SSC QUANT QUIZ of 29th Feb Solutions

1. **(D)** $(\sin x)\times(\cos x) = 2$
$2(\sin x)\times(\cos x) = 4$
$\sin 2x = 4$
Range of sine function is – 1 to 1
So, Sin 2x = 4 is not possible
$\Rightarrow$ No solution

2. **(A)** $\tan\theta + \sin\theta = m$ .....(i)
$\tan\theta - \sin\theta = n$ .....(ii)
Adding equations (i) and (ii)
$m + n = 2\tan\theta$
Subtracting equation (ii) from (i)
$m - n = 2\sin\theta$
$(m + n)(m - n) = 2\tan\theta \cdot \sin\theta$
$m^2 - n^2 = 4\tan\theta \cdot \sin\theta$
$= 4\sqrt{\tan^2\theta.\sin^2\theta}$
$= 4\sqrt{\frac{\sin^2\theta}{\cos^2\theta}.\sin^2\theta} = 4\sqrt{\frac{\sin^2\theta}{\cos^2\theta}.(1-\cos^2\theta)}$
$= 4\sqrt{\tan^2\theta.\sin^2\theta}$
$= 4\sqrt{(\tan\theta+\sin\theta)(\tan\theta-\sin\theta)}$
$= 4\sqrt{mn}$

3. **(B)** Arc length, $L = R \times \theta$ [θ is in radians]
$R_1 \times \theta_1 = R_2 \times \theta_2$ [R_1 and R_2 are radii of the two circles]
$\frac{R_1}{R_2} = \frac{\theta_2}{\theta_1}$
Radio of diameters = Ratio of radii = $\theta_2 : \theta_1$
$= 120 : 75$
$= 8 : 5$

4. $2^{3\sin\theta}.16^{\cos\theta} = 2^{3\sin\theta}.(2^4)^{\cos\theta}$
$= 2^{3\sin\theta}.2^{4\cos\theta}$
$= 2^{(3\sin\theta + 4\cos\theta)}$
So, $2^{3\sin\theta}$. $16^{\cos\theta}$ will be minimum when $3\sin\theta + 4\cos\theta$ is minimum
Minimum value of $3\sin\theta + 4\cos\theta = -\sqrt{(3)^2+(4)^2}$
$= -\sqrt{9+16}$
$= -5$
So, Minimum value of given function = $2^{-5} = \frac{1}{32}$

5. **(B)** $\tan(a + b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$
$\tan(a + b) = \frac{\frac{n}{n+1}+\frac{1}{2n+1}}{1-\frac{n}{n+1}\times\frac{1}{2n+1}}$
$= \frac{n(2n+1)+(n+1)}{(n+1)(2n+1)-n}$
$= \frac{2n^2+n+n+1}{2n^2+3n+1-n}$
$= \frac{2n^2+2n+1}{2n^2+2n+n}$
$= 1$
$\tan(a + b) = 1 = \tan 45°$
$\Rightarrow a + b = 45° = \frac{\pi}{4}$

6. $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$
Using C & D method:
$\frac{\sin(x+y)+\sin(x-y)}{\sin(x+y)-\sin(x-y)} = \frac{a+b+a-b}{a-b-a+b}$
$\frac{2\sin\left(\frac{x+y+x-y}{2}\right)\cos\left(\frac{x+y-x+y}{2}\right)}{2\cos\left(\frac{x+y+x-y}{2}\right)\sin\left(\frac{x+y-x+y}{2}\right)} = \frac{2a}{2b} = \frac{a}{b}$
$\frac{2\sin x\ \cos y}{2\cos x\ \sin y} = \frac{a}{b}$
$\Rightarrow \frac{\tan x}{\tan y} = \frac{a}{b}$

7. **(D)** $\operatorname{cosec} 10° - \sqrt{3}\sec 10°$
$= \frac{1}{\sin 10°} - \frac{\sqrt{3}}{\cos 10°}$
$= \frac{\cos 10° - \sqrt{3}\sin 10°}{\sin 10°\cos 10°}$
$= \frac{2\left(\frac{1}{2}\cos 10° - \frac{\sqrt{3}}{2}\sin 10°\right)}{\sin 10°\cos 10°}$
$= \frac{2\times 2\left(\frac{1}{2}\cos 10° - \frac{\sqrt{3}}{2}\sin 10°\right)}{2\sin 10°\cos 10°}$

$= \frac{4(\sin 30° \cos 10° - \cos 30° \sin 10°)}{2 \sin 10° \cos 10°}$

$= \frac{4\sin(30° - 10°)}{\sin 20°} = \frac{4 \sin 20°}{\sin 20°}$

$= 4$

8. **(C)** $\sin\theta + \cos\theta = m$ .....(i)

Squaring both sides

$\sin^2\theta + \cos^2\theta + 2 \sin\theta.\cos\theta = m^2$

$1 + 2 \sin\theta. \cos\theta = m^2$

$\sin\theta. \cos\theta = \frac{m^2 - 1}{2}$ .....(ii)

$\sin^3 \theta + \cos^3 \theta = n$

$(\sin\theta + \cos\theta)^3 - 3 \sin\theta. \cos\theta (\sin\theta + \cos\theta) = n$ .....(iii)

From equations (i), (ii) and (iii)

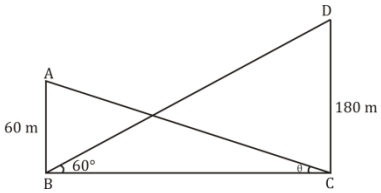
$m^3 - 3\left(\frac{m^2 - 1}{2}\right)(m) = n$

$m^3 - \left(\frac{3m^3 - 3m}{2}\right) = n$

$2m^3 - 3m^3 + 3m = 2n$

$m^3 - 3m + 2n = 0$

9.



in Δ BCD $\longrightarrow$

$\tan 60° = \frac{180}{BC}$

$BC = \frac{180}{\sqrt{3}} = 60\sqrt{3}$ m

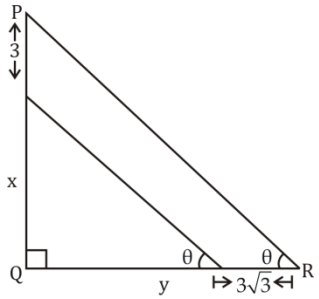
in Δ ABC $\longrightarrow$

$\tan\theta = \frac{AB}{BC} = \frac{60}{BC} = \frac{60}{60\sqrt{3}}$

$\tan\theta = \frac{1}{\sqrt{3}}$

$\theta = 30°$

10. (A)



Let, height of tower = x

Length of shadow of tower = y

Required angle = θ

$\tan\theta = \frac{x}{y} = \frac{x+3}{y+3\sqrt{3}}$

$\Rightarrow 3\sqrt{3}\, x + xy = xy + 3y$

$3\sqrt{3}\, x = 3y$

$\frac{x}{y} = \frac{3}{3\sqrt{3}}$

$\Rightarrow \tan\theta = \frac{x}{y} = \frac{1}{\sqrt{3}}$

$\Rightarrow \theta = 30°$