Equations

Past Trends

Attempt	Quadratic	Other	Marks
May 2018	2	3	5
Nov 2018	2	0	2
Jun 2019	1	1	2
Nov 2019	2	2	4
Nov 2020	2	1	3
Jan 2021	3	0	3
Jul 2021	1	3	4
Dec 2021	1	3	4
Jun 2022	1	3	4
Dec 2022	2	2	4
Jun 2023	2	2	4

Equation Basics

Definition	• It is a mathematical statement of **equality**
Solution of Equation or Root of Equation	• The value of variable (say x) that satisfies a given equation
Degree of an equation	• The highest power of variable in a given equation

Simple Equation

Description	• Equation of one degree and having one unknown variable is simple. • A simple equation has only one root. • It can be solved directly (No Method Needed)
Format of Equation	$$ax + b = 0$$ where, a is coefficient of x, b is constant, $a \neq 0$

Simultaneous Linear Equation (two variables)

Format of Equation	$$a_1 x + b_1 y + c_1 = 0$$ $$a_2 x + b_2 y + c_2 = 0$$ where, a is coefficient of x, b is coefficient of y, c is constant, $a \neq 0$
Formula	To solve linear equation in two variables, we need two such equations **Methods of Solution** • **Elimination Method:** In this method two given linear equations are reduced to a linear equation in one unknown by eliminating one of the unknowns and then solving for the other unknown. • **Substitution Method:** equation is written in the form of one variable in LHS and that value is substituted in other equation.

	• **Cross Multiplication Method:** Formula based method $$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Quadratic Equation

Description	• Equation having **degree = 2** is called as Quadratic Equation • QE will have two roots/ solutions usually denoted by α, β
Equation Format	$$ax^2 + bx + c = 0$$ where, a is coefficient of x^2, b is coefficient of x, c is constant, a ≠ 0
Trial and Error Method	$ax^2 + bx + c = 0$ • In this method value of **b** is split into two parts • Split is done in such a way that product of those two values is equal to **ac** • There will be four terms, we take common and form two factors • Solving factors we will get roots of the equation
Direct Formula	$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
Sum of Roots	$$\alpha + \beta = -\frac{b}{a}$$
Product of Roots	$$\alpha\beta = \frac{c}{a}$$
Construct a Quadratic Equation	$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$
Discriminant to find nature of roots of QE	Discriminant of QE is the mathematical expression which is used to understand nature of roots of QE, it is expressed as below: $b^2 - 4ac$ | Condition	Nature of Roots
$b^2 - 4ac = 0$	Real and Equal
$b^2 - 4ac < 0$	Imaginary
$b^2 - 4ac > 0$	Real and Unequal
$b^2 - 4ac > 0$ and a perfect square	Real, Unequal and Rational
$b^2 - 4ac > 0$ and not a perfect square	Real, Unequal, and Irrational	
Conjugate Pairs	• If one of the root of the equation is $m + \sqrt{n}$ • The other one is surely $m - \sqrt{n}$ • This pair of irrational roots are called as conjugate pairs

Cubic Equation	
Description	• Equation having **degree = 3** is called as Cubic Equation • Cubic Equation will have three roots
Format of Equation	$$ax^3 + bx^2 + cx + d = 0$$ where, a is coefficient of x^3, b is coefficient of x^2, c is coefficient of x, d is constant, a ≠ 0
Method of Solution	Trial and Error

PYQ May 18

If $2^{x+y} = 2^{2x-y} = \sqrt{8}$, then the respective values of x and y are ___

a. 1, 1/2   b. 1/2, 1   c. 1/2, 1/2   d. None

Ans: a

PYQ Nov 19

Find value of $x^2 - 10x + 1$ if $x = \dfrac{1}{5 - 2\sqrt{6}}$

a. 25   b. 1   c. 0   d. 49

Ans: c

Exercise

The diagonal of a rectangle is 5 cm and one of at sides is 4 cm. Its area is

a. 20 sq cm   b. 12 sq cm   c. 10 sq cm   d. None

Ans: b

PYQ Jul 21

The cost of 2 oranges and 3 apples is ₹ 28. If the cost of an apple is doubled then the cost of 3 oranges and 5 apples is ₹ 75. The original cost of 7 oranges and 4 apples (in (₹)) is:

a. 59   b. 47   c. 71   d. 63

Ans: a

Exercise

One student is asked to divide a half of a number by 6 and other half by 4 and then to add the two quantities. Instead of doing so the student divides the given number by 5. If the answer is 4 short of the correct answer then the number was

a. 320   b. 400   c. 480   d. None

Ans: c

PYQ Dec 21

In a multiple-choice question paper consisting of 100 questions of 1 mark each, a candidate gets 60% marks. If the candidate attempted all questions and there was a penalty of 0.25 marks for wrong answers is:

a. 32   b. 36   c. 40   d. 38

Ans: b

Exercise

The age of a person is twice the sum of the ages of his two sons and five years ago his age was thrice the sum of their ages. Find his present age

a. 60 years   b. 52 years   c. 51 years   d. 50 years

Ans: d

MTP Nov 20

If 2x-3y = 1 and 5x +2y = 50, then what is the value of (x-2y)?

a. -2   b. 6   c. 7   d. 10

Ans: a

PYQ May 18 **Ans: d**	If α, β are the roots of the equation $x^2 + x + 5 = 0$ then $\dfrac{\alpha^2}{\beta} + \dfrac{\beta^2}{\alpha}$ is equal to a. 16/5 b. 2 c. 3 d. 14/5
Exercise **Ans:**	The values of $4 + \cfrac{1}{4 + \cfrac{1}{4 + \cfrac{1}{4 + \dots \infty}}}$ a. $1 \pm \sqrt{2}$ b. $2 + \sqrt{5}$ c. $2 \pm \sqrt{5}$ d. None
Exercise **Ans: d**	The roots of the equation $x^2 + (2p-1)x + p^2 = 0$ are real if. a. $p \geq 1$ b. $p \leq 4$ c. $p \geq \dfrac{1}{4}$ d. $p \leq \dfrac{1}{4}$
PYQ Nov 18 **Ans: a**	When two roots of quadratic equations are $\alpha, \dfrac{1}{\alpha}$ then what will be the quadratic equation: a. $\alpha x^2 - (\alpha^2 + 1)x + \alpha = 0$ b. $\alpha x^2 - \alpha^2 x + 1 = 0$ c. $\alpha x^2 - (\alpha^2 + 1)x + 1 = 0$ d. None
PYQ Jun 19 **Ans: c**	Find the condition that one roots is double the other of $ax^2 + bx + c = 0$ a. $2b^2 = 3ac$ b. $b^2 = 3ac$ c. $2b^2 = 9ac$ d. $2b^2 > 9ac$
PYQ Nov 20 **Ans: c**	The rational root of the equation $0 = 2p^3 - p^2 - 4p + 2$ is: a. 2 b. -2 c. 1/2 d. -1/2
PYQ Jan 21 **Ans: c**	The value of p for which the difference between the root of equation $x^2 + px + 8 = 0$ is 2 a. ± 2 b. ± 4 c. ± 6 d. ± 8
PYQ Jan 21 **Ans: b**	The harmonic mean of the roots of the equation $(5 + \sqrt{2})x^2 - (4 + \sqrt{5})x + 8 + 2\sqrt{5} = 0$ is a. 2 b. 4 c. 6 d. 8