

Section 1: Trigonometric functions and identities

Solutions to Exercise level 1

$$1. \text{ (i) } \sec 30^\circ = \frac{1}{\cos 30^\circ} = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}}$$

$$\text{(ii) } \cot 60^\circ = \frac{1}{\tan 60^\circ} = \frac{1}{\sqrt{3}}$$

$$\text{(iii) } \operatorname{cosec} 45^\circ = \frac{1}{\sin 45^\circ} = \frac{1}{1/\sqrt{2}} = \sqrt{2}$$

$$\text{(iv) } \cot 135^\circ = \frac{1}{\tan 135^\circ} = -\frac{1}{\tan 45^\circ} = -1$$

$$\text{(v) } \operatorname{cosec} 150^\circ = \frac{1}{\sin 150^\circ} = \frac{1}{\sin 30^\circ} = \frac{1}{1/2} = 2$$

$$\text{(vi) } \sec 240^\circ = \frac{1}{\cos 240^\circ} = -\frac{1}{\cos 60^\circ} = -\frac{1}{1/2} = -2$$

$$\text{(vii) } \operatorname{cosec} \frac{4\pi}{3} = \frac{1}{\sin \frac{4\pi}{3}} = -\frac{1}{\sin \frac{\pi}{3}} = -\frac{1}{\sqrt{3}/2} = -\frac{2}{\sqrt{3}}$$

$$\text{(viii) } \sec \frac{7\pi}{4} = \frac{1}{\cos \frac{7\pi}{4}} = \frac{1}{\cos \frac{\pi}{4}} = \frac{1}{1/\sqrt{2}} = \sqrt{2}$$

$$\text{(ix) } \cot \frac{5\pi}{6} = \frac{1}{\tan \frac{5\pi}{6}} = -\frac{1}{\tan \frac{\pi}{6}} = -\frac{1}{1/\sqrt{3}} = -\sqrt{3}$$

$$2. \sec^2 x = 1 + \tan^2 x$$

$$= 1 + \left(\frac{12}{5}\right)^2$$

$$= 1 + \frac{144}{25}$$

$$= \frac{149}{25}$$

$$\sec x = \pm \frac{13}{5}$$

Since $0 \leq x \leq \frac{\pi}{2}$, $\sec x > 0$ so $\sec x = \frac{13}{5}$.

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3. $\sin x = \frac{3}{5} \Rightarrow \operatorname{cosec} x = \frac{5}{3}$

$$\operatorname{cosec}^2 x = 1 + \cot^2 x$$

$$\frac{25}{9} = 1 + \cot^2 x$$

$$\cot^2 x = \frac{16}{9}$$

$$\cot x = \pm \frac{4}{3}$$

Since $\frac{\pi}{2} \leq x \leq \pi$, $\cot x < 0$

$$\text{so } \cot x = -\frac{4}{3}$$

4. (i) $\sec \theta = 1$

$$\frac{1}{\cos \theta} = 1$$

$$\cos \theta = 1$$

$$\theta = 0^\circ \text{ or } 360^\circ$$

(ii) $\cot \theta = -0.7$

$$\frac{1}{\tan \theta} = -0.7$$

$$\tan \theta = -\frac{10}{7}$$

$$\theta = 125^\circ \text{ or } 305^\circ \text{ (to nearest degree)}$$

tan is negative
in the 2nd and
4th quadrants

(iii) $\operatorname{cosec} \theta = 5$

$$\frac{1}{\sin \theta} = 5$$

$$\sin \theta = 0.2$$

$$\theta = 11.5^\circ \text{ or } 168.5^\circ \text{ (1 d.p.)}$$

sin is positive
in the 1st and
2nd quadrants

(iv) $\cot \theta = 1$

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

$$\tan \theta = 1$$

$$\theta = 45^\circ \text{ or } 225^\circ$$

tan is positive
in the 1st and
3rd quadrants

5. (i) $\cot x = \sqrt{3}$

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

$$x = \frac{\pi}{6} \text{ or } \frac{7\pi}{6}$$

tan is positive
in the 1st and
3rd quadrants

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(ii) $\sec x = \sqrt{2}$

$$\cos x = \frac{1}{\sqrt{2}}$$

$$x = \frac{\pi}{4} \text{ or } \frac{7\pi}{4}$$

cos is positive
in the 1st and
4th quadrants

(iii) $\operatorname{cosec} \theta = -2$

$$\sin x = -\frac{1}{2}$$

$$x = \frac{7\pi}{6} \text{ or } \frac{11\pi}{6}$$

sin is negative
in the 3rd and
4th quadrants