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Mixed Maths Questions for SSC 10 + 2 and CGL Tier-I exams

SSC Maths Quiz 4

Directions: Read the following questions carefully and choose the right answer.

1. If $x^4 + \frac{1}{x^4} = 322$, and $x > 1$ then the value of $x^3 - \frac{1}{x^3}$ is

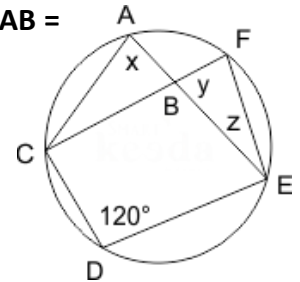
- A. 76 B. 54 C. 66 D. 36

2. Find the value of $\sin^2 10^\circ + \sin^2 20^\circ + \sin^2 30^\circ + \dots + \sin^2 80^\circ$.

- A. 2 B. 3 C. 1 D. 4

3. In the given figure, triangle ABC is an isosceles triangle such that $AB = BC$. Find x , y and z if angle CDE is 120° .

- A. $x = 60^\circ, y = 60^\circ, z = 60^\circ$ B. $x = 30^\circ, y = 40^\circ, z = 60^\circ$
C. $x = 40^\circ, y = 60^\circ, z = 60^\circ$ D. $x = 50^\circ, y = 40^\circ, z = 60^\circ$



4. Find the value of $\frac{16}{\sqrt{3}} (\cos 50^\circ \cos 10^\circ \cos 110^\circ \cos 60^\circ)$

- A. 1 B. 2 C. -1 D. -2

5. If the rate of income tax increases by 18%, net income decreases by 2%. What was the rate of income tax?

- A. 10 B. 20 C. 15 D. 12

6. If $x + y + z = 6\sqrt{3}$ and $x^2 + y^2 + z^2 = 36$. Find $x : y : z$.

- A. 1 : 1 : 2 B. 2 : 3 : 1 C. 1 : 1 : 1 D. 1 : 2 : 3

7. The speed of boat is 10 km/hr in still water and speed of current is 4 km/hr. A man covered 12 km upstream, took some rest and then covered 14 km downstream. Find the period of time for which he took rest if he took 4 hrs to cover his complete journey.

- A. 0.5 hr B. 1 hr C. 1.5 hr D. 1.25 hr

8. If R and r are respectively the circumradius and in radius of triangle having sides 40 cm, 41 cm and 9 cm, then find the value of 2 (R + r).

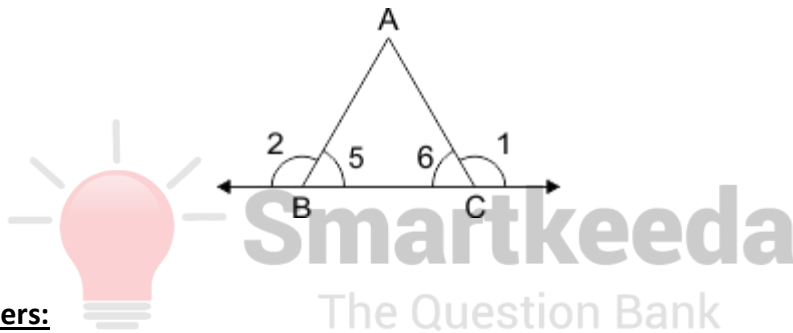
- A. 40 B. 49 C. 45 D. 44

9. In the given figure, the side BC of Δ ABC is produced on both side, then ∠1 + ∠2 is equal to

- A. ∠A + ∠180° B. 180° – ∠A C. 2∠A + 180° D. ∠A + 90°

10. Find the value of $\cos^2\theta \left(\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} + \sqrt{\frac{1-\sin\theta}{1+\sin\theta}} \right)$

- A. $\cos \theta$ B. $\frac{\cos \theta}{2}$ C. $2 \cos \theta$ D. $\sqrt{2} \cos \theta$



Correct answers:

1	2	3	4	5	6	7	8	9	10
A	D	A	C	A	C	B	B	A	C



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Explanation:

1. $x^4 + \frac{1}{x^4} = 322$ [$x > 1$] given

We know that, $[(a + b)^2 = a^2 + b^2 + 2ab]$ Or, $[(a + b)^2 - 2ab = a^2 + b^2]$

$$\text{So, } \left(x^2 + \frac{1}{x^2}\right)^2 - 2 \times x^2 \times \frac{1}{x^2}$$

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

$$\text{Or, } \left(x^2 + \frac{1}{x^2}\right)^2 = 322 + 2$$

$$\left(x^2 + \frac{1}{x^2}\right)^2 = \pm 18$$

$$\text{Also, } \left(x^2 - \frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2}$$

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

$$\left(x^2 - \frac{1}{x^2}\right)^2 + 2 = 18$$

$$[\because (a - b)^2 + 2ab = a^2 + b^2]$$

$$\left(x - \frac{1}{x}\right) = \pm 4$$

Now, Cubbing both sides, we get

$$x^3 - \frac{1}{x^3} - 3 \times x \times \frac{1}{x} \left(x - \frac{1}{x}\right) = 64$$

$$\text{Or, } x^3 - \frac{1}{x^3} - 3(4) = 64$$

$$x^3 - \frac{1}{x^3} = 12 + 64$$



$$x^3$$

$$\left(x^3 - \frac{1}{x^3}\right) = 76$$

Hence, option A is correct.

2. We can rewrite above equation as

$$\sin^2 10 + \sin^2 80 + \sin^2 20 + \sin^2 70 + \sin^2 30 + \sin^2 60 + \sin^2 40 + \sin^2 50 \dots$$

equation (A)

$$\text{We know that } \sin^2 x + \sin^2 (90 - x) = 1$$

Therefore equation A becomes

$$1 + 1 + 1 + 1 = 4$$

Hence, option D is correct.

3. **Method I :**

Since quadrilateral CDEF is Cyclic quadrilateral, therefore

$$\angle CDE + \angle CFE = 180^\circ$$

Therefore ,

$$\angle CFE = 180^\circ - 120^\circ = 60^\circ$$

We know that

Angles formed from two points on the same arc are equal .

Therefore

$$x = \angle CAE = 60^\circ$$

Since $AB = BC$



Thus $x = \angle ACB = 60^\circ$

By angle sum property of triangle ABC, we have

$$x + x + \angle ABC = 180^\circ$$

$$\angle ABC = 180 - 2x$$

$$\angle ABC = 180 - 120 = 60^\circ$$

$\angle ABC = y = 60^\circ$ as vertically opposite angles are same.

Using angle sum property in $\triangle FBE$, we get

$$60^\circ + 60^\circ + z = 180^\circ$$

Thus $z = 60^\circ$

Method II :

In this question, CDEF will be a cyclic quadrilateral.

Therefore, the sum of the opposite angle i.e. $\angle CDE = \angle CFE = 180^\circ$

$$120^\circ + \angle CFE = 180^\circ$$

$$\angle CFE = 180 - 120 = 60^\circ$$

Now, if we take CE a chord then we know that the angle made by the same chord on any point of the circumference is equal therefore

$$\angle CFE = \angle CAE = 60^\circ = x \text{ ----- (i)}$$

Again, according to the question, $AB = BC$ therefore $x = \angle ACB = 60^\circ$

In triangle ABC, $\angle X + \angle ACB + \angle ABC = 180^\circ$

$$60 + 60 + \angle ABC = 180$$

$$\angle ABC = 180 - 120 = 60^\circ \text{ ----- (ii)}$$

Now, AE and CF intersect each other at B

Therefore, $\angle ABC = \angle FBE = Y = 60^\circ$ (iii) (from the equation I, $\angle ABC = 60^\circ$)

Now in the triangle FBE, $\angle FBE + \angle BEF + \angle BFE = 60 + 60 + Z = 180$

By solving, $z = 60^\circ$

Therefore, $x = y = z = 60^\circ$

Hence, option A is correct answer.

4. We have $\cos x \cos(60 - x) \cos(60 + x) = \cos x (\cos x \cos 60 + \sin x \sin 60) (\cos x \cos 60 - \sin x \sin 60)$

$$= \cos x (\cos^2 x \cos^2 60^\circ - \sin^2 x \sin^2 60^\circ)$$

$$= \cos x \left(\frac{1}{4} \cos^2 x - \frac{3}{4} \sin^2 x \right)$$

$$= \frac{1}{4} (\cos^3 x - 3 \cos x (1 - \cos^2 x))$$

$$= \frac{1}{4} (4 \cos^3 x - 3 \cos x)$$

$$= \frac{1}{4} \cos 3x$$

Thus,

$$\cos x^\circ \cos(60 - x)^\circ \cos(60 + x) = \frac{1}{4} \cos(3x)$$

Therefore,

$$\cos 50^\circ \cos 10^\circ \cos 110^\circ = \frac{1}{4} \cos 150^\circ$$

$$= \frac{1}{4} \left(-\frac{\sqrt{3}}{2} \right) = -\frac{\sqrt{3}}{8} \quad \dots \text{eq A}$$

$$\text{Also } \cos 60^\circ = \frac{1}{2} \quad \dots \text{eq B}$$

Put values of eq.A and Eq.B in

$$\frac{16}{\sqrt{3}}(\cos 50^\circ \cos 10^\circ \cos 110^\circ \cos 60^\circ), \text{ we get}$$

$$= \frac{16}{\sqrt{3}} \times \left(-\frac{\sqrt{3}}{8}\right) \times \frac{1}{2}$$

$$= -1$$

Option C is hence the correct answer.

5. 18% of income tax = 2% of net income

$$\frac{\text{Income tax}}{\text{Net income}} = \frac{2}{18} = \frac{1}{9}$$

Let the income tax be x and Net income be $9x$

$$\text{Therefore total income} = x + 9x = 10x$$

$$\text{Rate of Income tax} = \frac{x}{10x} \times 100\% = 10\%$$

Hence, option A is correct.

6. Sol We have $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

$$\text{Therefore } (x + y + z)^2 = (6\sqrt{3})^2$$

$$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx = 108$$

$$= 36 + 2(xy + yx + zx) = 108$$

$$= xy + yz + zx = 36 \dots \dots \text{equation A}$$

$$\text{Comparing equation A with } x^2 + y^2 + z^2 = 36$$

$$\text{We get } x^2 = xy \text{ or } x = y$$

Similarly we get $x = y = z$

Therefore $x : y : z = 1 : 1 : 1$

Thus option C is correct answer.

7. We know that

Downstream speed = Speed of boat in still water + Speed of current

Upstream speed = Speed of boat in still water – Speed of current.

Downstream speed = $10 + 4 = 14$ km/hr

Upstream speed = $10 - 4 = 6$ km/hr

Time taken to cover 12 km upstream = $12/6 = 2$ hr

Time taken to cover 14 km downstream = $14/14 = 1$

Time for which he took rest = $4 - 3 = 1$ hr

Hence, option B is correct.

8. We have,

$$41^2 = 1681$$

$$40^2 = 1600$$

$$9^2 = 81$$

$$\text{Since, } 41^2 = 40^2 + 9^2$$

Therefore , Given triangle is a right angle triangle whose hypotenuse is 41, and others two are perpendicular and base.

Sum of base and perpendicular = 49 cm

We know In right angle triangle,

$$\begin{aligned} \text{Inradius} &= \frac{P + B - H}{2} \\ &= \frac{49 - 41}{2} = \frac{8}{2} = 4 \text{ cm} \end{aligned}$$

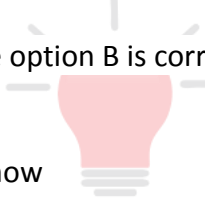
Also circumradius in right angle triangle =

$$\frac{H}{2} = \frac{41}{2} \text{ cm}$$

$$R + r = 4 + \frac{41}{2} = \frac{49}{2}$$

$$2(R + r) = 49 \text{ cm}$$

Hence option B is correct.



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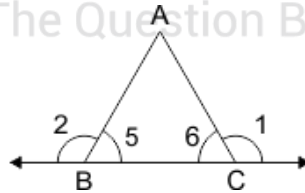
9. We know

$$\angle A + \angle 5 + \angle 6 = 180^\circ$$

$$\text{Also, } \angle 2 = \angle A + \angle 6$$

$$\text{and } \angle 1 = \angle A + \angle 5$$

[Exterior angle is equal to sum of two opposite angles of triangle]



$$\angle 1 + \angle 2 = 2\angle A + \angle 5 + \angle 6$$

$$= \angle A + 180^\circ$$

Hence, option A is correct.

$$10. \quad \cos^2 \theta \left(\sqrt{\frac{(1 + \sin \theta)(1 + \sin \theta)}{(1 - \sin \theta)(1 + \sin \theta)}} + \sqrt{\frac{(1 - \sin \theta)(1 - \sin \theta)}{(1 + \sin \theta)(1 - \sin \theta)}} \right)$$

$$\Rightarrow \cos^2\theta \left(\sqrt{\frac{(1 + \sin\theta)^2}{(1 - \sin^2\theta)}} + \sqrt{\frac{(1 - \sin\theta)^2}{(1 - \sin\theta)^2}} \right)$$

$$\Rightarrow \cos^2\theta \left(\sqrt{\frac{(1 + \sin\theta)^2}{\cos^2\theta}} + \sqrt{\frac{(1 - \sin\theta)^2}{\cos^2\theta}} \right)$$

$$\Rightarrow \cos^2\theta \left(\frac{1 + \sin\theta}{\cos\theta} + \frac{1 - \sin\theta}{\cos\theta} \right)$$

$$\Rightarrow \cos^2\theta \left(\frac{1 + \sin\theta + 1 - \sin\theta}{\cos\theta} \right) = \frac{2\cos^2\theta}{\cos\theta} = 2\cos\theta$$

Hence, option C is correct.



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