TRIGONOMETRIC RATIOS & IDENTITIES BASED QUANTITATIVE APTITUDE PRACTICE QUESTIONS AND ANSWERS PDF WITH EXPLANATION

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Q1. If cos θ = $\frac{1}{\sqrt{5}}$, where 0 < θ < $\frac{\pi}{2}$, then $\frac{2tan\theta}{1-tan^2\theta}$ is equal to

a) –4/3

b) 4 @ 3

c) 1 @ 3

d) –2/3

Q2. What is cot 1° cot 23° cot 45° cot 67° cot 89° equal to?

a) 1

b) 0

c) $\frac{1}{2}$

d) $\frac{1}{3}$

Q3. Consider the following :

1. sin 1° > sin 1^c
2. cos 1° < cos 1^c
3. tan 1° > tan 1^c .

Which of the above are not correct?

a) 2 and 3 only

b) 1 and 2 only

c) 1 and 3 only

d) 1, 2 and 3

Q4. What is the angle (in radian) included between the hands of a clock, when the time is 10 min past 5?

a) $\frac{19\pi}{36}$

b) $\frac{17\pi}{36}$

c) $\frac{5\pi}{9}$

d) $\frac{7\pi}{12}$

Q5. If x + y = 90° and sin x : sin y = $\sqrt{3}$: 1, then what is x : y equal to?

a) 1 : 2

b) 1 : 1

c) 2 : 1

d) 3 : 2

Q6. p = $tan^2x + cot^2$ x, then which one of the following is correct?

a) p ≥ 2

b) p ≤ 2

c) p < 2

d) p > 2

Q7. If sin x + cos x = c then $sin^6 x + cos^6$ x is equal to

a) $\frac{1 + 6c^2 - 3c^4}{4}$

b) $\frac{1 + 6c^2 - 3c^4}{16}$

c) $\frac{1 + 6c^2 + 3c^4}{16}$

d) $\frac{1 + 6c^2 + 3c^4}{4}$

Q8. If $2x^2$ cos 60° – 4 cot^2 45° – 2 tan 60° = 0, then what is the value of x?

a) 3

b) 2

c) $\sqrt{3} - 1$

d) $\sqrt{3} + 1$

Q9. What is the value of
$sin^2 6° + sin^2 12° + sin^2 18° + \ldots + sin^2 84° + sin^2 90°$?

a) 2

b) 1

c) 4

d) 8

Q10. If $\sin\theta + \cos\theta = \frac{1+\sqrt{3}}{2}$ where $0 < \theta < \frac{\pi}{2}$, then what is $\tan\theta + \cot\theta$ equal to ?

a) $\frac{1}{\sqrt{3}}$

b) $\frac{\sqrt{3}}{4}$

c) $\sqrt{3}$

d) $\frac{4}{\sqrt{3}}$

Q11. The angles A, B, C and D of a quadrilateral ABCD are in the ratio 1 : 2 : 4 : 5. A = 30°, B = 60°, C = 120°, D = 150° What is the value of $sec^2D – tan^2$ D?

a) $\frac{2}{3}$

b) $\frac{1}{2}$

c) 1

d) None of these

Q12. Which one of the following is correct?

a) $\sin x > \frac{1}{2}$, $0° < x < 30°$

b) $\tan x > 1$, $45° < x < 90°$

c) $\cos x > \frac{1}{2}$, $60° < x < 90°$

d) $\sin x = \cos x$ for some value of x, $30° < x < 45°$

Q13. The complement angle of 80° is

a) $\frac{5\pi}{9}$ radian

b) $\frac{9\pi}{5}$ radian

c) $\frac{\pi}{18}$ radian

d) $\frac{9}{5\pi}$ radian

Q14. Which one of the following is true for some value of θ, where 0° ≤ θ ≤ 90°?

a) sin θ + cos θ = 2

b) sin θ = $\sqrt{2}$

c) sin θ + cos θ = 0

d) sin θ – cos θ = 1

Q15. Consider the following :

1. $\frac{\cos A}{1-\tan A} + \frac{\sin A}{1-\cot A} = \cos A + \sin A$
2. $(1-sinA-cosA)^2 = 2(1 - \sin A)(1 + \cos A)$

Which of the above is/are identity/identities?

a) 2 only

b) 1 only

c) Both 1 and 2

d) Neither 1 nor 2

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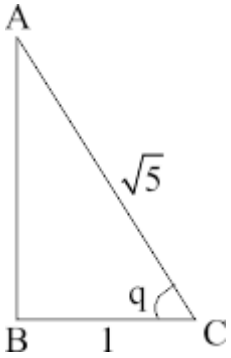
Answers to the above questions :

Q1. Answer: (a)

cos θ = $\frac{1}{\sqrt{5}}$

from ΔABC



AB = $\sqrt{(AB)^2 + (BC)^2}$

= $\sqrt{(\sqrt{5})^2 - (1)^2} = \sqrt{5-1} = \sqrt{4} = 2$

∴ tan θ = $\frac{AB}{BC} = \frac{2}{1} = 2$

Now, $\frac{2tan\theta}{1 - tan^2\theta} = \frac{2 \times 2}{1 - (2)^2} = -\frac{4}{3}$

Q2. Answer: (a)

cot 1° cot 23° cot 45° cot 67° cot 89°

= cot 1° × cot 23° × cot 45° × cot (90 - 23)° × cot (90 - 1)°

= cot 1° × cot 23° × cot 45° × tan 23° × tan 1° cot 1° × tan 1° × cot 23° × tan 23° × cot 45°

= 1 × 1 × 1 = 1

Q3. Answer: (c)

1 and 3 only

sin 1^c = sin 57° (approx)

$cos1^c$ = cos 57°

$tan1^c = tan57°$

$\therefore$ 180° = $\frac{22^c}{7}$

cos 0° = 1, cos 1° = 0.99

cos 57° = 0.54

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Q4. Answer: (a)

In 60 min h hand gains = 5 min

In 1 min h hand gains = $\frac{5}{60}$ min

In 10 min h hand gains = $\frac{5}{60} \times 10 = \frac{5}{6}$ min

There is 15 min gap between hours and minutes

hand but in 10 min h hand gains $\frac{5}{6}$ min more.

So, the actual gap = 15 + $\frac{5}{6} = \frac{95}{6}$ min

In 1 min, there are 6°,

In $\frac{95}{6}$ min, there are

$\frac{95}{6} \times 6° = \frac{95}{6} \times 6 \times \frac{\pi}{180} = \frac{19\pi}{36}$ radian

Q5. Answer: (c)

sin x : sin y = $\sqrt{3} : 1 = \frac{\sqrt{3}}{2} : \frac{1}{2}$

= sin 60° : sin 30°

∴ x : y = 60 : 30

⇒ x : y = 2 : 1.

Q6. Answer: (a)

Given, p = $tan^2x + cot^2x$

= $(\tan x + \cot x)^2 - 2$

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

= $\frac{4}{sin^2 2x}$ - 2

Since, the maximum value of sin 2x is 1.

∴ $P_{min} = \frac{4}{1}$ - 2 = 2.

∴ p ≥ 2

Hence, p ≥ 2.

Alternate Method

$p = tan^2x + cot^2x = tan^2x + \frac{1}{tan^2x}$

$\therefore$ A.M. $\geq$ G.M.

$\because tan^2x + \frac{1}{tan^2x} \geq 2\left(tan^2x \cdot \frac{1}{tan^2x}\right)^{\frac{1}{2}}$

$\Rightarrow tan^2x + \frac{1}{tan^2x} \geq 2 \Rightarrow P \geq 2$

Q7. Answer: (a)

sin x + cos x = c ....(i)

Squaring both sides.

$\Rightarrow sin^2x + cos^2x + 2 \sin x \cos x = c^2$

$\Rightarrow \sin x \cos = \frac{c^2 - 1}{2}$ ...(ii)

Now, cubing eqn (i) both sides

$\Rightarrow sin^3x + cos^3x + 3 \sin x \cos x (\sin x + \cos x) = c^3$

$\Rightarrow sin^3x + cos^3x + 3 \cdot \frac{(c^2 - 1)}{2} \times c = c^3$

$\Rightarrow sin^3x + cos^3x = c^3 - \frac{3}{2}(c^2 - 1)c$

$\Rightarrow sin^3x + cos^3x = c^3 - \frac{3c^3 + 3c}{2}$

$sin^3x + cos^3x = \frac{3c - c^32}{2}$ ...(iii)

On squaring both sides.

$\Rightarrow sin^6x + cos^6x + 2sin^3xcos^3x = \frac{(3c - c^3)^2}{4}$

$\Rightarrow sin^6x + cos^6x + 2\left(\frac{(c^2 - 1)}{2}\right)^3 = \frac{9c^2 + c^6 - 6c^4}{4}$

$\Rightarrow sin^6x + cos^6x$

$= \frac{9c^2 + c^6 - 6c^4 - c^6 + 1 + 3c^2(c^2 - 1)}{4}$

$sin^6x + cos^6x = \frac{1 + 6c^2 - 3c^4}{4}$

Q8. Answer: (d)

Given, $2x^2cos60° - 4cot^245° - 2tan60° = \theta$

$\Rightarrow 2x^2 \times \frac{1}{2} - 4(1)^2 - 2 \times \sqrt{3} = 0$

$\Rightarrow x^2 - 4 - 2\sqrt{3} = 0$

$\Rightarrow x^2 = 4 + 2\sqrt{3}$

$\Rightarrow x^2 = 3 + 1 + 2\sqrt{3}$

$\Rightarrow x^2 = (\sqrt{3})^2 + (1)^2 + 2\sqrt{3}.1$

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

Q9. Answer: (d)

$sin^26° + sin^212° + sin^218° + \ldots\ldots . sin^284° + sin^290°$

Now, $sin^284° = sin^2(90° - 6°) = cos^26°$

$\therefore sin^26° + sin^212° + sin^218° + \ldots . cos^212° + cos^26° + sin^290°$

$sin^26 + cos^26 + \ldots. + sin^242 + cos^242 + sin^290$

$= 7 + 1 = 8$

Q10. Answer: (d)

$\sin\theta + \cos\theta = \frac{1 + \sqrt{3}}{2} = \frac{1}{2} + \frac{\sqrt{3}}{2}$ i.e., $\theta = 30°$

$\tan 30 + \cot 30 = \frac{1}{\sqrt{3}} + \sqrt{3} = \frac{4}{\sqrt{3}}$

Q11. Answer: (c)

Required angles of a quadrilateral ABCD are 30°,

60°, 120°, and 150°, respectively.

$sec^2D - tan^2D = sec^2(150°) - tan^2(150°)$

$= sec^2(90° + 60°) - tan^2(90° + 60°)$

$= cosec^2 60° - cot^2 60°$

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

After we know that $sec^2\theta - tan^2\theta = 1$

Similarly, $sec^2D - tan^2D$ is always equal to 1.

Q12. Answer: (b)

Since, sin x < $\frac{1}{2}$, 0° < x < 30°

and cos x < $\frac{1}{2}$, 60° < x < 90°

then, sin x = cos x only for x = 45° in first quadrant.

Hence, option (a) is correct.

Q13. Answer: (d)

Complementary angle of 80° = 90° - 80° = 10°

10° can be written as = 10 × $\frac{\pi}{180} Rad = \frac{\pi}{18}$ rad.

Q14. Answer: (d)

(a) sin θ = $\sqrt{2}$ is not possible, since sin θ ≤ 1.

(b) sin θ + cos θ = 2 is not possible, since

$-\sqrt{2} \leq sin\theta + cos\theta \leq \sqrt{2}.$

(c) sin θ + cos θ = 0

⇒ sin θ = - cos θ ⇒ tan θ = - 1

$\Rightarrow \tan\theta = \tan\frac{3\pi}{4} \Rightarrow \theta = \frac{3\pi}{4}$

So, θ does not lie in $0° \leq \theta \leq 90°$.

Thus, option (c) is not correct.

(d) $\sin\theta - \cos\theta = 1$

Squaring both sides,

$sin^2\theta + cos^2\theta - 2\sin\theta\cos\theta = 1$

$\therefore 1 - \sin 2\theta = 1 \Rightarrow \sin 2\theta = 0 = \sin 0°$

$\Rightarrow \theta = \frac{n\pi}{2}$, $n \in N$

$\theta = 0, \frac{\pi}{2}$

Thus, option (d) is correct.

Q15. Answer: (c)

Statement 1

$$\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A}$$

$$\Rightarrow \frac{\cos A \cdot \cos A}{\cos A - \sin A} + \frac{\sin A \cdot \sin A}{\sin A - \cos A}$$

$$= \frac{cos^2A - sin^2A}{(\cos A - \sin A)} = \cos A + \sin A.$$

Statement 2

$(1 - \sin A - \cos A)^2 = 2(1 - \sin A)(1 + \cos A)$

LHS $= (1 - \sin A - \cos A)^2$

$= 1 + sin^2A + cos^2A - 2\sin A + 2\sin A\cos A - 2\cos A$

= 2 -2 sin A 2 + cos A + 2 sin A cos A

$\Rightarrow 2\{(1 - \sin A) + \cos A(1 - \sin A)\}$

$= 2(1 - \sin A)(1 + \cos A)$

So both (1) and (2) are correct.