1. Ans. C.

We have,

y is inversely proportional to $\sqrt{x}$.

Means $y \propto \frac{1}{\sqrt{x}}$

$\Rightarrow y = \frac{a}{\sqrt{x}}$

Given that $x = 36$ then $y = 36$.

$\Rightarrow 36 = \frac{a}{\sqrt{36}}$

$\Rightarrow a = 216$

So if $y = 54$ then,

$54 = \frac{216}{\sqrt{x}}$

$\Rightarrow \sqrt{x} = \frac{216}{54} = 4$

$\Rightarrow x = 16$

2. Ans. B.

We have, total amount = 500 rs

We want to buy some apples and some orange using total amount.

One apple rate is 5rs and one orange rate is 7 rs.

Let x apples and y orange buy by a person.

Then $5x + 7y = 500$

Now if we vary values of y. Then for proper value of x means not fraction we have to put y in term of multiples of 5.

So least value of y is 5.

Then $5x+7\times 5=500$

$\Rightarrow$ $x=93$

And maximum value of y is 70 .

Then, $5x+7\times 70=500$

$\Rightarrow$ $x=2$

So here between 5 and 70 , n no of terms which is multiple of 5.we use formula of AP series.

$70=5+(n-1)5$ $[\because l=a+(n-1)d]$

$\Rightarrow$ $70=5+5n-5$

$\Rightarrow$ $n=14$

Then there is 14 ways to buy apple and oranges.

3. Ans. A.

We have, Radha and Rani are sisters.

Let present age of Radha is x and present age of Rani is y .

Before 5 years, $(x-5)=3(y-5)$

$\Rightarrow$ $x-3y=-10$ ....(i)

Before 1 year, $x-1=2(y-1)$

$\Rightarrow$ $x-2y=-1$ ....(ii)

Solving equation (i) and (ii), we get

$x=17, y=9$

Then age difference between Radha and Rani is 8.

4. Ans. A.

(i) We have p is relatively prime to q and r.

Means there is nothing common between p,q and r.

Example $p=2$, $q=5$, $r=7$

Then if we product the q and r means $7\times5=35$.

So, p means 2 has no common factor with 35.

Means p is relative prime to the product qr .

Then statement-1 is correct.

(ii) if p divide the qr means q divides by p or r divides by p or both divides with p.

But there is not must condition that if p divides q then p must divides r.

So, statement-2 is wrong.

5. Ans. C.

We have a real number is x .

And, reciprocal of this number is $\frac{1}{x}$.

So, $x+\frac{1}{x}=\frac{26}{5}$

$\Rightarrow \frac{x^2+1}{x}=\frac{26}{5}$

$\Rightarrow 5x^2-26x+5=0$

$\Rightarrow 5x^2-25x-x+5=0$

$\Rightarrow 5x(x-5)-1(x-5)=0$

$\Rightarrow (5x-1)(x-5)=0$

$\Rightarrow$ $x = \frac{1}{5}, 5$

So, there are two types of such real numbers.

6. Ans. C.

We have,

Six cubes with same edge 12 cm are joint end to end.

Then total length of big cuboid(L) = $12 \times 6 = 72$ cm

and breadth(B) and height(H) is same 12 cm.

so, total surface area of cuboid = $2(LB + BH + LH)$

= $2(72 \times 12 + 12 \times 12 + 72 \times 12)$

= $3744\ cm^2$

7. Ans. A.

We have,

Radius of base(r) = 6 cm and height of circular cone(h) = 8 cm

We know that slant height (l) = $\sqrt{h^2 + r^2}$

$\Rightarrow$ $l = \sqrt{8^2 + 6^2}$

$\Rightarrow$ $l = 10$ cm

$\because$ total surface area of the cone = $\pi rl + \pi r^2$

= $\pi \times 6 \times 10 + \pi \times 6^2$

= $96\pi\ \text{cm}^2$

8. Ans. B.

We have,

Diameter of base = 6 cm and diameter of top of the bucket = 12 cm

Then radius of base $(r_1) = 3$ cm and radius of top of the bucket $(r_2) = 6$ cm

And, height of the bucket (h) = 7 cm

Then capacity or volume of the bucket = $\frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

= $\frac{1}{3}\pi \times 7\left(3^2 + 6^2 + 3\times 6\right)$

= $\frac{1}{3}\times\frac{22}{7}\times 7\times 63$

= 462 cm^3

9. Ans. B.

We have,

the volume of hemisphere = 155232 cm^3

Let, radius of hemisphere is r cm.

We know that the volume of hemisphere = $\frac{2}{3}\pi r^3$

So, $155232 = \frac{2}{3}\pi r^3$

$\Rightarrow r^3 = 74117.82$

$\Rightarrow r = 42$ cm

10. Ans. D.

We have three copper spheres of radius 3 cm, 4 cm and 5 cm.

We melted these spheres into a large sphere.

We know that volume of sphere is $\frac{4}{3}\pi r^3$.

$\therefore$ Volume of three small spheres = Volume of large sphere

$\Rightarrow \frac{4}{3}\pi\left(3^3+4^3+5^3\right)=\frac{4}{3}\pi r^3$

$\Rightarrow 27+64+125=r^3$

$\Rightarrow r=6$ cm

11. Ans. D.

We have, One trapezium ABCD.

$AB \parallel CD$ and $AD \perp AB$

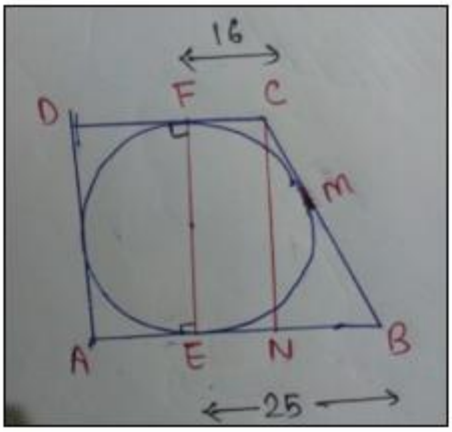
And, the trapezium has an incircle which touches AB at E and CD at F.

Here $EB=25$ cm and $FC=16$ cm.

If we draw one line from E to F which is pass through centre of circle then EF is tangent to circle and it makes 90° angle with AB and CD respectively.

Then $EF \parallel AD$

We draw a line from C to EB at position N means $CN \perp AB$



By the rule of tangent if two tangents which touches at different position in a circle has meet at one point then length is same from the particular position to tangent.

So, here MB and EB is tangent to circle and meet at B.

$BM = EB = 25$ cm

And, FC and MC is tangent to circle and meet at C.

$FC = MC = 16$ cm

Then $CB = 16 + 25 = 41$ cm

In a ΔCNB,

$41^2 = 9^2 + CN^2$

$\Rightarrow CN = 40$ cm

We can see $CN = FE = AD = 40$ cm

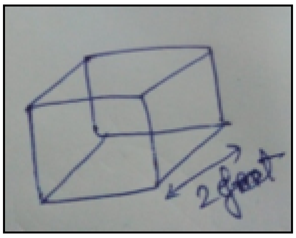
So. diameter is 40 cm.

12. Ans. D.

We have,

A thin rod of length 24 feet cut into equal size skeleton cube .

In a skeleton cube has 12 pieces. Means size of one piece is 2 feet.



Then, area of one of the faces of largest cube = side^2

= $2^2 = 4$ square feet

13. Ans. A.

We know that the common triplet sides of a right triangle $\left(a, \frac{a^2-1}{2}, \frac{a^2+1}{2}\right)$

So here we have one side is 15 cm.

Then other side is $\frac{15^2-1}{2}=112$ cm

And third side is $\frac{15^2+1}{2}=113$ cm

Then maximum perimeter = $15+112+113=240$ cm

14. Ans. B.

We have,

A cylinder height = 10 cm and radius is 6 cm.

Volume of a solid cylinder = $\pi r^2 h$

= $\pi \times 6^2 \times 10$

= 360π

Flat surface area of cylinder = $2\pi r^2 = 2\pi \times 6^2 = 72\pi \ cm^2$

A solid cylinder is melted into two cones with same height 10 cm .

The ratio of volume of two cone is 1:2.

Means if we divide 360π into 1:2 then $120\pi : 240\pi$.

So one cone volume is 120π and second has 240π.

∴ Cone volume = $\frac{\pi}{3} r^2 h$

Then first bigger cone has R radius. then $240\pi = \frac{\pi}{3} R^2 h \Rightarrow R^2 = 72$

Then flat surface area of first cone = $\pi R^2 = 72\pi$

Then second smaller cone has r radius. then $120\pi = \frac{\pi}{3} r^2 h \Rightarrow r^2 = 36$

Then flat surface area of second cone = $\pi r^2 = 36\pi$

Total surface area of cone = $72\pi + 36\pi = 108\pi$.

So flat surface area from cylinder to cone is increased by 36π which is 50 % increase.

15. Ans. A.

We have,

External radius of the sphere, $r_1 = 3$ cm $[\because \text{diameter} = 2 \times \text{radius}]$

Internal radius of the sphere, $r_2 = 2$ cm

Volume of metal in the hollow sphere = $\frac{4}{3}\pi\left(r_1^3 - r_2^3\right)$

= $\frac{4}{3}\pi \times \left(3^3 - 2^3\right)$

= $\frac{76\pi}{3}$ cm^3

Given that radius of the cone formed, $R = 4$ cm.

Let the height of the cone be h.

Volume of the cone = $\frac{1}{3}\pi R^2 h$

= $\frac{1}{3}\pi \times 4^2 \times h$

= $\frac{16\pi h}{3}$ cm^3

∴ Volume of the cone = volume of metal in the sphere

$\Rightarrow \frac{16\pi h}{3} = \frac{76\pi}{3}$

$\Rightarrow$ $h = \frac{76}{16} = 4.75$ cm

16. Ans. A.

We have an equilateral triangle XYZ .

Side $XY = 7$ cm

We know the area of equilateral triangle = $\frac{\sqrt{3}}{4}(side)^2$

A = $\frac{\sqrt{3}}{4}(7)^2$

A = $\sqrt{\left(\frac{7}{2}\right)^3\left(\frac{7}{2}\times 3\right)}$

A = $\sqrt{10.5\times 3.5^3}$

Now, $\log_{10} A^4 = \log_{10}\left(\sqrt{10.5\times 3.5^3}\right)^4$

$\Rightarrow$ $\log_{10} A^4 = \log_{10}\left(10.5\times 3.5^3\right)^2$

$\Rightarrow$ $\log_{10} A^4 = 2\log_{10}\left(10.5\times 3.5^3\right)$

$\Rightarrow$ $\log_{10} A^4 = 2\log_{10} 10.5 + 2\log_{10}(3.5)^3$

$\Rightarrow$ $\log_{10} A^4 = 2\log_{10}\left(\frac{1050}{100}\right) + 6\log_{10}\left(\frac{35}{10}\right)$

$\Rightarrow$ $\log_{10} A^4 = 2\log_{10} 1050 - 2\log_{10} 10^2 + 6\log_{10} 35 - 6\log_{10} 10^1$

$\Rightarrow$ $\log_{10} A^4 = 2(3.0212) - 4 + 6(1.5441) - 6$

$\Rightarrow$ $\log_{10} A^4 = 5.307$

17. Ans. A.

We have,

$(x-a)(x-b)(x-c)$

$\Rightarrow \left(x^2-bx-ax+ab\right)(x-c)$

$\Rightarrow x^3-cx^2-bx^2+cbx-ax^2+acx+abx-abc$

$\Rightarrow x^3-(a+b+c)x^2+(ab+bc+ca)x-abc$

18. Ans. B.

We have,

$\log_{10}1995=3.3000$

$\Rightarrow 1995=10^{3.3000}$ $\left[\because \log_a x=y \Rightarrow x=a^y\right]$

$\Rightarrow 1995\times10^{-6}=10^{3.3000}\times10^{-6}$

$\Rightarrow 0.001995=10^{3.3000-6}$

$\Rightarrow 0.001995=10^{-2.7}$

$\Rightarrow (0.001995)^{1/8}=\left(10^{-2.7}\right)^{1/8}$

$\Rightarrow (0.001995)^{1/8}=\frac{1}{10^{2.7/8}}$

$\Rightarrow (0.001995)^{1/8}=\frac{1}{10^{0.3375}}$

19. Ans. D.

We know that Heron’s formula, if we want to calculate area A of triangle having sides a,b,c units is

$A=\sqrt{s(s-a)(s-b)(s-c)}$

Here, $s = \frac{a+b+c}{2}$

We have,

$a = 30$ cm

$b = 28$ cm

$c = 16$ cm

Then, $s = \frac{30+28+16}{2} = \frac{74}{2} = 37$

$s - a = 37 - 30 = 7$

$s - b = 37 - 28 = 9$

$s - c = 37 - 16 = 21$

So, we have to know the logarithmic of 37, 7, 9 and 21 for finding the area of triangle.

20. Ans. A.

We have

$$x+2)x^4 - x^2 + 7x + 5(x^3 - 2x^2 + 3x + 1$$

$$x^4 + 2x^3$$

$$- \quad -$$

$$-2x^3 - x^2$$

$$-2x^3 - 4x^2$$

$$+ \quad +$$

$$3x^2 + 7x$$

$$3x^2 + 6x$$

$$- \quad -$$

$$x + 5$$

$$x + 2$$

$$- \quad -$$

$$3$$

So, here quotient $x^3 - 2x^2 + 3x + 1$ is compare with $ax^3 + bx^2 + cx + d$.

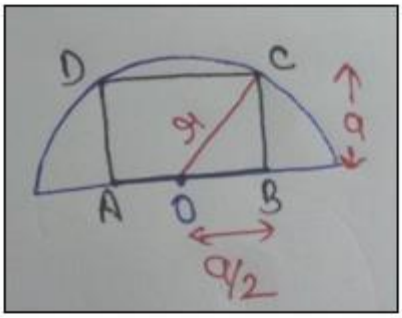
Then $a = 1, b = -2, c = 3, d = 1$

21. Ans. B.

We have,

Firstly square is inscribed in a semicircle radius r cm.

So, here sides of square is a cm.



In the figure $OB = \frac{a}{2}$, $OC = r$, $BC = a$

In a ΔOBC ,

$$r^2 = a^2 + \left(\frac{a}{2}\right)^2$$

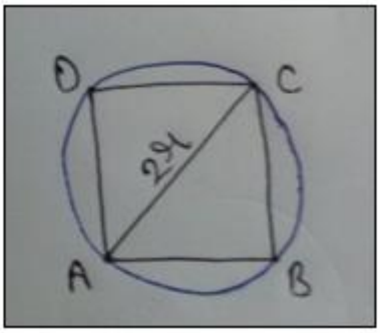
$$\Rightarrow r^2 = \frac{5a^2}{4}$$

$$\Rightarrow a^2 = \frac{4r^2}{5}$$

And, we have a square which is inscribed in a circle of radius r cm.

Here, diagonal of square is the same as diameter of circle.

So, here diagonal of square = $2r$



Then ratio of area of square inscribed in a semicircle to area of square inscribed in a circle

$$= \frac{\text{side}^2}{\frac{1}{2}(\text{diagonal})^2}$$

$$= \frac{a^2}{\frac{1}{2}\times(2r)^2}$$

$$= \frac{\frac{4r^2}{5}}{2r^2}$$

$$= \frac{2}{5}$$

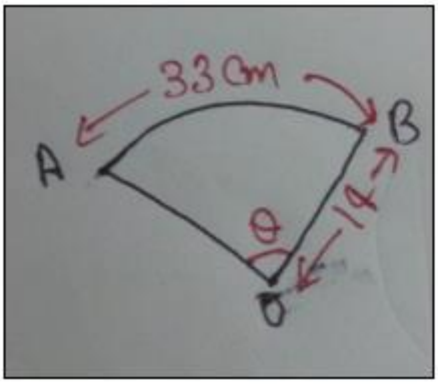
22. Ans. C.

We have ,

Length of arc = 33 cm and radius of circle is 14 cm.

Let θ is the angle subtended by the arc at centre of the circle.

We know that length of arc = $\frac{2\pi r\theta}{360^\circ}$



$\Rightarrow \quad 33 = \frac{2\pi \times 14 \times \theta}{360^\circ}$

$\Rightarrow \quad \theta = \frac{33 \times 360^\circ}{28\pi}$

$\Rightarrow \quad \theta = 135^\circ$

23. Ans. C.

We have,

The diameter of right circular cylinder = 20 cm

$\therefore \; 2r = 20$ cm

$\Rightarrow \; r = 10$ cm

We know that curved surface area = $2\pi rh$ sq. units

Given that curved surface area = 1000 cm^2

$\Rightarrow \; 2\pi rh = 1000$

$\Rightarrow \; \pi \times 20h = 1000$

$\Rightarrow \; h = \frac{50}{\pi}$ cm

We know that volume of cylinder = $\pi r^2 h$ sq. units

$= \pi \times (10)^2 \times \frac{50}{\pi}$

$= 5000\ \text{cm}^3$

24. Ans. A.

We have,

A square which is inscribed in a circle thus square vertices touch the circle .

∴ Radius of circle = 201 mm

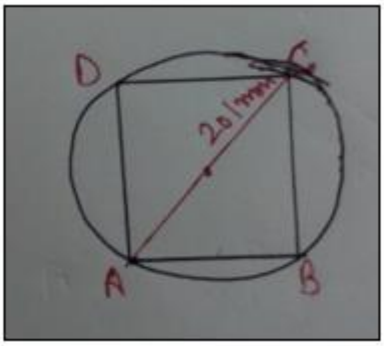
Thus, diagonal of the square = diameter of circle = $2 \times 201 = 402$ mm

We know that area of circle = πr^2

$= \pi \times (201)^2\ mm^2$

We know that area of square = $\frac{1}{2} \times (\text{diagonal})^2$

$= \frac{1}{2} \times (2 \times 201)^2$



So, the ratio of area of circle to square = $\frac{\pi \times (201)^2}{2 \times (201)^2}$

$= \frac{\pi}{2}$

$= \frac{22}{7 \times 2} = \frac{11}{7}$

25. Ans. C.

We have,

The length of hypotenuse = 10 cm

We know the Pythagoras theorem,

$\text{hypotenuse}^2 = \text{perpendicular}^2 + \text{base}^2$

Let, perpendicular is a cm and base is b cm.

Then, $10^2 = a^2 + b^2$

$\Rightarrow \; b = \sqrt{100 - a^2}$

We know that $\text{area} = \frac{1}{2} \times \text{perpendicular} \times \text{base}$

$\Rightarrow \; A = \frac{1}{2} \times a \times \sqrt{100 - a^2}$

We want maximum area so we do differentiation of area w.r.t. a which is equal to 0.

$\Rightarrow \; \frac{dA}{da} = \frac{a}{4} \times \frac{(-2a)}{\sqrt{100 - a^2}} + \frac{\sqrt{100 - a^2}}{2} = 0$

$\Rightarrow \; \frac{-a^2 + \left(100 - a^2\right)}{2\sqrt{100 - a^2}} = 0$

$\Rightarrow \; 2a^2 = 100$

$\Rightarrow \; a = \frac{10}{\sqrt{2}}$ cm

Then maximum area = $\frac{1}{2} \times \frac{10}{\sqrt{2}} \times \sqrt{100 - \frac{100}{2}}$

= $\frac{5}{\sqrt{2}} \times 5\sqrt{2}$

= 25 cm^2

26. Ans. C.

Consider $px^2 + 3x + 2q = 0$

$\Rightarrow$ Sum of roots = $-\frac{3}{p}$

According to the question

$\Rightarrow -\frac{3}{p} = -6$

$\Rightarrow -6p = -3$

$\Rightarrow p = \frac{3}{6} = \frac{1}{2}$

$\Rightarrow$ Product of roots = $\frac{2q}{p}$

According to the question

$\Rightarrow \frac{2q}{p} = -6$

$\Rightarrow \frac{4q}{1} = -6$

$\Rightarrow 4q = -6$

$\Rightarrow q = -\frac{6}{4} = -\frac{3}{2}$

p-q=(1/2)-(-3/2) = 2

27. Ans. D.

X = {a, {b}, c}, Y = {{a}, b, c} and Z = {a, b, {c)}

Now, $(X \cap Y) = \{c\}$

Z = {a, b, {c)}

Hence, (X ∩ Y) ∩ Z = $\{c\}$ ∩ {a, b, {c)} = Φ

28. Ans. B.

Consider $\frac{(x-y)^3+(y-z)^3+(z-x)^3}{9(x-y)(y-z)(z-x)}$

We know that when $A+B+C=0$ then $A^3+B^3+C^3=3ABC$

Clearly, (x-y) + (y-z) + (z-x) = 0

Hence, $(x-y)^3+(y-z)^3+(z-x)^3=3(x-y)(y-z)(z-x)$

$\Rightarrow \frac{(x-y)^3+(y-z)^3+(z-x)^3}{9(x-y)(y-z)(z-x)} = \frac{3(x-y)(y-z)(z-x)}{9(x-y)(y-z)(z-x)}=\frac{1}{3}$

29. Ans. A.

We are interested in finding LCM of the polynomials

$x^3 + 3x^2 + 3x + 1$, $x^3 + 5x^2 + 5x + 4$ and $x^2 + 5x + 4$

$\Rightarrow x^3 + 3x^2 + 3x + 1 = (x+1)^3$

$\Rightarrow x^3 + 5x^2 + 5x + 4 = (x+4)(x^2+x+1)$

$\Rightarrow x^2 + 5x + 4 = (x+4)(x+1)$

Hence, LCM of the polynomials $x^3 + 3x^2 + 3x + 1$, $x^3 + 5x^2 + 5x + 4$

and $x^2 + 5x + 4 = (x + 1)^3(x + 4)(x^2 + x + 1)$

30. Ans. D.

If $n^2 + 19n + 92$ is a perfect square.

Then let $n^2 + 19n + 92 = k^2$

$\Rightarrow n^2+19n+92-k^2=0$

$\Rightarrow n=\frac{-19\pm\sqrt{(19)^2-4(1)(92-k^2)}}{2(1)}=\frac{-19\pm\sqrt{361-368+4k^2}}{2(1)}=\frac{-19\pm\sqrt{-7+4k^2}}{2(1)}$

Now, n will attain integer value only if $-7+4k^2$ is a perfect square of odd integer.

$\Rightarrow 4k^2-7=(2x+1)^2$

$\Rightarrow$ $4k^2 - (2x+1)^2 = 7$

$\Rightarrow$ $(2k+2x+1)(2k-2x-1) = 7$

$\Rightarrow$ $(2k+2x+1)(2k-2x-1) = 7 \times 1$

Hence,

$(2k-2x-1) = 1$ .... (1)

$(2k+2x+1) = 7$ ....(2)

Adding (1) and (2)

⇒ 4k = 8

⇒ k = 2

Put the value of k in (1)

$\Rightarrow$ $4 - 2x - 1 = 1$

$\Rightarrow$ $-2x = 1 - 3 = -2$

$\Rightarrow$ $x = 1$

Now, $n^2 + 19n + 92 = 4$

$\Rightarrow n^2 + 19n + 88 = 0$

$\Rightarrow$ $n^2 + 11n + 8n + 88 = 0$

$\Rightarrow$ $n(n+11) + 8(n+11) = 0$

$\Rightarrow$ $(n+11)(n+8) = 0$

⇒ n = - 11 or n = -8

Hence, Required Sum = -11 – 8 = - 19

31. Ans. C.

We know that 1 is neither prime nor composite.

Hence, statement (1) is correct.

We know that 0 is neither positive nor negative.

Hence, statement (2) is correct.

Let p = 2 and q = 3

$\Rightarrow p \times q = 2 \times 3 = 6$

Here, $p \times q$ is even but q is odd.

Hence, if p × q is even, then p and q are not always even.

Hence, statement (3) is not correct.

32. Ans. B.

The ratio of the work done by (x + 2) workers in (x – 3) days to the work done by (x + 4) workers in (x – 2) days is 3 : 4.

$\Rightarrow \frac{x^2 - x - 6}{x^2 + 2x - 8} = \frac{3}{4}$

$\Rightarrow 4x^2 - 4x - 24 = 3x^2 + 6x - 24$

$\Rightarrow x^2 - 10x = 0$

$\Rightarrow x(x - 10) = 0$

$\Rightarrow x = 0$ or $x = 10$

But $x \neq 0$

Hence , x = 10

33. Ans. D.

Consider $\frac{1}{x^2 + 5x + 10} = \frac{1}{x^2 + 5x + \left(\frac{5}{2}\right)^2 + \frac{15}{4}} = \frac{1}{\left(x + \frac{5}{2}\right)^2 + \frac{15}{4}}$

Clearly, $\frac{1}{x^2 + 5x + 10}$ will be maximum when $x^2 + 5x + 10$ is minimum.

Now, $x^2 + 5x + 10$ will be minimum at x = $-\frac{5}{2}$

Hence, Maximum value of $\frac{1}{x^2+5x+10}$ = $\frac{1}{\left(-\frac{5}{2}\right)^2+5\left(-\frac{5}{2}\right)+10} = \frac{1}{\frac{25}{4}-\frac{25}{2}+10} = \frac{4}{25-50+40} = \frac{4}{15}$

34. Ans. C.

Consider $a = \sqrt{7+4\sqrt{3}}$

$\Rightarrow a = \sqrt{7+4\sqrt{3}} = \sqrt{4+3+4\sqrt{3}} = \sqrt{(2)^2+\left(\sqrt{3}\right)^2+2\times 2\times\sqrt{3}} = \sqrt{\left(2+\sqrt{3}\right)^2} = 2+\sqrt{3}$

Now , $a+\frac{1}{a} = 2+\sqrt{3}+\frac{1}{2+\sqrt{3}} = 2+\sqrt{3}+\frac{1}{2+\sqrt{3}}\times\frac{2-\sqrt{3}}{2-\sqrt{3}} = 2+\sqrt{3}+2-\sqrt{3} = 4$

35. Ans. D.

If (b - 6) is one root of the quadratic equation $x^2 - 6x + b = 0$, where b is an integer,

$\Rightarrow b^2-17b+72=0$

$\Rightarrow b^2-8b-9b+72=0$

$\Rightarrow b(b-8)-9(b-8)=0$

$\Rightarrow (b-8)(b-9)=0$

⇒ b = 8 or b = 9

Hence, maximum value of b^2 = $(9)^2=81$

36. Ans. B.

$(x^2-y^2)=35$

$\Rightarrow (x+y)(x-y)=35$

Factors of 35 = 35 , 7 , 5 , 1

Required pairs = (6,1) , (18 , 17)

So, two such pairs are possible.

37. Ans. A.

The equation $x^2 + px + q = 0$ has roots equal to p and q where $q \neq 0$.

Consider $x^2 + px + q = 0$

⇒ Sum of roots = $p + q = -\frac{p}{1} = -p$

⇒ 2p = - q ....(1)

Product of roots = $pq = \frac{q}{1} = q$

⇒ p =1

Put the value of p in (1)

⇒ q = - 2

38. Ans. B.

The sum of the squares of four consecutive natural numbers is 294.

Let four numbers are x , x+1 , x+2 and x+3

⇒ $(x)^2 + (x+1)^2 + (x+2)^2 + (x+3)^2 = 294$

⇒ $x^2 + x^2 + 1 + 2x + x^2 + 4 + 4x + x^2 + 9 + 6x = 294$

⇒ $4x^2 + 12x + 14 = 294$

⇒ $x^2 + 3x + 70 = 0$

⇒ $x^2 + 10x - 7x - 70 = 0$

⇒ $x(x+10) - 7(x+10) = 0$

⇒ $(x+10)(x-7) = 0$

⇒ $x = -10 \text{ or } x = 7$

But x is a natural number

So, x = 7

⇒ Sum of the numbers = $7+8+9+10=34$

39. Ans. B.

Cyclicity of 2,3,7 and 8 is 4

So in case of any number with unit digit 2,3,7 and 8 raised to some power, power is divided by 4 and remainder is obtained. We can find unit digit in this case using following table:

Unit digit/Remainder	4n+1	4n+2	4n+3	4n+4
2	2	4	8	6
3	3	9	7	1
7	7	9	3	1
8	8	4	2	6

Consider 3^{98}

When 98 is divided by 4 then 2 is obtained as a remainder.

Hence, Unit digit of 3^{98} will be 9.

Consider 3^{89}

When 89 is divided by 4 then 1 is obtained as a remainder.

Hence, Unit digit of 3^{89} will be 3.

Hence, Unit digit of $3^{98} - 3^{89} = 9 - 3 = 6$

40. Ans. A.

Consider $6^{23} \times 75^{9} \times 105^{2}$

⇒ $6^{23} = (2\times3)^{23} = 2^{23}\times3^{23}$

⇒ $75^{9} = (3\times5^{2})^{9} = 3^{9}\times5^{18}$

⇒ $105^{2} = (3\times5\times7)^{2} = 3^{2}\times5^{2}\times7^{2}$

We know that 10 is formed by the multiplication of 2 and 5.

If 10^n divides $6^{23} \times 75^9 \times 105^2$ then n will be the possible pairs of 2 and 5 present in $6^{23} \times 75^9 \times 105^2$.

Number of 2 present in $6^{23} \times 75^9 \times 105^2 = 23$

Number of 5 present in $6^{23} \times 75^9 \times 105^2 = 20$

Hence, Possible pairs will be 20.

$\Rightarrow$ n = 20

41. Ans. C.

$x - x^2$

$\Rightarrow f(x) = x - x^2$

$\Rightarrow f(x) = -x^2 + x$

Clearly, f(x) a quadratic polynomial and maximum of this quadratic polynomial occurs at $-\frac{b}{2a}$

Now, $(x - x^2)$ is maximum at x = $\frac{1}{2} = 0.5$

42. Ans. B.

Let speed of car = x kmph

Speed of train = y kmph

According to question

$\Rightarrow \frac{120}{x} + \frac{480}{y} = 11$

$\Rightarrow 120y + 480x = 11xy$

$\Rightarrow xy = \frac{120y + 480x}{11}$ ....(1)

$\Rightarrow \frac{200}{x} + \frac{400}{y} = 11\frac{40}{60} = 11\frac{2}{3} = \frac{35}{3}$

$\Rightarrow 200y + 400x = \frac{35}{3}xy$

$\Rightarrow xy = \frac{200y + 400x}{\frac{35}{3}}$ ……………..(2)

From (1) and (2),

$\Rightarrow 420y + 1680x = 660y + 1320x$

$\Rightarrow 240y = 360x$

$\Rightarrow \frac{x}{y} = \frac{240}{360} = \frac{2}{3}$

43. Ans. A.

Selling price of first item = Rs. 990

Profit = 10%

Cost price of first item = $990 \times \frac{100}{110} = Rs.900$

Selling price of second item = Rs. 990

Loss = 10%

Cost price of second item = $990 \times \frac{100}{90} = Rs.1100$

Total selling price of both items = 990+990 = Rs. 1980

Total cost price of both items = 900+1100 =Rs. 2000

Loss% = $\frac{2000 - 1980}{2000} \times 100 = 1\%$

44. Ans. A.

$\frac{36}{11} = 3 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}}$

$$\frac{36}{11}=3+\frac{3}{11}=3+\frac{1}{\frac{11}{3}}=3+\frac{1}{3+\frac{2}{3}}=3+\frac{1}{3+\frac{1}{\frac{3}{2}}}=3+\frac{1}{3+\frac{1}{1+\frac{1}{2}}}$$

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

After comparison, We can say that

x = 3, y = 1 and z = 2

Hence, x+y+z =3+1+2 = 6

45. Ans. C.

A library bas an avenge number, of 510 visitors on Sunday and 240 on other days.

Total number of days in month = 30

Number of Saturday in this month = 5

Remaining days = 25

Required average = $\frac{5\times510+25\times240}{30}=\frac{2550+6000}{30}=285$

46. Ans. D.

Consider statement 1: $\sqrt{75}$ is a rational number.

$\Rightarrow \sqrt{75} = 5\sqrt{3}$

Clearly, $5\sqrt{3}$ is an irrational number.

So, statement 1 is not correct.

Consider statement 2: There exists at least a positive integer x such that $-\frac{4x}{5}<-\frac{7}{8}$

$\Rightarrow -\frac{4x}{5} < -\frac{7}{8}$

$\Rightarrow x > \frac{7}{8} \times \frac{5}{4}$

$\Rightarrow x > \frac{35}{32}$ ……..(1)

Clearly, there exist a lot of positive integers that satisfy equation (1) i.e.

x= 2 , 3………………..

So, statement (2) is correct.

Consider statement 3 : $\frac{x-2}{x} < 1$ for all real values of x.

For x = 4

$\Rightarrow \frac{x-2}{x} = \frac{4-2}{2} = \frac{2}{2} = 1$

So, statement (3) is incorrect.

Consider statement 4 : 4.232323……. can be expressed in the form $\frac{p}{q}$ where p and q are integers.

Let x = 4.2323… ………………(1)

Multiply by 100

⇒ 100x = 423.232323 ………………. ……..(2)

Subtract (2) from (1)

$\Rightarrow 99x = 419$

$\Rightarrow x = \frac{419}{99}$

Hence, statement (4) is correct.

47. Ans. C.

Tap X can drain out the full tank in = 20 minutes

Tap (X+Y) can drain out the full tank in = 15 minutes

Total capacity of full tank = LCM (20,15) = 60 units

Efficiency of tap X = $\frac{60}{20} = 3$ unit/minute

Efficiency of tap (X+Y) = $\frac{60}{15} = 4$ unit/minute

Efficiency of tap Y = 4 unit/minute – 3 unit/minute = 1 unit/minute

Tap Y alone can drain out the full tank in = $\frac{60}{1} = 60$ minute

48. Ans. B.

Consider $x = 14q + 7$

$x = 15Q + 5$

Put q = 1

$x = 14 \times 1 + 7 = 21$

But when we divide 21 by 15, remainder will be 6.

So, 21 is not required answer.

Put q = 2

$x = 14 \times 2 + 7 = 35$

But when we divide 35 by 15, remainder will be 5.

So, 35 is required answer.

49. Ans. C.

Consider $x = 9^{20} \Rightarrow x = 3^{40}$

$\log x = 40 \log 3 = 40 \times 0.477 = 19.08$

$\log x = 19.08$

Since the characteristic of $\log x$ is 19.

Hence, Number of digits = 19 + 1 = 20

Now, $y = 8^{23} \Rightarrow y = 2^{69}$

$\log y = 69 \log 2 = 69 \times 0.301 = 20.769$

$\log y = 20.769$

Since the characteristic of $\log y$ is 20.

Hence, Number of digits = 20+ 1 = 21

Now, $z = 7^{25}$

$\log z = 25 \log 7 = 25 \times 0.845 = 21.125$

$\log z = 21.125$

Since the characteristic of $\log z$ is 21.

Hence, Number of digits = 21 + 1 = 22

50. Ans. C.

Consider $16 + 6\sqrt{7}$

$\Rightarrow 16 + 6\sqrt{7} = 9 + 7 + 6\sqrt{7} = (3)^2 + \left(\sqrt{7}\right)^2 + 2 \times 3 \times \sqrt{7} = \left(3 + \sqrt{7}\right)^2$

Hence, $\sqrt{16 + 6\sqrt{7}} = \sqrt{\left(3 + \sqrt{7}\right)^2} = \left(3 + \sqrt{7}\right)$

51. Ans. A.

Let the length and the breadth of the rectangle is l and b. Then new length and breadth are $1.2l$ and $1.1b$. Now the percentage change in the area

$$\%\text{age change} = \frac{A' - A}{A} \times 100\%$$
$$= \frac{(1.2l \times 1.1b) - (l \times b)}{(l \times b)} \times 100\%$$
$$= 32\%$$

52. Ans. B.

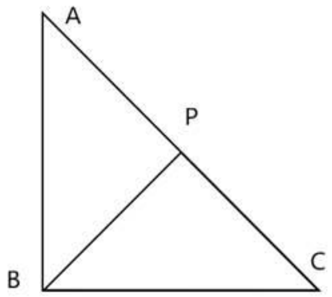
If the height and radius of two cylinder are h_1, r_1 and h_2, r_2 respectively.

Then, their volumes are $V_1 = \pi r_1^2 h_1$ and $V_2 = \pi r_2^2 h_2$ respectively. But it is given that

$$V_1 = V_2$$
$$\pi r_1^2 h_1 = \pi r_2^2 h_2$$
$$\frac{r_1}{r_2} = \sqrt{\frac{h_2}{h_1}}$$
$$\frac{r_1}{r_2} = \sqrt{\frac{3}{2}} = \frac{\sqrt{3}}{\sqrt{2}} \qquad \left[\frac{h_1}{h_2} = \frac{2}{3}\right]$$

53. Ans. B.

Given that ΔABC is a right-angled triangle and $AB = 5\,cm,\ BC = 10\,cm$



Then, $AC = \sqrt{AB^2 + BC^2} = \sqrt{25 + 100} = 5\sqrt{5}$

If BP is perpendicular on AC, the then are of the ΔABC

$$A = \frac{1}{2}.AB.BC = \frac{1}{2}.AC.PB$$
$$\Rightarrow AB.BC = AC.PB$$
$$\Rightarrow 5 \times 10 = 5\sqrt{5} \times PB$$
$$\Rightarrow PB = 2\sqrt{5}\ cm$$

54. Ans. C.

If all the sides of a parallelogram are equal, then it is a rhombus. We know that the diagonals of the rhombus bisect each other at right-angle. Let the diagonals are $d_1 \text{ and } d_2$, then given that

$\frac{d_1}{d_2} = \frac{1}{2}$ and $d_1 + d_2 = 12$

From above two, $d_1 = 4,\ d_2 = 8$

Now, area of parallelogram,

$$A = \frac{1}{2} d_1 d_2 = \frac{1}{2} \times 4 \times 8 = 16\,cm^2$$

55. Ans. C.

Let the side of the equilateral triangle and side of the circle are $x \text{ and } y$ respectively.

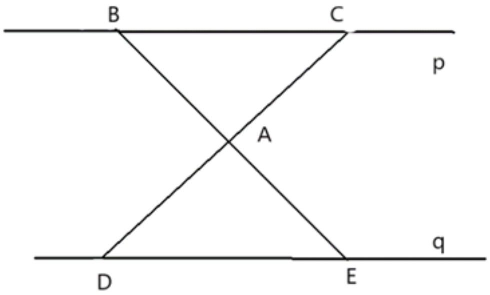
Given that the circumference is equal, then

$$3x = 4y \Rightarrow \frac{x}{y} = \frac{4}{3}$$

Now, $\frac{A_T}{A_S} = \frac{\frac{\sqrt{3}}{4}x^2}{y^2} = \frac{\sqrt{3}}{4}\left(\frac{4}{3}\right)^2 = \frac{4\sqrt{3}}{9}$

56. Ans. C.

Line BE and CD intersects each other at point A. These two lines bisect each other (situated on same parallel line). And the $\Delta ABC \,\&\, \Delta ADE$ is similar.



So, $\frac{AB}{AE}=\frac{AC}{AD}=\frac{4}{9}$

And $\frac{\Delta ABC}{\Delta ADE}=\frac{AC^2}{AD^2}=\frac{16}{81}$

57. Ans. D.

The area of the triangle (ΔABC) formed by the joining of the mid-point of sides of a triangle (ΔPQR) is $\frac{1}{4}th$ the area of the triangle (ΔPQR).

Hence, $\Delta ABC=\frac{1}{4}\Delta PQR=\frac{128}{4}=32\,cm^2$

58. Ans. D.

If a sector of a circles subtending an angle θ at the centre and radius is r, then length of the sector $l=r\theta=20\times\left(150^\circ\times\frac{\pi}{180^\circ}\right)=\frac{50\pi}{3}cm$

If it is bent to form a circle of radius r' then the circumference of the new circle

$$circumference=2\pi r'=\frac{50\pi}{3}$$

$$radius,\ r'=\frac{25}{3}cm$$

59. Ans. A.

Given that the length of the median of an equilateral triangle is l, that is the height of the triangle. In general, the height of an equilateral triangle is equal to $\frac{\sqrt{3}}{2}$ times a side of the equilateral triangle.

Let the base of the triangle is s then, $l = \frac{\sqrt{3}}{2} s$

Now, the area of the triangle $\Delta = \frac{1}{2} \times l \times s = \frac{l}{2} \times \frac{2l}{\sqrt{3}} = \frac{l^2}{\sqrt{3}}$

60. Ans. B.

Let the sides of the cuboid is l, m and n, then

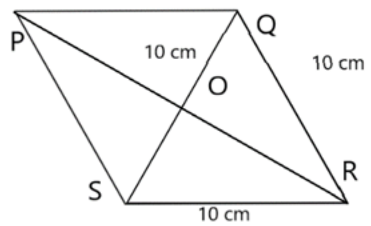
$$\begin{aligned} x &= lm \qquad &...(i) \\ y &= mn \qquad &...(ii) \\ z &= nl \qquad &...(iii) \end{aligned}$$

Now multiplying each together

$$xyz = (lmn)^2 = V^2$$
$$V^2 = xyz$$

61. Ans. B.

As we know that the diagonal of the parallelogram bisect each other. Then $SO = OQ = 5\,cm$



Since it is given that ΔQRS is a equilateral triangle so diagonal PR and QS intersects at right-angle.

So, In ΔOQR, $OR^2 = QR^2 - OQ^2$

$$OR = \sqrt{10^2 - 5^2} = 5\sqrt{3}$$

Hence, $PR = 2OR = 10\sqrt{3}\ cm$

62. Ans. B.

Given that the area of the ΔABC and ΔPQR are 75 cm and 50 cm respectively.

Then, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP} = \frac{AB+BC+CA}{PQ+QR+RP} = \frac{75}{50} = \frac{3}{2}$

Let $PQ = 20\,cm$, then $AB = \frac{3}{2}PQ = 30\,cm$

63. Ans. A.

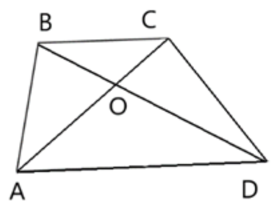
If AB is the diameter and O is the centre and the radius is 6.5 cm then $AB = 13\,cm$.

Given that $AP = x, BP = y$. We know that if a point P lies on the circle then ABP forms a right-angled triangle. So, $AB^2 = AP^2 + BP^2 \Rightarrow x^2 + y^2 = 169$.

From the above option $x = y = 6.5\,cm$ does not satisfies the condition.

64. Ans. D.

The sides AD, BC of a trapezium ABCD are parallel and the diagonals AC and BD meet at O. If the area of triangle AOB is 3 cm square and the area of triangle BDC id=s 8 cm square. Then what is the area of the triangle AOD



Given that $AD \parallel BC$ and $\Delta AOB = 3cm^2, \Delta BDC = 8cm^2$

So for $\Delta ABC = \Delta BCD$ (they are on the same base and between the sam eparallel lines)

$\Rightarrow \Delta AOB + \Delta OBC = \Delta BCD$

$\Rightarrow \Delta OBC = 8 - 3 = 5\,cm^2$

$\Delta COD = \Delta BCD - \Delta OBC = 8 - 5 = 3\,cm^2$

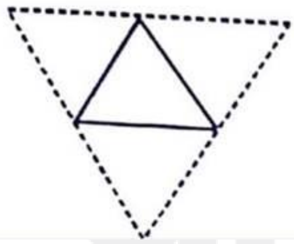
$\Delta ABD = \Delta ACD$ (they are on the same base and between the sam eparallel lines)

From the property of the trapezium

$$\Delta AOB \times \Delta COD = \Delta BOC \times \Delta AOD$$
$$3 \times 3 = 5 \times \Delta AOD$$
$$\Delta AOD = \frac{9}{5} = 1.8\,cm^2$$

65. Ans. B.

When, we draw such figures as mentioned in the question the vertex of the old triangle are the mid points of the sides of new triangle and the sides of the old triangle are half of the opposite side.



So the perimeter of such triangle will be doubled to the old one.

Hence, the perimeter of triangle $= 2 \times 22 = 44\,cm$

66. Ans. C.

We have $\frac{\sin 19^o}{\cos 71^o} + \frac{\cos 73^o}{\sin 17^o}$

$$\Rightarrow \frac{\sin(90-71)^o}{\cos 71^o} + \frac{\cos(90-17)^o}{\sin 17^o}$$
$$\Rightarrow \frac{\cos 71^o}{\cos 71^o} + \frac{\sin 17^o}{\sin 17^o}$$
$$\Rightarrow 1 + 1$$
$$\Rightarrow 2$$

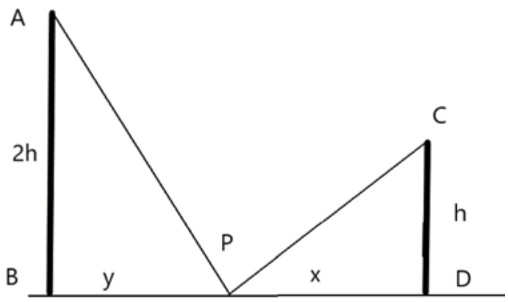
67. Ans. C.

Given that the angle of elevation from point P to the top of pole are complementary to each other and $DP = x,\ BP = y$.

Let the $\angle BPA = \theta \Rightarrow \angle DPA = 90^{o} - \theta$

In the ΔAPB, $\tan\theta = \frac{AB}{PB} = \frac{2h}{y}$ ...(i)

And in the ΔCPD, $\tan\left(90^{o} - \theta\right) = \frac{CD}{PD} \Rightarrow \cot\theta = \frac{h}{x}$ ...(ii)



From equation (i) and (ii),

$$\tan\theta.\cot\theta = \frac{2h}{y}.\frac{h}{x}$$
$$1 = \frac{2h^2}{xy}$$
$$2h^2 = xy$$

68. Ans. D.

If $0 < \theta < 90^{o}$, then all the ratios will be positive.

Given that $\sin\theta = \frac{3}{5}$

$$\Rightarrow x = \cot\theta = \sqrt{\csc^2\theta - 1} = \sqrt{\frac{25}{9} - 1} = \frac{4}{3}$$
$$\Rightarrow 3x = 4$$

So,

$$1+3x+9x^2+27x^3+81x^4+243x^5$$
$$\Rightarrow 1+3x+(3x)^2+(3x)^3+(3x)^4+(3x)^5$$
$$\Rightarrow 1+4+4^2+4^3+4^4+4^5$$
$$\Rightarrow \frac{4^6-1}{4-1}$$
$$\Rightarrow \frac{4095}{3}$$
$$\Rightarrow 1365$$

69. Ans. A.

We have

$$\cos^2 x+\cos x=1 \Rightarrow \cos x=1-\cos^2 x=\sin^2 x \qquad ...(i)$$

$$\sin^{12} x+3\sin^{10} x+3\sin^8 x+\sin^6 x$$
$$\Rightarrow \cos^6 x+3\cos^5 x+3\cos^4 x+\cos^3 x$$
$$\Rightarrow (\cos^2 x)^3+3(\cos^2 x)^2(\cos x)+3(\cos^2 x)(\cos x)^2+(\cos x)^3$$
$$\Rightarrow (\cos^2 x+\cos x)^2$$
$$\Rightarrow 1^2=1$$

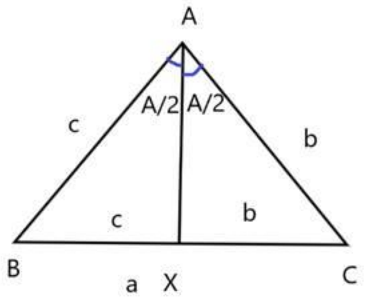
70. Ans. B.

We have

$$\log_{10}(\cos\theta)+\log_{10}(\sin\theta)+\log_{10}(\tan\theta)+\log_{10}(\cot\theta)+\log_{10}(\sec\theta)+\log_{10}(\cos ec\theta)$$
$$\Rightarrow \log_{10}(\cos\theta.\sin\theta.\tan\theta.\cot\theta\sec\theta.\cos ec\theta)$$
$$\Rightarrow \log_{10}\left(\frac{\cos\theta.\sin\theta.\tan\theta}{\cos\theta.\sin\theta.\tan\theta}\right)$$
$$\Rightarrow \log_{10} 1$$
$$\Rightarrow 0$$

71. Ans. D.

The angle bisector AX divide the side BC in the ratio of side AB and AC



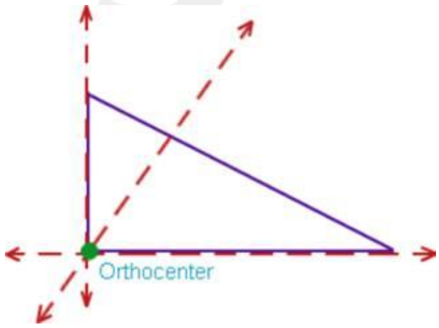
$$\frac{AB}{AC} = \frac{b}{c} = \frac{CX}{BX}$$

$$CX = \frac{b.a}{b+c},\ BX = \frac{c.a}{b+c}$$

So, $\frac{AB}{BX} = \frac{c}{\left(\frac{c.a}{b+c}\right)} = \frac{b+c}{a}$, so we cannot define relation between AB and BX.

And $\frac{BX}{CX} = \frac{\left(\frac{c.a}{b+c}\right)}{\left(\frac{b.a}{b+c}\right)} = \frac{c}{b}$ so we cannot define relation between BX and CX.

72. Ans. C.



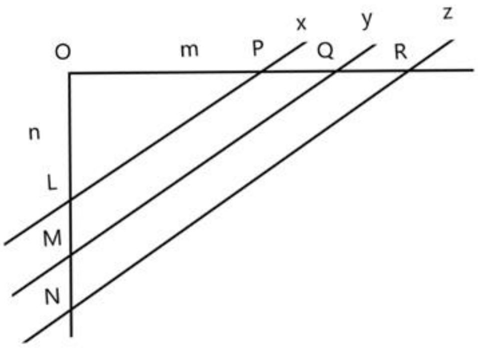
Orthocenter is the point of intersection of the altitudes. Each leg in a right triangle forms an altitude. So, in a right-angled triangle, the orthocenter lies at the vertex containing the right angle.

73. Ans. B.

If the radian measure of the arc is θ , then the area of the arc $A = \pi r^2\left(\frac{\theta}{2\pi}\right) = \frac{r^2\theta}{2}$

Here, $25.6 = \frac{1}{2}(4)^2\,\theta \Rightarrow \theta = \frac{25.6}{8} = 3.2 \quad [r = 4\,cm]$

74. Ans. B.



From the figure, we can see the $\Delta OPL, \Delta OQM\ and\ \Delta ORN$ are similar.

Hence, $\frac{OP}{OL} = \frac{PQ}{LM} = \frac{QR}{MN}$

$$\frac{3}{LM} = \frac{9}{10.5} \Rightarrow LM = \frac{10.5}{3} = 3.5cm$$

75. Ans. A.

Let the height of the cylinder is h and the radius is r; $(h = 2r)$, then $V = \pi r^2 h$

The maximum possible volume of sphere (radius R) is immersed into cylinder if $R \le r\ and\ 2r \le h$

For maximum possible $R = r = \frac{h}{2}$

When, we immersed the sphere into the cylinder the volume of water remains

= volume of cylinder – volume of sphere

$= \pi r^2 h - \frac{4}{3}\pi R^3$

$= 2\pi r^3 - \frac{4}{3}\pi r^3$

$= \frac{2}{3}\pi r^3$

$= \frac{1}{2} \times \frac{4}{3}\pi r^3$

$= \frac{V}{2}$ $\quad [V = \pi r^2 h = 2\pi r^3]$

76. Ans. A.

$240\,men \equiv 48\,days$

$160\,men \equiv \frac{48}{160} \times 240 = 72\ days$

77. Ans. C.

Given that $182 - R = 175 \Rightarrow R = 7$

$$\begin{array}{l} 17\overline{)N\quad}(182 \\ \;-X \\ \hline \;\;R \end{array}$$

or $N = 17 \times 182 + R = 3094 + 7 = 3101$

78. Ans. A.

Let the train and bus fair are $3x\ and\ 4x$. Train fare increased by 20% and bus fair increased by 30%. So new fair of train $1.2 \times 3x = 3.6x$ and new fair of bus $= 1.3 \times 4x = 5.2x$.

So, the ratio $= \frac{3.6x}{5.2x} = \frac{9}{13} = 9:13$

79. Ans. C.

Let the income of A and B are $4x$ and $3x$. And their expenditure are $3y$ and $2y$. The their savings are $(4x - 3y)\ and\ (3x - 2y)$. And

$4x - 3y = 600$
$3x - 2y = 600$
$x = y = 600$

Hence, monthly income of A $= 4x = Rs.2400$

80. Ans. C.

If percentage of profit and loss is same on a certain amount then there will always net loss.

$$loss\,\% = \frac{30 \times 30}{100}\% = 9\%$$

81. Ans. C.

lent A lent to C a some of amount of Rs. P and to B Rs.25,000. Rate of interest for both 7% and time is 4 years. Then simple interest, $SI = \frac{(25000 + P) \times 7 \times 4}{100} = 11200 \Rightarrow P = Rs.15,000$

82. Ans. B.

We have $x^2 + 5x + 6 = 0 \Rightarrow (x+2)(x+3) = 0 \Rightarrow x = -2, -3$

It is given that one of the roots of the equation $x^2 + 5x + 6 = 0$ is common with the roots of the equation $x^2 + kx + 1 = 0$

Let $x = -2$ is common roots then it satisfy the equation $x^2 + kx + 1 = 0$.

So, $(-2)^2 + k(-2) + 1 = 0 \Rightarrow k = \frac{5}{2}$

Let $x = -3$ is common roots then it satisfy the equation $x^2 + kx + 1 = 0$.

So, $(-3)^2 + k(-3) + 1 = 0 \Rightarrow k = \frac{10}{3}$

83. Ans. D.

$$LCM\left(\frac{1}{3}, \frac{5}{6}, \frac{2}{9}, \frac{4}{27}\right) = \frac{LCM\ of\ numerator}{HCF\ of\ denomenator} = \frac{20}{3}$$

84. Ans. D.

Time taken by $X, Y \text{ and } Z$ to complete a round are 252 sec, 308 sec and 198 sec.

Now,
$$LCM(252, 308, 198) = LCM(2\times2\times7\times9, 2\times2\times7\times11, 2\times9\times11) = 2\times2\times7\times9\times11 = 2772$$

So, they meet again after 2772 sec or 46 min 12 sec.

85. Ans. A.

Let the three linear factors are $(x+a), (x+b) \, and \, (x+c)$

So, $(x+a)(x+b)(x+c) = x^3 + kx^2 - 7x + 6$

$$x^3 + (a+b+c)x^2 + (ab+bc+ca)x + abc = x^3 + kx^2 - 7x + 6$$

After comparing, $a+b+c = k, ab+bc+ca = -7 \text{ and } abc = 6$

Let $abc = 6 = -1\times-2\times3 \Rightarrow a = -1, b = -2, c = 3$

Then, $ab+bc+ca = 2-6-3 = -7(satisfied)$

So, $k = a+b+c = -1-2=3 = 0$

86. Ans. C.

Let the sum of the amount on each investment is $Rs.P$ and rate of interest is 20%.

ATQ $482 = P\left(1+\frac{10}{100}\right)^4 - P\left(1+\frac{20}{100}\right)^2$

$$482 = P\left[\left(\frac{11}{10}\right)^2 + \frac{6}{5}\right]\left[\left(\frac{11}{10}\right)^2 - \frac{6}{5}\right]$$
$$482 = P(2.41)(.01)$$
$$P = Rs.20,000$$

87. Ans. C.

Statement-1: Unit digit of 17^{174}

Cycle of 7 = 4(7,9,3,1), 174 = 4 x 43 + 2

So, last digit of 17^{174} is 9.

Statement-2: Let two odd numbers are $2k-1 \text{ and } 2k+1$.

So, $(2k+1)^2-(2k-1)^2=(4k)(2)=8k$

Hence, it is always divisible by 8.

Statement-3: Let two consecutive odd numbers are $2k-1 \text{ and } 2k+1$

Then, $(2k-1)(2k+1)+1=4k^2-1+1=4k^2=(2k)^2$

Hence, it is always a perfect square.

Here statement 2 and 3 are correct.

88. Ans. A.

If the HCF of the two numbers is 12, then the numbers are $12x \text{ and } 12y$ (where $x \text{ and } y$ are coprime to each other).

So, the LCM of the numbers $=12\times x\times y=12xy$ = multiple of 12

From the above option we can see that 80 is not multiple of 12.

89. Ans. A.

We have $x=\frac{1+\sqrt{3}}{2} \text{ and } y=x^3$.

So,

$$y = x^3 = \left(\frac{1+\sqrt{3}}{2}\right)^3 = \frac{1}{8}\left(1+3\sqrt{3}+3\sqrt{3}+9\right) = \frac{1}{4}\left(5+3\sqrt{3}\right)$$
$$20y = 5\left(5+3\sqrt{3}\right) = 25+15\sqrt{3} \qquad ...(i)$$
$$y^2 = \frac{1}{16}\left(5+3\sqrt{3}\right)^2 = \frac{1}{16}\left(25+27+30\sqrt{3}\right) = \frac{1}{8}\left(26+15\sqrt{3}\right)$$
$$8y^2 = 26+15\sqrt{3} \qquad ...(ii)$$

From equation (i) and (ii),

$$8y^2 - 20y = 1$$
$$8y^2 - 20y - 1 = 0$$

90. Ans. A.

Given that $a\sqrt{a}+b\sqrt{b}=32 \quad and \quad a\sqrt{b}+b\sqrt{a}=31$

$$a\sqrt{a}+b\sqrt{b}+a\sqrt{b}+b\sqrt{a}=32+31$$
$$(a+b)\left(\sqrt{a}+\sqrt{b}\right)=63 \qquad ...(i)$$
$$a\sqrt{a}+b\sqrt{b}-a\sqrt{b}-b\sqrt{a}=32-31$$
$$(a-b)\left(\sqrt{a}-\sqrt{b}\right)=1 \qquad ...(ii)$$

Multiplying equation (i) and (ii)

$$\left(a^2-b^2\right)(a-b)=63$$
$$(a+b)(a-b)^2 = 7\times 3^2 = 63\times 1^2$$

By comparing, we get $a+b=7 \quad and \quad a-b=3$ or $a+b=63 \quad and \quad a-b=1$

$a=5 \quad and \quad b=2$ or $a=32 \quad and \quad b=31$

So, $\frac{5}{7}(a+b)=\frac{5}{7}\times 7=5$ or $\frac{5}{7}(a+b)=\frac{5}{7}\times 63=45$

91. Ans. A.

Average number of bikers killed per day in 2017
$$=\frac{\text{bikers cyclist per year}}{\text{total days}}=\frac{3559}{365}\approx 10$$

92. Ans. D.

Average number of bikers killed per day in 2017

$$= \frac{\text{bikers killed per year}}{\text{total days}} = \frac{48716}{365} \approx 134$$

93. Ans. A.

Percentage change in the fatalities of the pedestrian during the period 2014-17.

$$\%\text{age change} = \frac{\text{number of accidents in2014 - number of accidents in 2017}}{\text{number of accidents in2014}} \times 100\%$$

$$= \frac{20457 - 12330}{12330} = \frac{8127}{12330} \times 100\% = 65.9\% \approx 66\%$$

94. Ans. D.

We have

Year	2014	2015	2016	2017
Numbers of Bikers killed	40957	46070	52750	48716
Numbers of Pedestrian killed	12330	13894	15746	20457
Numbers of Cyclist killed	4037	3125	2585	3559

Average number of pedestrians killed per day in 2017

$$= \frac{\text{Pedestrians killed per year}}{\text{Total days}} = \frac{20457}{365} \approx 56$$

95. Ans. D.

Total number of Scooter of companies X and Y sold by showroom A

$$= \frac{19}{100} \times 6400 = 1216$$

Total number of Scooter of company X sold by showroom B

$$= \frac{18}{100} \times 3000 = 540$$

Total number of Scooter of company X sold by showroom E

$$= \frac{8}{100} \times 3000 = 240$$

So, required difference $= 1216 - (540 + 240) = 1216 - 780 = 436$

96. Ans. A.

Total number of Scooter of companies X and Y sold by showroom A
$=\frac{19}{100}\times 6400=1216$

Total number of Scooter of company X sold by showroom A
$=\frac{24}{100}\times 3000=720$

Total number of Scooter of company Y sold by showroom A=
$1216-720=496$

Total number of Scooter of companies X and Y sold by showroom C
$=\frac{15}{100}\times 6400=960$

Total number of Scooter of company X sold by showroom C
$=\frac{20}{100}\times 3000=600$

Total number of Scooter of company Y sold by showroom C= $960-600=360$

Total number of Scooter of companies X and Y sold by showroom E
$=\frac{12}{100}\times 6400=768$

Total number of Scooter of company X sold by showroom E
$=\frac{8}{100}\times 3000=240$

Total number of Scooter of company Y sold by showroom E= $768-240=528$

So, Average number of scooters sold by showrooms A,C and E
$=\frac{496+360+528}{3}=461\frac{1}{3}$

97. Ans. C.

Total number of Scooter of companies X and Y sold by showroom B
$=\frac{21}{100}\times 6400=1344$

Total number of Scooter of company X sold by showroom A
$=\frac{24}{100}\times 3000=720$

So, required %age $= \frac{1344-720}{720} \times 100 = 86\frac{2}{3}$

98. Ans. C.

Total number of Scooter of companies X and Y sold by showroom E $= \frac{12}{100} \times 6400 = 768$

Total number of Scooter of company X sold by showroom E $= \frac{8}{100} \times 3000 = 240$

Total number of Scooter of company Y sold by showroom E= $768 - 240 = 528$

Total number of Scooter of companies X and Y sold by showroom C $= \frac{15}{100} \times 6400 = 960$

So, required %age $= \frac{528}{960} \times 100 = 55$

99. Ans. C.

From the given data series-I and series-II have 100 students.

For series-I

$$20+15+10+x+y=100$$
$$x+y=55 \qquad ...(i)$$

For series-II

$$4+8+4+2x+y=100$$
$$2x+y=84 \qquad ...(ii)$$

From equation (i) and (ii),

$$x=29, y=26$$

Class interval	Mid-point	Frequency Series-I	m.f	Frequency Series-I	m.f
10-20	15	20	300	4	60
20-30	25	15	375	8	200
30-40	35	10	350	4	140
40-50	45	29	1305	58	2610
50-60	55	26	1430	26	1430
total		100	3760	100	4440

We can see in series-II the highest frequency range is 40-50.

$$\textbf{Estimated Mode} = L + \frac{f_m - f_{m-1}}{(\mathbf{f_m} - \mathbf{f_{m-1}}) + (\mathbf{f_m} - \mathbf{f_{m+1}})} \times w$$

where:

- L is the lower class boundary of the modal group
- f_{m-1} is the frequency of the group before the modal group
- f_m is the frequency of the modal group
- f_{m+1} is the frequency of the group after the modal group
- w is the group width

$$L = 40, f_{m-1} = 4, f_m = 58, f_{m+1} = 26, W = 10$$

$$\begin{aligned}\text{mode} &= 40 + \frac{58-4}{2\times 58 - 4 - 26} \times 10 \\ &= 40 + \frac{54}{86} \times 10 \\ &= 46.27\end{aligned}$$

100. Ans. C.

From the given data series-I and series-II have 100 students.

For series-I

$$20 + 15 + 10 + x + y = 100$$
$$x + y = 55 \qquad ...(i)$$

For series-II

$$4 + 8 + 4 + 2x + y = 100$$
$$2x + y = 84 \qquad ...(ii)$$

From equation (i) and (ii),

$x = 29, y = 26$

Class interval	Mid-point	Frequency Series-I	m.f	Frequency Series-I	m.f
10-20	15	20	300	4	60
20-30	25	15	375	8	200
30-40	35	10	350	4	140
40-50	45	29	1305	58	2610
50-60	55	26	1430	26	1430
total		100	3760	100	4440

Now, mean of the series-I $= \frac{\sum m.f}{\sum f} = \frac{3760}{100} = 37.6$