ACE OF PACE

ENGINEERING | **Grade X moving to XI** | **DATE: 11/01/2026**

Section – A

1. **(C)**

Using

$$\frac{1}{lm}+\frac{1}{mn}+\frac{1}{ln}=\frac{l+m+n}{lmn}$$

and for a cubic $ax^3+bx^2+cx+d=0$,

$$l+m+n=-\frac{b}{a},\ lmn=-\frac{d}{a}.$$

Hence, $$\frac{l+m+n}{lmn}=\frac{b}{d}=\frac{-20}{-5}=4.$$

2. **(B)**

Since, $-\sqrt{\frac{3}{2}}$ and $\sqrt{\frac{3}{2}}$ are zeros,

$\left(x+\sqrt{\frac{3}{2}}\right)\left(x-\sqrt{\frac{3}{2}}\right)=x^2-\frac{3}{2}$ is factor of $f(x)$.

Multiplying by 2 to clear fractions:

$2x^2-3$ is a factor of $f(x)$.

Factorizing:

$$\begin{aligned}f(x)&=2x^4-2x^3-7x^2+3x+6\\&=(2x^2-3)(x^2-x-2)\\&=(2x^2-3)(x-2)(x+1)\end{aligned}$$

Thus, $f(x)=2\left(x+\sqrt{\frac{3}{2}}\right)\left(x-\sqrt{\frac{3}{2}}\right)(x-2)(x+1)$

3. **(A)**

$$1+\frac{1}{x}=\frac{x+1}{x},1+\frac{1}{x+1}=\frac{x+2}{x+1},1+\frac{1}{x+2}=\frac{x+3}{x+2}$$

So the product becomes:

$$\frac{x+1}{x}\cdot\frac{x+2}{x+1}\cdot\frac{x+3}{x+2}=\frac{x+3}{x}$$

Now substitute:

$$x\left[\frac{x+3}{x}-1\right]=x\left[\frac{x+3-x}{x}\right]=x\left(\frac{3}{x}\right)=3$$

4. **(A)**

$\alpha+\beta+\gamma=5,\ \alpha\beta+\beta\gamma+\gamma\alpha=6,\ \alpha\beta\gamma=1$

Using the identity:

$$\alpha^3+\beta^3+\gamma^3-3\alpha\beta\gamma=(\alpha+\beta+\gamma)\left(\alpha^2+\beta^2+\gamma^2-\alpha\beta-\beta\gamma-\gamma\alpha\right)$$

Now, $\alpha^2+\beta^2+\gamma^2=(\alpha+\beta+\gamma)^2-2(\alpha\beta+\beta\gamma+\gamma\alpha)=25-12=13$

Hence, $\alpha^3+\beta^3+\gamma^3=5(13-6)+3(1)=35+3=38$

5. **(A)**

Roots are in the ratio 2 : 4 : 5; let them be $2m$, $4m$, $5m$.

Product $=(2m)(4m)(5m)=40m^3=1080 \Rightarrow m^3=27 \Rightarrow m=3$.

Sum of roots $=2m+4m+5m=11m=33$.

For $x^3-ax^2+bx-1080=0$, sum of roots = a and coefficient of $x^2=-a=-33$.

Hence, $a=33$.

6. **(C)**

$$\frac{2x^2+12x+16}{3x^2+6x}\times\frac{4x^2-100}{6x+30}=\frac{2\left(x^2+6x+8\right)}{3x(x+2)}\times\frac{4\left(x^2-25\right)}{6(x+5)}$$

$$=\frac{2(x+4)(x+2)}{3x(x+2)}\times\frac{4(x+5)(x-5)}{6(x+5)}$$

$$=\frac{4(x+4)(x-5)}{9x}$$

7. **(C)**

Trying $x=1$ gives zero, hence $(x-1)$ is a factor.

Dividing, the remaining quadratic is $2x^2-5x+3=(2x-3)(x-1)$.

$\therefore\quad 2x^3-7x^2+8x-3=(x-1)^2(2x-3)$

8. **(B)**

$$\frac{y^4-x^4}{x(x+y)}=\frac{(y-x)(y+x)\left(y^2+x^2\right)}{x(x+y)}=\frac{(y-x)\left(y^2+x^2\right)}{x}$$

So numerator becomes:

$$\frac{(y-x)\left(y^2+x^2\right)-y^3}{x}$$

Expand:

$$(y-x)\left(y^2+x^2\right)-y^3=y^3+yx^2-xy^2-x^3-y^3=-x\left(y^2-xy+x^2\right)$$

Thus expression reduces to:

$$\frac{-x\left(y^2-xy+x^2\right)}{x\left(y^2-xy+x^2\right)}=-1$$

9. **(A)**

$$\left(x^3+\frac{1}{x^3}\right)-5\left(x^2+\frac{1}{x^2}\right)+\left(x+\frac{1}{x}\right)$$

Given $x+\frac{1}{x}=5$,

$$x^2+\frac{1}{x^2}=25-2=23,\ \ x^3+\frac{1}{x^3}=125-15=110$$

Substitute:

$$110-5(23)+5=110-115+5=0$$

10. **(B)**

$$\begin{aligned}10x^2+x-2+6xy+3y &= 10x^2+5x-4x-2+6xy+3y\\ &= 5x(2x+1)-2(2x+1)+3y(2x+1)\\ &= (2x+1)(5x-2+3y)\end{aligned}$$

11. **(C)**

Let $f(x)=ax^2+bx+10$.

$$f(5)=25a+5b+10=75,\quad f(-5)=25a-5b+10=45$$

Subtracting,

$$10b=30\Rightarrow b=3$$

Substitute in $f(5)$:

$$25a+15+10=75\Rightarrow 25a=50\Rightarrow a=2$$

So, $f(x)=2x^2+3x+10$. Since p, q are its roots,

$$p\times q=\frac{10}{2}=5$$

12. **(B)**

Let $a=kc$, $b=kd$ and $e=mg, f=mh$.

$$\frac{ae+bf}{ae-bf}=\frac{kc\cdot mg+kd\cdot mh}{kc\cdot mg-kd\cdot mh}=\frac{cg+dh}{cg-dh}$$

13. **(A)**

Let Ronit's present age be x years. Then, father's present age $=(x+3x)$ years = $4x$ years.

$\therefore\quad (4x+8)=\frac{5}{2}(x+8)$

$\Rightarrow\quad 8x+16=5x+40$

$\Rightarrow\quad 3x=24$

$\Rightarrow\quad x=8$

Hence, required ratio $=\dfrac{(4x+16)}{(x+16)}=\dfrac{48}{24}=2$

14. **(B)**

$$u=\frac{1}{x},\ \ v=\frac{1}{y}$$

Then: $7u-2v=5$ (1)

$8u+7v=15$ (2)

Solving (1) and (2):

$$u=1, v=1 \Rightarrow x=1, y=1$$
$$x+y=1+1=2$$

15. **(A)**

Let the equation of the line be $y=mx+c$.

Using A (2, 5):

$5=2m+c$ ...(1)

Using B(10, 9):

$9=10m+c$ ...(2)

Subtracting (1) from (2):

$$4=8m \Rightarrow m=\frac{1}{2}$$

Substituting in (1):

$c=4$

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

(Only (6, 8) does not satisfy this equation.)

16. **(A)**

$$mn=\frac{r}{p}$$

$$(km)(kn)=mnk^2=\frac{c}{a}$$

$$\Rightarrow k^2=\frac{c}{a}\cdot\frac{p}{r}$$

$$k=\sqrt{\frac{cp}{ar}}$$

$\therefore$ Option (A) is correct.

17. **(D)**

From $2x^2-7x+3=0$, the roots are

$$x=\frac{7\pm 5}{4}=3, \frac{1}{2}$$

Since q is integral, $q=3$. Given $p=q^2$, we get $p=9$.

Now substitute $x=9$ in $ax^2+4x+6=0$

$$81a+36+6=0 \Rightarrow 81a+42=0 \Rightarrow a=-\frac{14}{27}$$

18. **(A)**

Given,

$$x^2-2x-(15+nm)=x(x+n+m)=x^2+(n+m)x$$

Comparing coefficients, $n+m=-2$ and $nm=-15$.

Hence n, m are roots of $t^2+2t-15=0$ which gives $t=3, -5$.

Therefore, $n-m=8$

19. **(A)**

- $A=1$
- $B=-2(a+4)$
- $C=a^2+8$

$$\Delta = B^2 - 4AC = \left[-2(a+4)\right]^2 - 4(1)\left(a^2+8\right)$$
$$= 4(a+4)^2 - 4\left(a^2+8\right)$$
$$= 4\left[\left(a^2+8a+16\right) - a^2 - 8\right]$$
$$= 4(8a+8) = 32(a+1)$$

For real roots:

$$32(a+1) \ge 0 \Rightarrow a+1 \ge 0 \Rightarrow a \ge -1$$

20. **(C)**

Sum of roots = 14

Product of roots = 12 × 4 = 48

Quadratic Equation: $x^2 - 14x + 48 = 0$

Section – B

21. **(A)**

Using the given roots:

- One root of $f(x) = 0$ is $2 \Rightarrow 4p + 2q + r = 0$
- One root of $g(x) = 0$ is $\frac{1}{4} \Rightarrow 16p + 4q + r = 0$

Solving gives:

$$q = -6p,\ r = 8p$$

Now,

- Sum of roots of $f(x)$ is $-\frac{q}{p} = 6$
- Sum of roots of $g(x)$ is $-\frac{q}{r} = \frac{3}{4}$

22. **(A)**

$\alpha + \beta = -m$ and $\alpha\beta = 1$

$\Rightarrow \gamma + \delta = -n$ and $\gamma\delta = 1$

$$(\alpha-\gamma)(\beta-\gamma)(\alpha+\delta)(\beta+\delta)$$
$$= (\alpha-\gamma)(\beta+\delta)(\beta-\gamma)(\alpha+\delta)$$
$$= [\alpha\beta + \alpha\delta - \gamma\beta - \gamma\delta][\alpha\beta + \beta\delta - \alpha\gamma - \gamma\delta]$$
$$= [1 + \alpha\delta - \gamma\beta - 1][1 + \beta\delta - \gamma\alpha - 1]$$
$$= (\alpha\delta - \gamma\beta)(\beta\delta - \gamma\alpha)$$
$$= \delta^2 - \alpha^2 - \beta^2 + \gamma^2$$
$$= \left(\delta^2 + \gamma^2\right) - \left(\alpha^2 + \beta^2\right)$$
$$= \left[(\delta+\gamma)^2 - 2\delta\gamma\right] - \left[(\alpha+\beta)^2 - 2\alpha\beta\right]$$
$$= \left[\left(-n^2\right) - 2\cdot 1\right] - \left[(-m)^2 - 2\cdot 1\right]$$
$$= n^2 - m^2$$

23. **(B)**

$$\frac{xy}{x+y}=a \Rightarrow \frac{1}{a}=\frac{1}{x}+\frac{1}{y}$$

Similarly, $\frac{1}{b}=\frac{1}{x}+\frac{1}{z}$, $\frac{1}{c}=\frac{1}{y}+\frac{1}{z}$

Add first two and subtract the third:

$$\frac{1}{a}+\frac{1}{b}-\frac{1}{c}=\frac{2}{x}$$

Hence, $x=\dfrac{2}{\frac{1}{a}+\frac{1}{b}-\frac{1}{c}}=\dfrac{2abc}{ac+bc-ab}$

24. **(D)**

$$N=\sqrt[3]{4}+\sqrt[3]{2}+1 \;\Rightarrow\; N-1=\sqrt[3]{4}+\sqrt[3]{2}$$

$$\left(N-1\right)^3=4+2+3\sqrt[3]{8}\left(\sqrt[3]{4}+\sqrt[3]{2}\right)=6+6\left(N-1\right)$$

$$\left(N-1\right)^3=6N \Rightarrow 1-\frac{3}{N}-\frac{3}{N^2}-\frac{1}{N^3}=0$$

$$\therefore\ \frac{1}{N^3}+\frac{3}{N^2}+\frac{3}{N}=1$$

25. **(A)**

Let total work = 12 units.

In 10 weeks, work done $=\frac{5}{6}=10$ units.

Washed away $=\frac{1}{2}\times 10=5$ units.

Remaining work = 12 – 5 = 7 units.

200 men do 10 units in 10 weeks $\Rightarrow$ 1 unit per week.

140 men do $\frac{7}{10}$ unit per week.

Time for 7 units $=7\div\frac{7}{10}=10$ weeks.

Total time = 10 + 4 + 10 = 24 weeks.

Section – C

26. **(D)**

First 2 options leave no consecutive days for O and K, third is simply not possible because O and K cannot occur on same day. Option D gives chance to create valid order.

27. **(B)**

M	T	W	Th	F
H	K	O	I	U
	Z			

28. **(D)**

Test **Z on Thursday**: Since I is already on Thursday, Thursday must be the **double-session day**. K and O cannot use Thursday (already full), so they must be placed on **two consecutive days between Monday–Wednesday**. H must be scheduled **before Thursday**, so H also goes Monday–Wednesday. That leaves **only Friday** for U. Thus, **U is forced onto Friday** when **Z is on Thursday**.

For all other possible days for Z, U still has more than one available position.

29. **(B)**

1 January 1970 (exactly 56 years ago) is same day, Thursday two days ago will be Tuesday.

30. **(D)**

Difference between successive terms is 1, 4, 9, 16, which are perfect squares.

Next difference is 25, so next term is 30 + 25.