

**RD SHARMA**

**Solutions**

**Class 10 Maths**

**Chapter 6**

**Ex 6.2**

**Q1) If  $\cos\theta = \frac{4}{5}$ , find all other trigonometric ratios of angle  $\theta$ .**

**Solution:**

We have:

$$\begin{aligned} \sin\theta &= \sqrt{1 - \cos^2\theta} = \sqrt{1 - \left(\frac{4}{5}\right)^2} \\ &= \sqrt{1 - \frac{16}{25}} \\ &= \sqrt{\frac{25-16}{25}} \\ &= \sqrt{\frac{9}{25}} = \frac{3}{5} \end{aligned}$$

Therefore,  $\sin\theta = \frac{3}{5}$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4} \quad \sec\theta = \frac{1}{\cos\theta} = \frac{1}{\frac{4}{5}} = \frac{5}{4}$$

i.e.  $\operatorname{cosec}\theta = \frac{1}{\sin\theta} = \frac{1}{\frac{3}{5}} = \frac{5}{3}$  and  $\cot\theta = \frac{1}{\tan\theta} = \frac{1}{\frac{3}{4}} = \frac{4}{3}$

$$\operatorname{cosec}\theta = \frac{1}{\sin\theta} = \frac{1}{\frac{3}{5}} = \frac{5}{3} \quad \cot\theta = \frac{1}{\tan\theta} = \frac{1}{\frac{3}{4}} = \frac{4}{3}$$

**Q2) If  $\sin\theta = \frac{1}{\sqrt{2}}$ , find all other trigonometric ratios of angle  $\theta$ .**

**Solution:**

We have,

$$\begin{aligned} \cos\theta &= \sqrt{1 - \sin^2\theta} = \sqrt{1 - \left(\frac{1}{\sqrt{2}}\right)^2} \\ &= \sqrt{1 - \frac{1}{2}} \\ &= \sqrt{\frac{2-1}{2}} \\ &= \frac{1}{\sqrt{2}} \end{aligned}$$

$$= \tan \Theta = \frac{\sin \Theta}{\cos \Theta} = \frac{1\sqrt{2}}{1\sqrt{2}} = 1 \tan \Theta = \frac{\sin \Theta}{\cos \Theta} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}}} = 1$$

$$= \operatorname{cosec} \Theta = \frac{1}{\sin \Theta} = \frac{1}{1\sqrt{2}} = \sqrt{2} \operatorname{cosec} \Theta = \frac{1}{\sin \Theta} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$$

$$= \sec \Theta = \frac{1}{\cos \Theta} = \frac{1}{1\sqrt{2}} = \sqrt{2} \sec \Theta = \frac{1}{\cos \Theta} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$$

$$= \cot \Theta = \frac{1}{\tan \Theta} = \frac{1}{1} = 1 \cot \Theta = \frac{1}{\tan \Theta} = \frac{1}{1} = 1$$

**Q3) If  $\tan \Theta = \frac{1}{\sqrt{2}}$ , find the value of  $\frac{\operatorname{cosec}^2 \Theta - \sec^2 \Theta}{\operatorname{cosec}^2 \Theta + \cot^2 \Theta}$ .**

**Solution:**

$$\text{We know that } \sec \Theta = \sqrt{1 + \tan^2 \Theta} \sec \Theta = \sqrt{1 + \left(\frac{1}{\sqrt{2}}\right)^2}$$

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

$$= \sqrt{1 + \frac{1}{2}} = \sqrt{\frac{3}{2}}$$

$$= \cot \Theta = \frac{1}{\tan \Theta} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2} \cot \Theta = \frac{1}{\tan \Theta} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$$

$$= \operatorname{cosec} \Theta = \sqrt{1 + \cot^2 \Theta} = \sqrt{1 + 2} = \sqrt{3} \operatorname{cosec} \Theta = \sqrt{1 + \cot^2 \Theta} = \sqrt{1 + 2} = \sqrt{3}$$

Substituting it in equation (1) we get

$$= \frac{(\sqrt{3})^2 - (\sqrt{2})^2}{(\sqrt{3})^2 + (\sqrt{2})^2} = \frac{3 - 2}{3 + 2} = \frac{1}{5} = \frac{3}{10}$$

**Q4) If  $\tan \Theta = \frac{3}{4}$ , find the value of  $\frac{1 - \cos \Theta}{1 + \cos \Theta}$ .**

**Solution:**

We know that

$$\sec \Theta = \sqrt{1 + \tan^2 \Theta} \sec \Theta = \sqrt{1 + \left(\frac{3}{4}\right)^2}$$

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

$$= \sqrt{1+916} \sqrt{1 + \frac{9}{16}}$$

$$= \sqrt{16+916} \sqrt{\frac{16+9}{16}}$$

$$= \sqrt{2516} \sqrt{\frac{25}{16}}$$

$$= \sec\Theta = 54 \sec\Theta = \frac{5}{4}$$

$$= \sec\Theta = \frac{1}{\cos\Theta} = \frac{5}{4} = \frac{1}{\frac{4}{5}} = \frac{4}{5} = \cos\Theta$$

Therefore, We get  $\frac{1-\frac{4}{5}}{1+\frac{4}{5}} = \frac{\frac{1}{5}}{\frac{9}{5}} = \frac{1}{9}$

**Q5) If  $\tan\Theta = \frac{12}{5}$ , find the value of  $\frac{1+\sin\Theta}{1-\sin\Theta}$ .**

**Solution:**

$$\cot\Theta = \frac{1}{\tan\Theta} = \frac{1}{\frac{12}{5}} = \frac{5}{12}$$

$$= \operatorname{cosec}\Theta = \sqrt{1+\cot^2\Theta} = \sqrt{1+\left[\frac{5}{12}\right]^2} = \sqrt{\frac{144+25}{144}} = \sqrt{\frac{169}{144}} = \frac{13}{12}$$

$$\operatorname{cosec}\Theta = \frac{1}{\sin\Theta} = \frac{13}{12} \Rightarrow \sin\Theta = \frac{12}{13}$$

$$= \sin\Theta = \frac{12}{13}$$

i.e. We get  $\frac{1+\frac{12}{13}}{1-\frac{12}{13}} = \frac{\frac{25}{13}}{\frac{1}{13}} = 25$

**Q6) If  $\cot\Theta = \frac{1}{\sqrt{3}}$ , find the value of  $\frac{1-\cos^2\Theta}{2-\sin^2\Theta}$ .**

**Solution:**

$$\operatorname{cosec}\Theta = \sqrt{1+\cot^2\Theta} = \sqrt{1+\frac{1}{3}} = \sqrt{\frac{4}{3}} = \frac{2}{\sqrt{3}}$$

$$= \operatorname{cosec}\Theta = \frac{2}{\sqrt{3}}$$

$$= \sin \Theta = \frac{1}{\operatorname{cosec} \Theta} = \frac{1}{2\sqrt{3}} = \frac{\sqrt{3}}{6} \sin \Theta = \frac{1}{\operatorname{cosec} \Theta} = \frac{1}{\frac{2}{\sqrt{3}}} = \frac{\sqrt{3}}{2}$$

$$\text{and } \frac{1}{\cot \Theta} = \frac{\sin \Theta}{\cos \Theta} = \cos \Theta = \sin \Theta \times \cot \Theta = \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{3}} = \frac{1}{2}$$

Therefore, on substituting we get

$$= 1 - (12)^2 - (\sqrt{32})^2 = 1 - 142 - 34 = 34 \cdot 54 = 35 \frac{1 - (\frac{1}{2})^2}{2 - (\frac{\sqrt{3}}{2})^2} = \frac{1 - \frac{1}{4}}{2 - \frac{3}{4}} = \frac{\frac{3}{4}}{\frac{5}{4}} = \frac{3}{5} .$$

**Q7) If  $\operatorname{cosec} A = \sqrt{2}$ , find the value of  $\frac{2\sin^2 A + 3\cot^2 A}{4(\tan^2 A - \cos^2 A)}$ .**

**Solution:**

$$\text{We know that } \cot A = \frac{1}{\tan A} = \frac{1}{\frac{1}{\cot A}} = \cot A = \sqrt{\operatorname{cosec}^2 A - 1}$$

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

$$\tan A = \frac{1}{\cot A} = \frac{1}{1} = 1$$

$$\sin A = \frac{1}{\operatorname{cosec} A} = \frac{1}{\sqrt{2}}$$

$$\cos A = \frac{1}{\sec A} = \frac{1}{\sqrt{2}}$$

$$\cos A = \sqrt{1 - \sin^2 A} = \sqrt{1 - (\frac{1}{\sqrt{2}})^2} = \sqrt{1 - \frac{1}{2}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

On substituting we get:

$$= \frac{2[\frac{1}{\sqrt{2}}]^2 + 3[1]^2}{4[1] - [\frac{1}{\sqrt{2}}]^2} = \frac{2 \times \frac{1}{2} + 3}{4[1] - [\frac{1}{2}]} = \frac{2 \times \frac{1}{2} + 3}{4[1 - \frac{1}{2}]}$$

$$\Rightarrow 1 + 3 = 4 \Rightarrow \frac{4}{4 \times \frac{1}{2}} = \frac{4}{2} = 2$$

**Q8) If  $\cot \Theta = \sqrt{3}$ , find the value of  $\frac{\operatorname{cosec}^2 \Theta + \cot^2 \Theta}{\operatorname{cosec}^2 \Theta - \sec^2 \Theta}$ .**

**Solution:**

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$$\operatorname{cosec}\Theta = \sqrt{1 + \cot^2\Theta} = \sqrt{1 + (\sqrt{3})^2} = \sqrt{1+3} = 2$$

$$\operatorname{cosec}\Theta = \sqrt{1 + \cot^2\Theta} = \sqrt{1 + (\sqrt{3})^2} = \sqrt{1+3} = 2$$

$$\sin\Theta = \frac{1}{\operatorname{cosec}\Theta} = \frac{1}{2} \quad \cot\Theta = \frac{\cos\Theta}{\sin\Theta} \quad \cos\Theta = \cot\Theta \cdot \sin\Theta$$

$$\sin\Theta = \frac{1}{\operatorname{cosec}\Theta} = \frac{1}{2} \quad \cot\Theta = \frac{\cos\Theta}{\sin\Theta} \quad \cos\Theta = \cot\Theta \cdot \sin\Theta \Rightarrow \cos\Theta = \sqrt{3} \cdot \frac{1}{2} \Rightarrow \cos\Theta = \frac{\sqrt{3}}{2}$$

$$\sec\Theta = \frac{1}{\cos\Theta} = \frac{2}{\sqrt{3}}$$

On substituting we get:

$$(2)^2 + (\sqrt{3})^2 (2)^2 - (2\sqrt{3})^2 = 4 + 3 \cdot 12 - 43 = 7 \quad \frac{(2)^2 + (\sqrt{3})^2}{(2)^2 - (\frac{2}{\sqrt{3}})^2} = \frac{4+3}{\frac{12-4}{3}} = \frac{7}{\frac{8}{3}}$$

$$= 21 \cdot \frac{3}{8} = \frac{63}{8}$$

**Q9) If  $3\cos\Theta = 1$ , find the value of  $\frac{6\sin^2\Theta + \tan^2\Theta}{4\cos\Theta}$ .**

**Solution:**

$$\cos\Theta = \frac{1}{3}, \quad \sin\Theta = \sqrt{1 - \cos^2\Theta} = \sqrt{1 - \frac{1}{9}}, \quad \sin\Theta = \sqrt{1 - \cos^2\Theta}$$

$$= \sqrt{1 - \frac{1}{9}} = \sqrt{\frac{8}{9}} = \frac{2\sqrt{2}}{3}$$

$$\tan\Theta = \frac{\sin\Theta}{\cos\Theta} = \frac{\frac{2\sqrt{2}}{3}}{\frac{1}{3}} = 2\sqrt{2}$$

On substituting we get

$$6\left[\frac{2\sqrt{2}}{3}\right]^2 + (2\sqrt{2})^2 \cdot \frac{1}{3} = \frac{16}{3} + 8 = \frac{16+24}{3} = \frac{40}{3}$$

$$= \frac{40}{3} \cdot \frac{3}{4} = 10$$

**Q10) If  $\sqrt{3}\tan\Theta = \sin\Theta$ , find the value of  $\frac{\sin^2\Theta - \cos^2\Theta}{\sin^2\Theta - \cos^2\Theta}$ .**

**Solution:**

$$\sqrt{3}\sin\Theta\cos\Theta = \sin\Theta \cdot \sqrt{3} \frac{\sin\Theta}{\cos\Theta} = \sin\Theta$$

$$= \cos\Theta = \sqrt{3} \Rightarrow 1\sqrt{3}\cos\Theta = \frac{\sqrt{3}}{3} \Rightarrow \frac{1}{\sqrt{3}}$$

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

$$= \sin^2\Theta - \cos^2\Theta = \left(\frac{2}{3}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2 = \frac{4}{9} - \frac{1}{3}$$

$$= \frac{4}{9} - \frac{3}{9} = \frac{1}{9}$$

**Q11) If  $\operatorname{cosec}\Theta = \frac{13}{12}$ , find the value of  $\frac{2\sin\Theta - 3\cos\Theta}{4\sin\Theta - 9\cos\Theta}$ .**

**Solution:**

$$\sin\Theta = \frac{1}{\operatorname{cosec}\Theta} = \frac{1}{\frac{13}{12}} = \frac{12}{13}$$

$$= \cos\Theta = \sqrt{1 - \sin^2\Theta} = \sqrt{1 - \left(\frac{12}{13}\right)^2} = \sqrt{1 - \frac{144}{169}} = \sqrt{\frac{25}{169}} = \frac{5}{13}$$

$$= \frac{2 \cdot \frac{12}{13} - 3 \cdot \frac{5}{13}}{4 \cdot \frac{12}{13} - 9 \cdot \frac{5}{13}} = \frac{\frac{24}{13} - \frac{15}{13}}{\frac{48}{13} - \frac{45}{13}} = \frac{\frac{9}{13}}{\frac{3}{13}} = 3$$

**Q12) If  $\sin\Theta + \cos\Theta = \sqrt{2}\cos(90^\circ - \Theta)$ , find  $\cot\Theta$ .**

**Solution:**

$$\sin\Theta + \cos\Theta = \sqrt{2}\sin\Theta \quad [\cos(90^\circ - \Theta) = \sin\Theta]$$

$$\sin\Theta + \cos\Theta = \sqrt{2}\sin\Theta \quad [\cos(90^\circ - \Theta) = \sin\Theta]$$

$$\Rightarrow \cos\Theta = \sqrt{2}\sin\Theta - \sin\Theta$$

$$\Rightarrow \cos\Theta = \sqrt{2}\sin\Theta - \sin\Theta \Rightarrow \cos\Theta = \sin\Theta(\sqrt{2} - 1) \Rightarrow \cot\Theta = \sqrt{2} - 1$$

Divide both sides with  $\sin\Theta$  we get

$$= \frac{\cos\Theta}{\sin\Theta} = \frac{\sin\Theta(\sqrt{2} - 1)}{\sin\Theta} = \sqrt{2} - 1$$

$$= \cot\Theta = \sqrt{2} - 1$$

**Q-13. If  $2\sin^2\Theta - \cos^2\Theta = 2$ , then find the value of  $\Theta$ .**

**Solution.**

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

$$\Rightarrow 2\sin^2\Theta - (1 - \sin^2\Theta) = 2 \Rightarrow 2\sin^2\Theta - 1 + \sin^2\Theta = 2$$

$$\Rightarrow 2\sin^2\Theta - 1 + \sin^2\Theta = 2 \Rightarrow 3\sin^2\Theta = 3 \Rightarrow 3\sin^2\Theta = 3 \Rightarrow \sin^2\Theta = 1 \Rightarrow \sin\Theta = 1$$

$$\Rightarrow \sin\Theta = 1 \Rightarrow \sin\Theta = \sin 90^\circ \Rightarrow \sin\Theta = \sin 90^\circ \Rightarrow \Theta = 90^\circ \Rightarrow \Theta = 90^\circ$$

**Q-14. If  $\sqrt{3}\tan\Theta - 1 = 0$ , find the value of  $\sin^2\Theta - \cos^2\Theta$ .**

**Solution.**

$$\sqrt{3}\tan\Theta - 1 = 0 \Rightarrow \sqrt{3}\tan\Theta = 1 \Rightarrow \tan\Theta = \frac{1}{\sqrt{3}} \Rightarrow \Theta = 30^\circ$$

$$\Rightarrow \sqrt{3}\tan\Theta = \frac{1}{\sqrt{3}} \Rightarrow \tan\Theta = \frac{1}{3} \Rightarrow \Theta = 30^\circ$$

Now,

$$\sin^2\Theta - \cos^2\Theta$$

$$= \sin^2(30^\circ) - \cos^2(30^\circ)$$

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

$$= \frac{1}{4} - \frac{3}{4} = -\frac{2}{4} = -\frac{1}{2}$$