ACE OF PACE

ENGINEERING **Grade X moving to XI** **DATE: 23/11/2025**

Section – A

1. (A)

$x^2+\frac{1}{x^2}=3^2-2=7$

$x^3+\frac{1}{x^3}=3^3-3(3)=18$

$x^5+\frac{1}{x^5}=(18)(7)-3=126-3=123$

2. (D)

$p^2+q^2+r^2=1^2-2(-1)=3$

$p^3+q^3+r^3-3pqr=(p+q+r)\left(p^2+q^2+r^2-(pq+qr+rp)\right)$

$p^3+q^3+r^3-3(-1)=(1)\times(3-(-1))\Rightarrow p^3+q^3+r^3=4-3=1$

3. (B)

Multiplying: $9x+6y=21$ and $4x-6y=18$. Adding $13x=39\Rightarrow x=3$

$3(3)+2y\Rightarrow 7\Rightarrow 9+2y=7\Rightarrow y=-1$

$\frac{x}{y}=\frac{3}{-1}=-3$

4. (D)

$\alpha+\beta=-4,\ \alpha\beta=-1$

$\frac{(\alpha+\beta)+2}{\alpha\beta+(\alpha+\beta)+1}=\frac{-4+2}{-1+1(-4)+1}=\frac{-2}{-4}=\frac{1}{2}$

5. (A)

Minimum occurs at $x=-\frac{-8}{2(2)}=2$

$f(2)=2(2)^2-8(2)+c=c-8$

$c-8=-1\Rightarrow c=7$

6. (B)

$\frac{1}{3}\pi R_c^2\,h=\pi R_{cyl}^2\,h\ \Rightarrow\ \frac{R_c^2}{R_{cyl}^2}=3\ \Rightarrow\ \frac{R_c}{R_{cyl}}=\sqrt{3}$.

7. (C)

$F = S + 20.$

$F - 5 = 3(S - 5) \Rightarrow S + 15 = 3S - 15 \Rightarrow 30 = 2S \Rightarrow S = 15.$

8. (D)

For equal of $x^2 + mx + (m-1) = 0$, $D = m^2 - 4(m-1) = 0$.

$m^2 - 4m + 4 = 0 \Rightarrow (m-2)^2 = 0 \Rightarrow m = 2$.

The only possible value is $m = 2$.

The product of all possible values is 2.

9. (C)

$x^2 - x - 2 = (x-2)(x+1).$

$P(2) = 0 \Rightarrow 4a + 2b = -2$ ... (i)

$P(-1) = 0 \Rightarrow a - b = 7$ ... (ii)

Solving gives $a = 2, b = -5.$

$a + b = -3$

10. (A)

The real roots are $x \in \{-3, -2, 2, 3\}$.

Sum of cubes of distinct roots: $(-3)^3 + (-2)^3 + (2)^3 + (3)^3 = -27 - 8 + 8 + 27 = 0$

11. (A)

$11(x + y) = 143 \Rightarrow x + y = 13$.

$|x - y| = 3$.

Case 1: $x = 8$, $y = 5$ (Number 85).

Case 2: $x = 5, y = 8$ (number 58)

12. (B)

From the equation, $\alpha + \beta = 5$ and $\alpha\beta = 3$.

The expression is $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$

Calculate the numerator: $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = (5)^2 - 2(3) = 25 - 6 = 19$.

The final value is $\frac{19}{3}$.

13. (D)

$\alpha + \beta = p$, $\alpha\beta = q.$

$p^2 - 2q = 7$ and $p^3 - 3pq = 18$.

By inspection, $p = 3, q = 1$ satisfies both equations $3^2 - 2(1) = 7$ and $3^3 - (3)(1) = 18$

$p + q = 3 + 1 = 4$

14. (A)

From Vieta's formulas, the sum of roots $\alpha + \beta + \gamma = 6$.

We use the identify: $(\alpha + \beta + \gamma)^2 = \alpha^2 + \beta^2 + \gamma^2 + 2(\alpha\beta + \beta\gamma + \gamma\alpha)$.

The sum of products in pairs is $\alpha\beta + \beta\gamma + \gamma\alpha = k$

Substitute the known values: $(6)^2 = 12 + 2(k)$

$36 = 12 + 2k$

$2k = 24 \Rightarrow k = 12$

15. (B)

Squaring twice leads to $x^2 - 50x + 13 = 0$.

Only one root, $x \approx 0.26$, satisfies the initial condition $3 - \sqrt{x+1} \geq 0$ (i.e., $x \leq 8$)

16. (B)

$\sqrt{14 + 6\sqrt{5}} = \sqrt{14 + 2\sqrt{45}}$

Since $9 + 5 = 14$ and $9 \times 5 = 45$; $\sqrt{9} + \sqrt{5} = 3 + \sqrt{5}$

17. (B)

$S_1 = 3, S_2 = 1, S_3 = -1$

Required value $= S_1 + S_2 + S_3 = 3 + 1 + (-1) = 3$

18. (C)

For no solution, $\frac{k-1}{2} = \frac{4}{k+1} \neq \frac{6}{10}$.

$\frac{k-1}{2} = \frac{4}{k+1} \Rightarrow k^2 - 1 = 8 \Rightarrow k = \pm 3$

Both $k = 3$ and $k = -3$ satisfy the $\neq \frac{6}{10}$ condition.

19. (A)

$3x - y - 1 = 0$

Slope $m = 3$.

$y - 2 = 3(x - 1) \Rightarrow 3x - y - 1 = 0$

20. (A)

Let $a^x = b^y = c^z = k$.

$a = k^{1/x}, b = k^{1/y}, c = k^{1/z}$.

$b^2 = ac \Rightarrow k^{2/y} = k^{1/x}\,k^{1/z}$

$\Rightarrow \frac{2}{y} = \frac{1}{x} + \frac{1}{z}$

Section – B

21. (C)

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

22. (C)

$$E = \frac{x^3 + y^3 + z^3}{xyz}$$

Since $x + y + z = 0$, the identity $x^3 + y^3 + z^3 = 3xyz$ applies

$$E = \frac{3xyz}{xyz} = 3$$
$$E^{2025} = 3^{2025}$$

23. (A)
$\alpha + \beta = 6, \alpha\beta = 1$
$\alpha^2 + \beta^2 = 34$
$\alpha^4 + \beta^4 = (34)^2 - 2(1)^2 = 1156 - 2 = 1154$

24. (A)
Combined rate $R = \frac{1}{10} + \frac{1}{15} - \frac{1}{30} = \frac{6+4-2}{60} = \frac{8}{60} = \frac{2}{15}$.
Time $T = \frac{1}{R} = \frac{15}{2} = 7.5$ hours

25. (C)
$\alpha^2 + \beta^2 = 6$.
New Sum $S' = 6 + 2 = 8$
New product $P' = (-1)^2 + 6 + 1 = 8$
Equation $x^2 - 8x + 8 = 0$

Section – C

26. (B)
The rule is a $** + 5$ alphabetical shift ** for every letter, followed by **reversing the order** of the resulting code.
FLIGHT shifted by +5 becomes: K Q N L M Y
Reversed: **Y M L N Q K**.

27. (B)
The denominators are product of consecutive integers: $n(n+1)$, starting with 1×2
The next term's denominator is $6 \times 7 = 42$

28. (A)
At 4:30, the minute hand points 6.
If 6 is East, the entire clock face is rotated 90° clockwise.
The hour hand is between 4 and 5.
In the new orientation, 3 is North and 6 is East.
The hour hand is between North and East, pointing **North-East**.

29. (C)
Hard : 8
Study : 6
$\therefore$ Very : 7

30. (B)
The rule is $a \,\Delta\, b = a^2 + b^2$
$4 \,\Delta\, 2 = 4^2 + 2^2 = 20$
$10 \,\Delta\, 6 = 10^2 + 6^2 = 100 + 36 = 136$