ACE OF PACE
Grade X moving to XI

ENGINEERING **SOLUTIONS** **DATE: 07/09/2025**

SECTION – A

1. **(B)**

The area of the circle inside the triangle is 45% of the total area of the diagram. The area of the circle outside the triangle is (100 – 40 – 45)% = 15% of the total area of the diagram. Therefore, the percentage of the circle that lies outside the triangle is $\frac{15}{15+45}\times 100 = 25\%$

2. **(B)**

Let the price of one pen be Rs. P, notebook be Rs. N and one file be Rs. F

According to the problem statement

$\Rightarrow$ 4P + 6N + 9F = 305 …(i)

$\Rightarrow$ 3P + 4N + 2F =145 …(ii)

Now $2\times(\text{i})-(\text{ii})$

$\Rightarrow$ (8 – 3)P + (12 – 4) N + (18 – 2) F = 5P + 8N + 16F = 2 $\times$ 305 – 145 = 465

$\therefore$ The cost of 5 pens, 8 notebooks and 16 files is Rs. 465

3. **(D)**

In five seconds, the cyclist will have travelled 5×5m = 25 m.

Hence the wheels will have made $25 \div 1.25$ = 20 complete turns.

4. **(D)**

According to factor theorem, x – a is a factor of p(x) if and only if p(a) = 0.

Here, it is given that x – 3 is a factor of $5x^3 - 2x^2 + x + k$.

$p(3) = 5(3)^3 - 2(3)^2 + 3 + k = 0$

Therefore, $5(27) - 2(9) + 3 + k = 0$

135-18 +3 + k = 0

120 + k = 0

Therefore, k = –120

5. **(C)**

Since there are 180° in a straight line, we can form the equation.

$20^\circ + (10x-2)^\circ + (3x+6)^\circ = 180^\circ$

20 + 10x – 2 + 3x + 6 = 180 (in degrees)

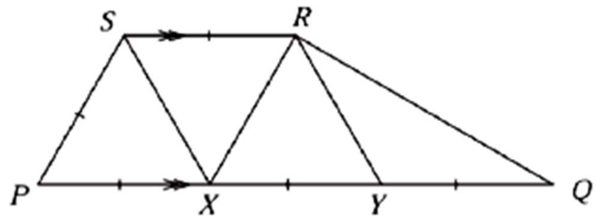
13x + 24 = 180

13x = 156

x = 12.

Therefore, $\angle CED = (3\times 12+6)^\circ = 42^\circ$

6. **(D)**



The diagram shows the trapezium described with points X and Y added on PQ such that PX = XY = YQ = PS = SR. Since angle RSP = 120°, angle SPQ = 60° using co-interior angles and so triangle SPX is equilateral. Similarly, it can easily be shown that triangles SXR and RXY are also equilateral. In triangle RYQ we then have RY = YQ and angle RYQ = 120° using angles on a straight line adding to 180°. Hence triangle RYQ is isosceles and so angle $YQR = \frac{1}{2}\left(180^\circ - 120^\circ\right) = 30^\circ$.

Therefore, angle PQR is 30°.

7. **(A)**

$$\frac{1}{k+1} = \frac{k+1}{9} = \frac{5}{8k-1}$$

$5k + 5 = 8k - 1 \Rightarrow k = 2$

8. **(A)**

Let, $k^3 = x$

So, $8x^2 + 15x - 2 = 0$

$\Rightarrow 8x^2 + 16x - x - 2 = 0$

$\Rightarrow 8x(x+2) - 1(x+2) = 0$

$\Rightarrow (8x-1)(x+2) = 0$

$\Rightarrow 8x - 1 = 0 \Rightarrow x = \frac{1}{8}$

$\Rightarrow x + 2 = 0 \Rightarrow x = -2$ [Not possible because we only want positive values of k]

Now, $k^3 = \frac{1}{8}$

$\Rightarrow k = \frac{1}{2} \Rightarrow \frac{1}{k} = 2$

Then, $\left(k + \frac{1}{k}\right) = \left(\frac{1}{2} + 2\right) = \frac{5}{2} = 2\frac{1}{2}$

$\therefore$ The value of $\left(k + \frac{1}{k}\right)$ is $2\frac{1}{2}$.

9. **(A)**

Since 899 is divisible by 29, so you can directly divide the remainder of 63 by 29, So $\frac{63}{29}$ will give 5 as a remainder.

10. **(B)**

Since each side of the smaller cube is 3 cm, it can be figured out that each face of the original cube is divided into 4 parts, or in other words, the original cube is divided into 64 smaller cubes. For a smaller cube to have none of its sides painted, it should not be a part of the face of the original cube (i.e. none of its faces should be exposed). We can find at the centre of the original cube there are $(2\times 2\times 2) = 8$ such cubes.

11. **(B)**

$\frac{a}{b+c}+\frac{b}{c+a}+\frac{c}{a+b}+3-3$

$=\frac{a+b+c}{b+c}+\frac{b+c+a}{c+a}+\frac{a+b+c}{a+b}-3$

$=(a+b+c)\left(\frac{1}{a+b}+\frac{1}{b+c}+\frac{1}{c+a}\right)-3$

$=3\left(\frac{10}{3}\right)-3=7$

12. **(B)**

$N=2^{64} \quad \therefore \lambda=64$

13, **(A)**

$\frac{a+3d}{a+9d}=\frac{a+d}{a+5d}$

$a^2+5ad+3ad+15d^2=a^2+9ad+ad+9d^2$

$6d^2=2ad$

$\therefore a=3d$

$\therefore \frac{a+d}{a+5d}=\frac{3d+d}{3d+5d}=\frac{4d}{8d}=\frac{1}{2}$

14. **(C)**

The two equations are : 2o + 3b + 4a = 15 and 3o + 2b + a = 10
Adding the two equations, we get
5o + 5b + 5a = 25

$\Rightarrow o+b+a=5$

$\therefore 3o+3b+3a=15$

15. **(C)**

$p(x)=x+\frac{1}{x}$ has degree of x a negative integer.

16. **(D)**

The number of terms of the sequence forms the sum of first n natural numbers i.e. $\frac{n(n+1)}{2}$.

Thus, the first 23 letters will account for the first $\frac{23\times 24}{2}=276$ terms of the sequence.

The 288^{th} term will be the 24^{th} letter which is x.

17. **(A)**

Taking

$\Rightarrow (x+1)^2>(5x-1)$

$\Rightarrow x^2-3x+2>0$

$\Rightarrow (x-1)(x-2)>0$

x < 1 or x > 2 ….. (i)

Taking

$\Rightarrow (x+1)^2<(7x-3)$

$\Rightarrow x^2-5x+4<0$

$\Rightarrow (x-1)(x-4) < 0$

$\Rightarrow 1 < x < 4$ …..(ii)

Combining (i) and (ii) we get $2 < x < 4$

Hence, x will only take one integer i.e. 3

So, option (A) is correct.

18. **(D)**

HCF of 60, 84 and 108 is 12. Hence, 12 students should be seated in each room. So for subject A we would require $\left(\frac{60}{12}\right) = 5$ rooms, for subject B we would require $\left(\frac{84}{12}\right) = 7$ rooms and for subject C we would require $\left(\frac{108}{12}\right) = 9$ rooms. Hence, minimum number of rooms required to satisfy our condition = (5 + 7 + 9) = 21 rooms.

19. **(B)**

Since the cyclicity of the power of 2 is 4, so 2^{51} can be written as $2^{4(12)+3}$ and the unit digit will be $2^3 = 8$.

20. **(A)**

By remainder theorem, Remainder = p(2).

Therefore, p(2) = 16 – 16 + 2 + 4 = 6.

SECTION – B

21. **(B)**

$D = 0 \Rightarrow (2b)^2 - 4ac = 0$

$b^2 = ac$

22. **(D)**

$2A_{15} - 5A_{14} - 8A_{13} = 0$

$\therefore 2A_{15} - A_{14} = 4(A_{14} + 2A_{13})$

$\frac{2A_{15} - A_{14}}{A_{14} + 2A_{13}} = 4$

23. **(B)**

$p(x) = x^{10}$ $\quad$ $p(2) = 2^{10}$

$p(1) = 1$

$p(x) = (x-1)(x-2)Q(x) + ax + b$

Put x = 1 $\Rightarrow$ a + b = 1

Put x = 2 $\Rightarrow$ 2a + b = 2^{10}

$\therefore$ $a = 2^{10} - 1 = 1023$

$b = -1022$

$\therefore$ remainder = 1023x – 1022

24. **(A)**

Odd numbers between 1 and 1000 are 3, 5, 7, 9, 11, 13, ……. 993, 995, 997, 999 and those numbers which are divisible by 3 are 3, 9, 15, 21, …… 993, 999.

They form an A.P. of which a = 3, d = 6, ℓ = 999. $\therefore$ n = 167

$S = \frac{n}{2}[a + \ell] = 83667$

25. **(C)**

By Vieta's formula, $p = \alpha + \beta$, $q = \alpha\beta$.

Given that $\frac{\alpha+\beta}{2} = 5$ and $\sqrt{\alpha\beta} = 3$.

Therefore, p = 10 and q = 9.

SECTION – C

26. **(B)**

XYZ is a three-digit number.
So, we can write this as : 100X + 10Y+ Z
XYZ + YZX + ZXY
= 100X + 10Y + Z + 100Y + 10Z + X + 100Z + 10X + Y
= 111X + 111Y + 111Z
= 111 (X + Y + Z)
Hence, XYZ + YZX + ZXY is divisible by X + Y + Z and 111.
Also 111 is divisible by 3 and 37.
Since X + Y + Z is not divisible by 3.
XYZ + YZX + ZXY is not divisible by 9.

27. **(D)**

B is opposite to D
A is opposite of F
E is opposite to C
i.e. D is correct

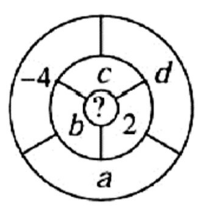
28. **(D)**

A standard die has a total of 21 dots on its faces. The faces that are glued together have the same number of dots. Since the die in the centre of the solid has all its faces glued to other dice, the sum of the dots that are not on the surface of the solid is 2×21. Therefore, the number of dots on the surface of the solid is

$7\times 21 - 2\times 21 = 5\times 21 = 105$

29. **(D)**

Let the numbers in the four regions that are neighbours to – 4 be a, b, c and d as shown in the diagram.



The question tells us that a + b + c + d = – 4.
However, we also know that a + b + c + d + ? = 2 and hence ? = 6.
(Note: The values a = d = – 4 and b = c = 2 give a complete solution to the problem).

30. **(B)**

When the card is turned about its lower edge, the light grey triangle will be at the top and the dark grey triangle will be on the left. When this is turned about its right-hand edge, the light grey triangle will be at the top and the dark grey triangle will be on the right. Therefore Joanna will see option B.