Quant Mega Quiz for SSC CGL Tier – 2 (Solutions)

S1. Ans.(c)

Sol.

sin θ + cosec θ = 2

So, sin θ = 1

And cosec θ = 1

$$\sin^{1000}\theta + \frac{1}{\sin^{1000}\theta} = (1)^{1000} + \frac{1}{(1)^{1000}}$$

= 1 + 1 = 2

S2. Ans.(d)

Sol.

$\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$

So, $\theta_1 = \theta_2 = \theta_3 = 90°$

$\cos\theta_1 + \cos\theta_2 + \cos\theta_3$

= cos 90° + cos 90° + cos 90°

= 0

S3. Ans.(a)

Sol.

(sec θ – cos θ) (cosec θ – sin θ) (tan θ + cot θ)

$$\frac{(1-\cos^2\theta)}{\cos\theta} \times \frac{(1-\sin^2\theta)}{\sin\theta} \times \frac{(1+\cot^2\theta)}{\cot\theta}$$

$$\frac{\sin^2\theta}{\cos\theta} \times \frac{\cos^2\theta}{\sin\theta} \times \frac{\operatorname{cosec}^2\theta}{\cot\theta}$$

$$\sin\theta \times \cos\theta \times \frac{\sin\theta}{\sin^2\theta \times \cos\theta}$$

= 1

S4. Ans.(d)

Sol.

$$\Big[\underbrace{1 + \sin\theta + \sin^2\theta + \sin^3\theta + \ldots\ldots\infty}_{G.P}\Big] = 4 + 2\sqrt{3}$$

Sum = $\frac{a}{1-r}$

Here, a = 1

r = sin θ

$$S_\infty = \frac{1}{1-\sin\theta} = 4 + 2\sqrt{3}$$

$$\Rightarrow 1 - \sin\theta = \frac{1}{4+2\sqrt{3}}$$

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$$1 - \sin\theta = \frac{(4 - 2\sqrt{3})}{16 - 12}$$
$$= \frac{4 - 2\sqrt{3}}{4}$$
$$1 - \sin\theta = 1 - \frac{\sqrt{3}}{2}$$
$\sin\theta = \frac{\sqrt{3}}{2}$

$\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$

S5. Ans.(b)

Sol.

$12\sin\theta + 5\cos\theta = 13.$

Since, 12, 5, 13 are triples

So,

$\sin\theta = \frac{12}{13}$ $\cos\theta = \frac{5}{13}$

$\cot\theta = \frac{5}{12}$

S6. Ans.(c)

Sol.

Given,

p = asinx + bcosx

q = acosx – bsinx

$\Rightarrow p^2 = a^2\sin^2 x + b^2\cos^2 x + 2ab\sin x\cos x$

and $q^2 = a^2\cos^2 x + b^2\sin^2 x - 2\,ab\sin x\cos x$

$\therefore p^2 + q^2 = a^2(\sin^2 x + \cos^2 x) + b^2(\cos^2 x + \sin^2 x)$

$= a^2 + b^2$

S7. Ans.(d)

Sol.

We know that, $\sin 30° = \frac{1}{2}$

Value of sin increases 0° to 90°

$\therefore \sin 31° > \sin 30°$ and $\sin 32° > \sin 30°$

$\Rightarrow \sin 31° > \frac{1}{2}$ and $\sin 32° > \frac{1}{2}$

On adding both sides, we get

$\sin 31° + \sin 32° > \frac{1}{2} + \frac{1}{2}$

$\Rightarrow \sin 31° + \sin 32° > 1$

S8. Ans.(c)

Sol.

$\left(\cos^2\frac{\pi}{8} + \sin^2\frac{\pi}{8}\right) + 4\cos^2\frac{\pi}{4} - \sec\frac{\pi}{3} + 5\tan^2\frac{\pi}{3}$

$= 1 + 4\left(\frac{1}{\sqrt{2}}\right)^2 - 2 + 5\left(\sqrt{3}\right)^2$

$(\because \sin^2\theta + \cos^2\theta = 1)$

$= 1 + 2 - 2 + 15 = 16$

S9. Ans.(d)

Sol.

We know that

$-1 \le \cos\theta \le 1$

$\therefore -1 \le \cos 2x \le 1$ or

$-1 + 1 \le 1 + \cos 2x \le 1 + 1$

$\Rightarrow 0 \le 1 + \cos 2x \le 2$

S10. Ans.(a)

Sol.

$\cos 3\theta + \sin 3\theta$

$= \sqrt{2}\left(\frac{1}{\sqrt{2}}\cos 3\theta + \frac{1}{\sqrt{2}}\sin 3\theta\right)$

$= \sqrt{2}\,(\sin 45^\circ \cos 3\theta + \cos 45^\circ.\,\sin 3\theta)$

$= \sqrt{2}\,\sin(45^\circ + 3\theta)$

The maximum value occurs when

$\sin(45^\circ + 3\theta) = 1$

i.e. $3\theta = 45^\circ \Rightarrow \theta = 15^\circ$

S11. Ans.(d)

Sol.

$(34^{43} + 43^{34})/7 = [(35-1)^{43} + (42+1)^{34}/7]$

Applying binomial theorem to $(35-1)^{43}$, all terms will be divisible by 35 (i.e. 7) except the last term which will be –1. Similarly, last term of $(42+1)^{34}$ will be +1.

Therefore, $34^{43} + 43^{34}$ will leave remainder $[(-1) + (+1)] = 0$, when divided by 7.

S12. Ans.(b)

Sol.

Two prime numbers greater than 2 must be odd.

Sum of two odd numbers must always be even, thus,

X + Y = 87 is not possible.

S13. Ans.(b)

Sol. $7! + 8! + 9! + 10! + \ldots\ldots\ldots + 100 = 7.6! + 8.7.6! + 9.8.7.6! + \ldots\ldots\ldots + 100!$

Is completely divisible by 7 as each of the terms contain at least one 7 in it.

Now, $1! + 2! + 3! + 4! + 5! + 6! = 1 + 2 + 6 + 24 + 120 + 720 = 873$

which leaves a remainder of 5 when divided by 7.

S14. Ans.(a)

Sol.

Clearly, $(2272 - 875) = 1397$, is exactly divisible by N.

Now, $1397 = 11 \times 127$

$\therefore$ The required 3-digit number is 127, the sum of whose digits is 10.

S15. Ans.(d)

Sol.

$(3^{25} + 3^{26} + 3^{27} + 3^{28}) = 3^{25} \times (1 + 3 + 3^2 + 3^3)$

$= 3^{25} \times 40 = 3^{24} \times 3 \times 4 \times 10 = (3^{24} \times 4 \times 30)$, which is divisible by 30.

S16. Ans.(b)

Sol. Let the common remainder be x. Then numbers (34041 – x) and (32506 – x) would be completely divisible by n.

Hence the difference of the numbers (34041 – x) and (32506 – x) will also be divisible by n

or (34041 – x – 32506 + x) = 1535 will also be divisible by n.

Now, using options we find that 1535 is divisible by 307.

S17. Ans.(b)

Sol.

Given, L.C.M = 40 H.C.F

l = 40 h

And,

l + h = 1476

41h = 1476 ⇒ h = 36

We know,

L.C.M × H.C.F = I no. × II no.

$40h \times h = 288 \times x$

$40 \times 36 \times 36 = 288 \times x$

x = 180

Thus, the other no. 180

S18. Ans.(b)

Sol.

$7^4/2400$ gives us a remainder of 1. Thus, the remainder of $7^{99}/2400$ would depend on the remainder of $7^3/2400 \rightarrow$ remainder = 343.

S19. Ans.(a)

Sol.

Remainder = 12

Divisor = 4 × 12 = 48

$\text{Quotient} = \frac{48}{8} = 6$

Dividend = divisor × Quotient + remainder = 48 × 6 + 12

= 288 + 12 = 300

S20. Ans.(c)

Sol.

$= \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \ldots \times \frac{98}{99} \times \frac{99}{100}$

$= \frac{2}{100} = \frac{1}{50}$

S21. Ans.(b)
Sol.
$\cos(\theta - A) = a$
$\cos(\theta - B) = b$
Put $\theta = 90°$
$\cos(90° - A) = a$
$a = \sin A$
$b = \sin B$
Put $A = 60°$
$B = 30°$
$$a = \frac{\sqrt{3}}{2}$$
$$b = \frac{1}{2}$$
$\therefore \sin^2(A - B) + 2ab\cos(A - B)$
$$\sin^2(60° - 30°) + 2 \times \frac{\sqrt{3}}{2} \times \frac{1}{2}\cos(60° - 30°)$$
$$\Rightarrow \frac{1}{4} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$$
$$\Rightarrow \frac{1}{4} + \frac{3}{4} = 1$$
Now check the option
Option (b):- $a^2 + b^2$
$$\Rightarrow \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2$$
$\Rightarrow \frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$ (Satisfy)

S22. Ans.(b)
Sol.
$$\frac{1}{2}\left(\cos 15°.\cos 7\frac{1}{2}°.\cos 82\frac{1}{2}°\right) \times 2$$
$$\Rightarrow \frac{1}{2}\left(\cos 15°.2 \times \cos 7\frac{1}{2}°.\sin 7\frac{1}{2}°\right)$$
$$\Rightarrow \frac{1}{2}\cos 15°.\sin 15°$$
Multiply and divide by 2
$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times 2\cos 15° \sin 15°$$
$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times \sin 2 \times 15°$$
$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times \sin 30°$$
$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

S23. Ans.(a)
Sol.
$k = (\sec\alpha + \tan\alpha(\sec\beta + \tan\beta)(\sec\gamma + \tan\gamma)$ ...(i)
$k = (\sec\alpha - \tan\alpha)(\sec\beta - \tan\beta)(\sec\gamma - \tan\gamma)$ ...(ii)
Multiplying equation (i) & (ii)
$k^2 = (\sec^2\alpha - \tan^2\alpha)(\sec^2\beta - \tan^2\beta)(\sec^2\gamma - \tan^2\gamma)$
$k^2 = 1 \Rightarrow k = \pm 1$

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S24. Ans.(b)
Sol.

$$\frac{2\cos 40° - \cos 20°}{\sin 20°}$$
$$= \frac{\cos 40° - \cos 20° + \cos 40°}{\sin 20°}$$
Using formula, cos C - cos D = $2\sin\frac{C+D}{2}\sin\frac{D-C}{2}$
$$= \frac{2\sin 30°.\sin(-10°) + \cos 40°}{\sin 20°}$$
$$\begin{bmatrix} \sin(-\theta) = -\sin\theta \\ \cos(90° - 50°) = \sin 50° \end{bmatrix}$$
$$= \frac{\sin 50° - \sin 10°}{\sin 20°}$$
Use sin C – sin D
$$= 2\sin\frac{C-D}{2}\cos\frac{C+D}{2}$$
$$= \frac{2\sin 20°.\cos 30°}{\sin 20°}$$
$= 2\cos 30° = \sqrt{3}$

S25. Ans.(b)
Sol.

$$2\sqrt{2}\sin 10°\times\left(\frac{1}{2\cos 5°} + \frac{\cos 40°}{\sin 5°} - 2\sin 35°\right)$$
$$\Rightarrow 2\sqrt{2}\sin 10°\times\left(\frac{\sin 5° + 2\cos 5°\cos 40° - 2\sin 35°.2\sin 5°\cos 5°}{2\sin 5°\cos 5°}\right)$$
Using formula, 2cosA cosB = cos(A+B) + cos(A-B)
$$\Rightarrow 2\sqrt{2}\sin 10°\times\left(\frac{\sin 5° + \cos 45° + \cos 35° - 2\sin 35°\sin 10°}{\sin 10°}\right)$$
$\Rightarrow 2\sqrt{2}$ (sin 5° + cos 45° + cos 35° – 2sin 35°.sin 10°)
$$\Rightarrow 2\sqrt{2}\left[\sin 5° + \frac{1}{\sqrt{2}} + \cos 35° - (\cos 25° - \cos 45°)\right]$$
$$\Rightarrow 2\sqrt{2}\left[\sin 5° + \frac{1}{\sqrt{2}} + \cos 35° - \cos 25° + \frac{1}{\sqrt{2}}\right]$$
$$\Rightarrow 2\sqrt{2}\left[\sin 5° + \cos 35° - \cos 25° + \frac{2}{\sqrt{2}}\right]$$
$$\Rightarrow 2\sqrt{2}\left[\sin 5° - 2\sin 30°.\sin 5° + \frac{2}{\sqrt{2}}\right]$$
$\Rightarrow 2\sqrt{2}$ [sin 5° – sin 5° + $\sqrt{2}$] = 4

S26. Ans.(b)
Sol.

Applying C & D
$$\frac{2\tan\theta}{2\cot\theta} = \frac{3}{1}$$
$$\frac{\sin^2\theta}{\cos^2\theta} = \frac{3}{1}$$
$\sin^2\theta = 3(1 - \sin^2\theta)$
$4\sin^2\theta = 3$
$\sin\theta = \sqrt{3}/2$

S27. Ans.(c)

Sol.

$$\Rightarrow 2\frac{\cos 22°}{\cos 22°} - \frac{2\tan 75°}{5\tan 75°} - \frac{3\tan 20°.\cot 20° \tan 40° \cot 40°}{5}$$

$$= 2 - \frac{2}{5} - \frac{3}{5}$$

$$= 1$$

S28. Ans.(c)

Sol.

$(\sin^2\theta + \cos^2\theta)(\cos^2\theta - \sin^2\theta) = \frac{2}{3}$

$2\cos^2\theta - 1 = \frac{2}{3}$

S29. Ans.(a)

Sol.

$$\frac{\sin\alpha}{\cos(30°+\alpha)} = 1$$

$$\frac{\sin\alpha}{\sin(90-30-\alpha)} = 1$$

$$\frac{\sin\alpha}{\sin(60-\alpha)} = 1$$

$\sin\alpha = \sin(60 - \alpha)$

$\alpha = 60 - \alpha$

$\alpha = 30°$

$\sin 30° + \cos 60°$

$$= \frac{1}{2} + \frac{1}{2} = 1$$

S30. Ans.(c)

Sol.

$$\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$$

$\sin\theta + \cos\theta = 3\sin\theta - 3\cos\theta$

$2\sin\theta = 4\cos\theta$

$\tan\theta = 2$

$\sin^4\theta - \cos^4\theta$

$= (\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta)$

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

$= \cos^2\theta(\tan^2\theta - 1)$

$$= \frac{\tan^2\theta - 1}{\sec^2\theta} = \frac{4-1}{1+4} = \frac{3}{5}$$