ac$

$10^2-4(1)(+1)$

$100-84$

16

$x = \frac{-b \pm \sqrt{D}}{2a}$

$\frac{-10+\sqrt{16}}{2}, \frac{-5-\sqrt{16}}{2}$

$\frac{-10+16}{2} = \frac{-5-16}{2}$

$\frac{6}{2} = -3 = -21$

Eg:- find α and β from the following:-

Case 1:- $x^2 - 5x + 4 = 0$. $a=1, b=-5, c=4$

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\alpha, \beta = 1$ and 4

Case 2:- $x^2 - 5x + 3 = 0$. $a=1, b=-5, c=3$

Case 3:- $4x^2 - 20x + 25 = 0$ $\alpha, \beta = \frac{5}{2}$

Case 4:- $x^2 - 5x + 7 = 0$. $\alpha, \beta = \frac{5 \pm \sqrt{3}i}{2}$

- If a, b and c are Integer
  - If $b^2 - 4ac < 0$, imaginary Root (-ve $\sqrt{-3}$)
  - If $b^2 - 4ac \geq 0$; Real Root (+ve value)
  - If $b^2 - 4ac > 0$ and is not a perfect Square; Real and Irrational roots.
  - If $b^2 - 4ac > 0$ and is a perfect square; Real, rational and unequal.
  - If $b^2 - 4ac = 0$; real and equal root, rational
  - If $b^2 - 4ac \neq 0$, unequal Roots.

If α & β are roots of quadratic Eq^n, then such Eq^n can be expressed as.

$[(x-\alpha)(x-\beta) = 0]$

$x^2 - \alpha x - \beta x + \alpha\beta = 0$

$\rightarrow x^2 - (\alpha+\beta)x + \alpha\beta = 0$

Eg:- find the quadratic eq^n from the following:-

Case 1:- $\alpha = 2$, $\beta = 5$.

$x^2 - 7x + 10 = 0$

Case 2:- $\alpha = -1$, $\beta = 4$

$x^2 - 3x - 4 = 0$

Case 3:- $\alpha = -3$, $\beta = -5$

$x^2 + 8x + 15 = 0$.

Case #:- Solve for x

Case 1:- $x^2 = 4$.

± 2.

$x^2 - 4 = 0$

$x^2 - 2^2 = 0$

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

$x = \pm 2$

Case 2:- $x = \sqrt{4}$.

$x = 2$

[The value of $\sqrt{}$ is always positive]

Cubic Equation

$x^3 + 4x^2 - 7x - 10 = 0$ $\quad x = a$

$0 + 0 - 0 - 10 \neq 0$

$1 + 4 - 7 - 10 \neq 0$ $\quad x = 1$

$-1 + 4 + 7 - 10 = 0$ $\quad x = -1$

$x + 1 = 0$

$(x+1)(x^2 + 3x - 10) = 0$

$x^2 + 3x - 10$

$x+1 \;|\; x^3 + 4x^2 - 7x - 10$

$-x^2 + x^2$

$3x^2 - 7x - 10$

$3x^2 + 3x$

$-10x - 10$

$-10x - 10$

$\times$

either $x + 1 = 0$

$x = -1$ or $x^2 + 3x - 10 = 0$

$$\frac{-3 \pm \sqrt{9 - (4)(1)(-10)}}{2}$$

$$\frac{-3 \pm 7}{2} = 2, -5$$

$x = -1, 2, -5$

Eg a) 1, 2, 5 b) −1, 2, 5 c) −1, 2, −5, d) 1, −2, 5

Add or subtract

4

$x^3 + 4x^2 - 7x - 10 = 0$

put $-1^3 + 4(-1)^2 - 7(-1) - 10 = 0$

1 (+/−) x = M+

1 (+/−) = x4 = M+

1 (+/−) x7 = M−

$\alpha + \beta + \gamma = \frac{-b}{a} = -4$

$\alpha\beta\gamma = 10$

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Eg :- $x^3 - 7x^2 - 5x + 315 = 0$

a) 7, -5, 9 b) 7, -5, -9 c) -7, 5, -9 d) -7, 5, 9

$\alpha + \beta + \gamma = 7$

7 +/- XX = = M+
7 +/- XX = X7 = M-
7 X 5 3 = M-
315 M+
MRC

If α, β and γ are roots of cubic equation, then such equation can be expressed as

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

$(x-\alpha)(x-\beta)(x-\gamma) = 0$

If $ax^3 + bx^2 + cx + d = 0$

$x^3 - [(\alpha+\beta+\gamma)x^2 + [\alpha\gamma + \beta\gamma + \alpha\beta]x - \alpha\beta\gamma = 0$

$x^3 + \frac{bx^2}{a} + \frac{cx}{a} + \frac{d}{a} = 0$

$\alpha + \beta + \gamma = -b/a$

$\alpha\beta + \beta\gamma + \alpha\gamma = c/a$

$\alpha\beta\gamma = \frac{-d}{a}$

Eg.

Application of Equations

Cost and profit function

Total cost = fixed Cost + Variable Cost

Eg: Rent, salary

If FC is "a" and VC per unit is "b" and no. of units produced be x, then

$TC = y = a + bx$

Eg:- If FC = 50000 and VC pu = Rs 100, then

Total Cost.

$TC = y = 50000 + 100x$

TC if 1 unit is produced = Rs 50100

20 unit = 52000

200 = 70000

$50000 + 100 \times 20$

$50000 + 100 \times 200$

Similarly Total Revenue = FR + VR

If FR is "c" and VR pu is "d" and no. of units sold be x.

$TR = c + dx$

Eg:- If FR = 10000 and Variable Revenue 900 per unit then $TR = y = 10000 + 900x$

TR if 1 unit is sold ∴ Rs 10900

if 20 sold = 28000

200 = 190000

20×900

profit = TR − TC

If $TR = 10000 + 900x$

$TC = 50000 + 100x$

then $TP = 800x - 40000$

If 200 unit are sold 120000

If of 2 = Rs 24000

Break Even point

Minimum point / No. of units to be sold to avoid losses

i.e when Total loss = 0

If TP = $800x - 40000$

BEP TL = 0

$800x - 40000 = 0$

$x = 50$ units

TP = $x = 50$	TP = 0
$x = 49$	TP = -800
48	TP = -1600
51	TP = +800. profit

Eg: Compute BEP if TP = $70x - 25000$

a) 357 b) 357.14 c) 358 d) None of these

If x is is in fraction, then always take upper - ∞ next Integeral value.

beginning step