ACE OF PACE

ENGINEERING **Grade X moving to XI** **DATE: 08/02/2026**

Section – A

1. (D)
Let other root be r.
Sum of roots, $r+\sqrt{2}=-\frac{a}{2} \rightarrow$ rational.
So, $r=P-\sqrt{2}$ where P is rational.
Product of roots, $\left(P-\sqrt{2}\right)\sqrt{2}=\frac{b}{2} \rightarrow$ rational.
Now, $\left(P-\sqrt{2}\right)\sqrt{2}=\sqrt{2}P-2$ which is rational only when $P = 0$.
$\therefore \quad r=-\sqrt{2}$
$-\frac{a}{2}=r+\sqrt{2}=0 \Rightarrow a=0$
$\frac{b}{2}=\left(-\sqrt{2}\right)\sqrt{2}=-2 \Rightarrow b=-4$.
$\therefore \; a-b=4$.

2. (A)
$\frac{ab}{a^2+b^2}=\frac{1}{2} \Rightarrow a^2-2ab+b^2=0 \Rightarrow (a-b)^2=0$
$\Rightarrow a=b$
$a+b=10 \Rightarrow 2a=10 \Rightarrow a=5$

3. (B)
If n is even then clearly $n^4\left(n^4+15\right)$ is divisible by 16
Let $n = 2m - 1$ (odd).
$n^4+15=\left(n^4-1\right)+16$
$=\left(n^2+1\right)(n+1)(n-1)+16$
$=\left(4m^2-4m+2\right)(2m)(2m-2)+16$
$=8\left(2m^2-2m+1\right)\underbrace{m(m-1)}_{\text{divisible by 2}}+16$
$\Rightarrow n^4+15$ is divisible by 16.

4. (C)
Remainder has degree < 2
Let it be $ax+b$.
$p(x)=\left(x^2+5x+6\right)q(x)+ax+b$
Also, $p(-2)=3,\; p(-3)=5$ by remainder theorem.

$p(-2)=3 \Rightarrow oq(x)-2a+b=3 \Rightarrow b-2a=3$
$p(-3)=5 \Rightarrow oq(x)-3a+b=5 \Rightarrow b-3a=5$
Solving gives $a=-2,\ b=-1$.

5. (A)

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

$$x^3+\frac{1}{x^3}=\left(x+\frac{1}{x}\right)^3-3x\cdot\frac{1}{x}\left(x+\frac{1}{x}\right)$$
$$=4^3-3\times 4=52$$

6. (B)

$$\frac{\lambda+3}{2}=\frac{\lambda}{3\lambda+2}\neq\frac{1}{2}$$

Solving first quality, $(\lambda+3)(3\lambda+2)=2\lambda$
$$3\lambda^2+9\lambda+6=0$$
$$\lambda=-1,-2$$
When $\lambda=-2$, first two ratios equal the third ratio.

7. (C)

4891 = 4757 + 134
So, check if 4757& 134 have common factor.
$\because$ 67 divides both, both 4757 & 4891 are divisible by 67.

8. (D)

$$6x^2-7\sqrt{3}x+5=6x^2-2\sqrt{3}x-5\sqrt{3}x+5$$
$$=2\sqrt{3}x\left(\sqrt{3}x-1\right)-5\left(\sqrt{3}x-1\right)$$
$$=\left(2\sqrt{3}x-5\right)\left(\sqrt{3}x-1\right)$$
$\therefore\ a=-1,\ b=2\sqrt{3},\ c=-5$

9. (B)

$$9^{\frac{x+2}{4}}=3^{\frac{x+2}{2}}=3^{\frac{x}{2}+1}=3\times\left(3^x\right)^{\frac{1}{2}}$$
$$=3\times 64^{\frac{1}{2}}=24$$

10. (C)

$b+c=-a,\ c+a=-b,\ a+b=-c$

$$\frac{(b+c)^2}{bc}+\frac{(c+a)^2}{ca}+\frac{(a+b)^2}{ab}=\frac{a^2}{bc}+\frac{b^2}{ca}+\frac{c^2}{ab}$$
$$=\frac{a^3+b^3+c^3}{abc}\quad\left\{a^3+b^3+c^3=3abc\right\}$$
$$=\frac{3abc}{abc}=3$$

11. (A)
Let present ages of father be x, son be y in years.
Given $x = 4y$, $x + 5 = 3(y + 5)$
Solving, $4y+5=3y+15 \Rightarrow y=10 \Rightarrow x=40$

12. (C)
$p(x)=\left(x^2-3x+2\right)q(x)+2x+1$
Put $x=1 \to p(1)=\left(1^2-3\times1+2\right)q(1)+2\times1+1$
$=0\times q(1)+3$
$\because\ p(1)=3$, use remainder theorem.

13. (D)
$ak^2+bk+c=0$
Clearly putting $x = 0$ in given polynomial gives 0.

14. (B)
Let the number be N.
$N=299Q+184=13\times23Q+13\times14+2$
$=13(23Q+14)+2$

15. (B)
$\frac{a+b}{ab}=\frac{1}{3},\ \frac{a-b}{ab}=\frac{1}{2}$
$\frac{1}{b}+\frac{1}{a}=\frac{1}{3},\ \frac{1}{b}-\frac{1}{a}=\frac{1}{2}$
Subtracting the two, $\frac{2}{a}=\frac{1}{3}-\frac{1}{2}$
$\Rightarrow a=-12$

16. (D)
$4ax^2+2bx+c=a(2x)^2+b(2x)+c$
So, now we must have $2x=\alpha$ & $2x=\beta$.

17. (A)
Let the number be x, y.
$x+y=76,\ \frac{4}{5}x=\frac{11}{10}y \Rightarrow x=\frac{11}{8}y$
$\frac{11}{8}y+y=76 \Rightarrow \frac{19}{8}y=76 \Rightarrow y=32$
$x=76-y=44$

18. (B)
Let present age of father be x, son be y is years.
$x=4y,(x-6)(y-6)=52$
Solving, $(4y-6)(y-6)=52$
$\Rightarrow 4y^2-30y-16=0$

$\Rightarrow\ y = 8, -\frac{1}{2}\ \left\{-\frac{1}{2} \text{ rejected}\right\}$

$\Rightarrow\ x = 32$

19. (C)

$(x+y)^2 = (x^2+y^2) + 2xy = 25 + 2\times 12 = 49$

$\Rightarrow\ x+y = \pm 7$

$x^3 + y^3 = (x+y)^3 - 3xy(x+y)$

When $x+y=7\ \Rightarrow\ 7^3 - 3\times 12\times 7 = 91$

When $x+y=-7\ \Rightarrow\ (-7)^3 - 3\times 12(-7) = -91$

20. (C)

$4ax^2 + 4bx + 4c = 4(ax^2 + bx + c)$

Multiplying a polynomial by some constant does not change zeros.

Section – B

21. (B)

Observe $(7+4\sqrt{3})(7-4\sqrt{3}) = 7^2 - (4\sqrt{3})^2 = 1$

So, $7+4\sqrt{3}$ & $7-4\sqrt{3}$ are reciprocals.

Let $(7+4\sqrt{3})^x = t\ \Rightarrow\ (7-4\sqrt{3})^x = \frac{1}{t}$

Equation is $t + \frac{1}{t} = 14\ \Rightarrow\ t^2 - 14t + 1 = 0$

$t = \frac{14 \pm \sqrt{196-4}}{2} = 7 \pm 4\sqrt{3}$

$(7+4\sqrt{3})^x = 7+4\sqrt{3}$ OR $(7+4\sqrt{3})^x = 7-4\sqrt{3}$

$\Rightarrow\ x = 1$ OR $x = -1$

22. (B)

When n is even, $n^4 + 4^n$ is even so composite.

Let $n = 2m-1$ (odd)

$$\begin{aligned} n^4 + 4^n &= (n^2)^2 + 2\cdot(2^n)\cdot n^2 + (2^n)^2 - 2\cdot 2^n\cdot n^2 \\ &= (n^2+2^n)^2 - 2\cdot 2^n\cdot n^2 \\ &= (n^2+2^n)^2 - 2^{2m}\cdot n^2 \\ &= (n^2+2^n)^2 - (n\cdot 2^m)^2 \\ &= (n^2+2^n-n\cdot 2^m)(n^2+2^n+n\cdot 2^m) \end{aligned}$$

$n^4 + 4^n$ is factorised, hence it is composite.

23. (C)

Let roots be α, β.

$(\alpha-\beta)^2 = (\alpha+\beta)^2 - 4\alpha\beta$

$4^2 = m^2 - 4(2m+1)$

$\Rightarrow m^2 - 8m - 20 = 0$

$\Rightarrow m = 10, -2$

24. (A)

$$\frac{2}{\sqrt{2}+\sqrt{3}+\sqrt{5}} = \frac{2\left(\sqrt{2}+\sqrt{3}-\sqrt{5}\right)}{\left(\sqrt{2}+\sqrt{3}+\sqrt{5}\right)\left(\sqrt{2}+\sqrt{3}-\sqrt{5}\right)}$$

$$= \frac{2\left(\sqrt{2}+\sqrt{3}-\sqrt{5}\right)}{\left(\sqrt{2}+\sqrt{3}\right)^2 - \left(\sqrt{5}\right)^2} = \frac{2\left(\sqrt{2}+\sqrt{3}-\sqrt{5}\right)}{2+3+2\sqrt{6}-5}$$

$$= \frac{\sqrt{2}+\sqrt{3}-\sqrt{5}}{\sqrt{6}} = \sqrt{\frac{1}{3}} + \sqrt{\frac{1}{2}} - \sqrt{\frac{5}{6}}$$

25. (C)

Let $6^x = t \Rightarrow t^2 = 36^x$

Equation is $\frac{t^2}{18} - t + 2 = 0 \Rightarrow t^2 - 18t + 36 = 0$

Let x_1, x_2 be roots of original equation.

$\Rightarrow 6^{x_1}, 6^{x_2}$ are roots of new equation.

Product of roots, $6^{x_1} \cdot 6^{x_2} = 36 \Rightarrow 6^{x_1+x_2} = 36$

$\Rightarrow x_1 + x_2 = 2$.

Section – C

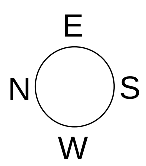
26. (A)

There are 90000 5-digit numbers.
Observe that every alternate number has sum of digits even (eg. 10000 **x**, 10001 ✓, 10002 **x**, 10003 ✓,…….)
So half of 90000, 45000 is the answer.

27. (A)

January 31, 1970 (exactly 56 years age) will be same day : Saturday
30 days ago it will be Thursday.

28. (D)



29. (D)
Father of father $\rightarrow$ grandfather
Granddaughter $\rightarrow$ same generation
Husband $\rightarrow$ same generation but cannot be brother cousin.

30. (C)
Bell A rings every 12 seconds.
Bell B rings every 15 seconds.
LCM (12, 15) = 60
At 60^{th} second, both ring together.
So bell A rings at 0^{th} , 12^{th} , 24^{th} , 36^{th} , 48^{th}
Second $\Rightarrow$ 5 times.