

Section – A: Only One Option Correct

- (C)
 $\alpha + \beta = -3/2$ and $\alpha\beta = 9/2$
$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{-3/2}{9/2} = -\frac{1}{3}$$
- (B)
$$x^4 + 1 = x^4 + 2x^2 + 1 - 2x^2$$
$$= (x^2 + 1)^2 - (\sqrt{2}x)^2$$
$$= (x^2 + \sqrt{2}x + 1)(x^2 - \sqrt{2}x + 1)$$
$$\therefore b_1c_1 + b_2c_2 = (\sqrt{2})(1) + (-\sqrt{2})(1) = 0$$
- (D)
Let $p(x) = 3x^3 - 2x^2 + x - 1$
By remainder theorem,
Remainder = $p\left(-\frac{1}{2}\right)$
$$= 3\left(-\frac{1}{2}\right)^3 - 2\left(-\frac{1}{2}\right)^2 - \frac{1}{2} + 1 = \frac{-3}{8}$$
- (B)
$$C = \frac{b^2}{4a} \Rightarrow D = 0$$
- (A)
$$\left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right)$$
$$\therefore x^3 + \frac{1}{x^3} + 10 = (-5)^3 - 3(-5) + 10 = -100$$
- (C)
P(x) intersects X-axis three times.

7. (C)

$$\alpha + \beta = \frac{-k}{3} \text{ and } \alpha\beta = \frac{1-k^2}{3}$$

$$\alpha^2 + \beta^2 - \alpha\beta = 9 \Rightarrow (\alpha + \beta)^2 - 3\alpha\beta = 9$$

$$\therefore \left(\frac{-k}{3}\right)^2 - 3\left(\frac{1-k^2}{3}\right) = 9 \Rightarrow \frac{k^2}{9} + k^2 - 1 = 9$$

$$\therefore k = \pm 3$$

8. (B)

Let x be speed of person in still water and y be speed of stream.

$$\therefore x + y = 13 \text{ and } x - y = 7$$

$$\therefore x = 10 \text{ km/hr}$$

9. (D)

$$\text{Let } \frac{1}{2^x} = a \text{ and } \frac{1}{3^y} = b$$

$$\therefore 8a + 9b = 5$$

$$4a - 18b = -5$$

On solving, we get $a = \frac{1}{4}$ and $b = \frac{1}{3}$

$$\therefore 2^x = 4 \text{ \& } 3^y = 3$$

$$\therefore x = 2 \text{ \& } y = 1$$

$$\therefore x + y = 3$$

10. (A)

$$3x - 1 = \pm \frac{1}{2}$$

$$\therefore 3x - 1 = \frac{1}{2} \text{ and } 3x - 1 = \frac{-1}{2}$$

$$\therefore x = \frac{1}{2} \text{ and } x = \frac{1}{6}$$

11. (C)

$$\text{Let } 5^x = t$$

$$\therefore t^2 - 10t + 125 = 0$$

Let t_1 & t_2 be two roots.

$$\therefore x_1 \text{ \& } x_2 \text{ such that } t_1 = 5^{x_1} \text{ and } t_2 = 5^{x_2}$$

$$t_1 t_2 = 125$$

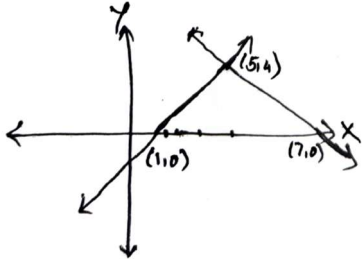
$$\therefore 5^{x_1} 5^{x_2} = 125$$

$$\therefore 5^{x_1+x_2} = 5^3$$

$$\therefore x_1 + x_2 = 3$$

12. (B)
 For no solution,
 $\frac{k}{3} = \frac{2}{k-1} \neq \frac{-2}{3}$
 $\therefore \frac{k}{3} = \frac{2}{k-1} \Rightarrow k = 3 \text{ or } -2 \text{ (Rejected)}$
 $\therefore k = 3$

13. (A)



Area of $\Delta = \frac{1}{2} \times 6 \times 4 = 12 \text{ sq. units}$

14. (C)
 $D = b^2 - 4ac$
 $\therefore 9a^2 - 8a = -1$
 $\therefore 9a^2 - 8a - 1 = 0 \Rightarrow (9a + 1)(a - 1) = 0$
 $\therefore a = -\frac{1}{9} \text{ or } a = 1$

15. (A)
 Theoretical

16. (D)
 Let the two digits number = $10x + y$
 $\therefore (10x + y) - (10y + x) = 27$
 $\therefore 9x - 9y = 27$
 $\therefore x - y = 3$

17. (B)
 Let α, β be roots of $-x^2 + 3x + m = 0$
 $\therefore \alpha + \beta = 3$ and $\alpha\beta = -m$
 Given: $\frac{\alpha}{\beta} = \frac{2}{3}$
 $\therefore \frac{2\beta}{3} + \beta = 3 \Rightarrow \beta = \frac{9}{5}$ and $\alpha = \frac{6}{5}$
 $\therefore m = -\alpha\beta = \frac{-54}{25}$

18. (D)

Roots of $x^2 + 4x - 21 = 0$ is 3 and -7 .

$$\therefore \alpha = 3$$

α is also roots of $x^2 + 3x + 2m = 0$

$$\therefore 3^2 + 3(3) + 3m = 0$$

$$\therefore m = -9$$

19. (D)
Theoretical

20. (A)

$$\text{Put } x = \frac{6-3y}{2} \text{ in } y^2 = 4x - 21$$

$$\therefore y^2 = 12 - 6y - 21$$

$$\therefore y^2 + 6y + 9 = 0$$

$$\therefore y = -3$$

$$\therefore x = \frac{15}{2}$$

Section – B: Challenge Yourself

21. (C)

$$\text{Let } x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots \infty}}}$$

$$\therefore x^2 = 6 + x$$

$$\therefore x^2 - x - 6 = 0$$

$$\therefore x = 3 \text{ or } x = -2$$

$$\therefore x > 0, x = 3$$

22. (A)

$$\alpha + \beta = \frac{7}{5} \text{ and } \alpha\beta = \frac{3}{5}$$

$$\frac{1}{\alpha^2 + \alpha} + \frac{1}{\beta^2 + \beta} = \frac{\alpha^2 + \alpha + \beta^2 + \beta}{\alpha^2\beta^2 + \alpha^2\beta + \alpha\beta^2 + \alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta + (\alpha + \beta)}{(\alpha\beta)^2 + \alpha\beta(\alpha + \beta) + \alpha\beta}$$

$$= \frac{\left(\frac{7}{5}\right)^2 - 2\left(\frac{3}{5}\right) + \left(\frac{7}{5}\right)}{\left(\frac{3}{5}\right)^2 + \left(\frac{3}{5}\right)\left(\frac{7}{5}\right) + \left(\frac{3}{5}\right)} = \frac{\frac{49}{25} + \frac{1}{5}}{\frac{30}{25} + \frac{3}{5}}$$

$$= \frac{54}{45} = \frac{6}{5}$$

23. (B)

$$\text{Use } a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

24. (D)

$$\text{Let } F(x) = q(x)(x^2 - x - 2) + ax + b$$

By remainder theorem, $F(-1) = 3$ and $F(2) = -1$

$$\therefore -a + b = 3 \text{ and } 2a + b = -1$$

$$\therefore a = \frac{-4}{3} \text{ and } b = \frac{5}{3}$$

$$\therefore \text{Remainder} = \frac{-4x + 5}{3}$$

25. (Bonus)

Let $f(x) = p(x) - x^2$, which is cubic

Then 1, 2 and 3 are zeros of $f(x)$

$$\therefore f(x) = (x-1)(x-2)(x-3)$$

$$\therefore p(x) = (x-1)(x-2)(x-3) + x^2$$

$$\therefore p(4) = (3)(2)(1) + 4^2$$

$$\therefore p(4) = 22$$

Section – C: Logical Reasoning

26. (D)

27. (C)

28. (A)

29. (A)

30. (C)