Section 1: Trigonometric functions and identities

Section test

1. The value of $\cot 210°$ is

(a) $-\sqrt{3}$ (b) $\sqrt{3}$

(c) $\frac{1}{\sqrt{3}}$ (d) $-\frac{1}{\sqrt{3}}$

2. The value of $\sec(-390°)$ is

(a) $-\frac{2}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}}$

(c) 2 (d) -2

3. The value of $\operatorname{cosec}\frac{17\pi}{6}$ is

(a) 2 (b) -2

(c) $\frac{2}{\sqrt{3}}$ (d) $-\frac{2}{\sqrt{3}}$

4. The value of sec x is 3, and $\pi < x < 2\pi$.
The value of tan x is

(a) $-\sqrt{10}$ (b) $\sqrt{8}$

(c) $-\sqrt{8}$ (d) $\sqrt{10}$

5. The value of cot x is -2, and $0° < x < 180°$.
The value of sin x is

(a) $-\frac{1}{\sqrt{5}}$ (b) $\frac{1}{\sqrt{5}}$

(c) $\frac{1}{\sqrt{3}}$ (d) $-\frac{1}{\sqrt{3}}$

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6. Solve the equation $\cot\theta = 2$ for $0° \le \theta \le 360°$.

7. Solve the equation $\sec x = -2$ for $-\pi \le x \le \pi$. Give your answers in terms of π.

8. Solve the equation $2\sec^2\theta + \tan\theta = 8$ for $0° \le \theta \le 180°$.

9. Find the exact value of $\arccos\left(-\frac{1}{2}\right) + \arctan(-1)$.

10. The exact value of $\cot\left(\arcsin\left(-\frac{\sqrt{3}}{2}\right)\right)$ is

(a) $\sqrt{3}$

(b) $\frac{1}{\sqrt{3}}$

(c) $-\sqrt{3}$

(d) $-\frac{1}{\sqrt{3}}$

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Solutions to section test

1. 210° is in the third quadrant.

$$\cot 210° = \frac{1}{\tan 210°} = \frac{1}{\tan(180° + 30°)} = \frac{1}{\tan 30°} = \frac{1}{1/\sqrt{3}} = \sqrt{3}$$

2. $$\sec(-390°) = \frac{1}{\cos(-390°)} = \frac{1}{\cos(-30°)} = \frac{1}{\cos 30°} = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}}$$

3. $$\operatorname{cosec} \frac{17\pi}{6} = \operatorname{cosec} \frac{5\pi}{6} = \frac{1}{\sin \frac{5\pi}{6}} = \frac{1}{\frac{1}{2}} = 2$$

4. Since sec x is positive, then cos x is positive, and since $\pi < x < 2\pi$, then x lies in the fourth quadrant.

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

$$3^2 = 1 + \tan^2 x$$

$$8 = \tan^2 x$$

$$\tan x = \pm\sqrt{8}$$

In the fourth quadrant, tan x is negative, so $\tan x = -\sqrt{8}$.

5. Since cot x is negative, then tan x is negative, and since $0° < x < 180°$, then x lies in the second quadrant.

$$\operatorname{cosec}^2 x = 1 + \cot^2 x = 1 + (-2)^2 = 5$$

$$\operatorname{cosec} x = \pm\sqrt{5}$$

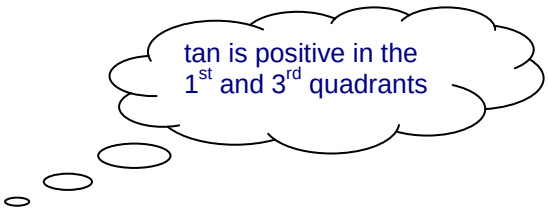
$$\sin x = \pm\frac{1}{\sqrt{5}}$$

Since x is in the second quadrant, $\sin x = \frac{1}{\sqrt{5}}$

6. $\cot\theta = 2$

$\tan x = \frac{1}{2}$

$x = 26.6°$ or $206.6°$



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7. $\sec x = -2$

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

$x = -\frac{2\pi}{3}$ or $\frac{2\pi}{3}$

cos is negative in the 2nd and 3rd quadrants

8. $2\sec^2\theta + \tan\theta = 8$

$2(1 + \tan^2\theta) + \tan\theta = 8$

$2 + 2\tan^2\theta + \tan\theta = 8$

$2\tan^2\theta + \tan\theta - 6 = 0$

$(2\tan\theta - 3)(\tan\theta + 2) = 0$

$\tan\theta = \frac{3}{2}$ or -2

$\tan\theta = \frac{3}{2} \Rightarrow \theta = 56.3°$

$\tan\theta = -2 \Rightarrow \theta = 116.6°$

The solutions are $\theta = 56.3°$ or $116.6°$

9. arccos x lies in the range $0 \le x \le \pi$, so $\arccos\left(-\frac{1}{2}\right) = \frac{2\pi}{3}$

arctan x lies in the range $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$, so $\arctan(-1) = -\frac{\pi}{4}$

$$\arccos\left(-\tfrac{1}{2}\right) + \arctan(-1) = \frac{2\pi}{3} - \frac{\pi}{4} = \frac{5\pi}{12}$$

10. arcsin x lies in the range $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$, so $\arcsin\left(-\frac{\sqrt{3}}{2}\right) = -\frac{\pi}{3}$

$$\cot\left(\arcsin\left(-\frac{\sqrt{3}}{2}\right)\right) = \cot\left(-\frac{\pi}{3}\right) = \frac{1}{\tan\left(-\frac{\pi}{3}\right)} = \frac{1}{-\sqrt{3}} = -\frac{1}{\sqrt{3}}$$