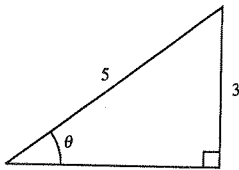


—CONTINUED—

- You should know that two acute angles α and β are complementary if $\alpha + \beta = 90^\circ$, and cofunctions of complementary angles are equal.
- You should know the trigonometric function values of 30° , 45° , and 60° , or be able to construct triangles from which you can determine them.

Solutions to Odd-Numbered Exercises

1.



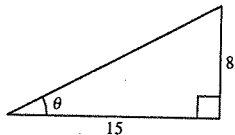
$$\text{adj} = \sqrt{5^2 - 3^2} = \sqrt{16} = 4$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{3}{5} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{5}{3}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{4}{5} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{5}{4}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{3}{4} \quad \cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{4}{3}$$

3.



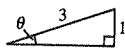
$$\text{hyp} = \sqrt{8^2 + 15^2} = 17$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{8}{17} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{17}{8}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{15}{17} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{17}{15}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{8}{15} \quad \cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{15}{8}$$

5.

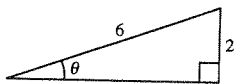


$$\text{adj} = \sqrt{3^2 - 1^2} = \sqrt{8} = 2\sqrt{2}$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{1}{3} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}} = 3$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{2\sqrt{2}}{3} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{3}{2\sqrt{2}} = \frac{3\sqrt{2}}{4}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{1}{2\sqrt{2}} = \frac{\sqrt{2}}{4} \quad \cot \theta = \frac{\text{adj}}{\text{opp}} = 2\sqrt{2}$$



$$\text{adj} = \sqrt{6^2 - 2^2} = \sqrt{32} = 4\sqrt{2}$$

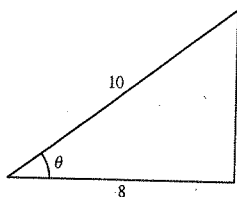
$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{2}{6} = \frac{1}{3} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{6}{2} = 3$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{4\sqrt{2}}{6} = \frac{2\sqrt{2}}{3} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{6}{4\sqrt{2}} = \frac{3}{2\sqrt{2}} = \frac{3\sqrt{2}}{4}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{2}{4\sqrt{2}} = \frac{1}{2\sqrt{2}} = \frac{\sqrt{2}}{4} \quad \cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$$

The function values are the same since the triangles are similar and the corresponding sides are proportional.

7.



$$\text{opp} = \sqrt{10^2 - 8^2} = 6$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{6}{10} = \frac{3}{5}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{8}{10} = \frac{4}{5}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{6}{8} = \frac{3}{4}$$

$$\csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{10}{6} = \frac{5}{3}$$

$$\sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{10}{8} = \frac{5}{4}$$

$$\cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{8}{6} = \frac{4}{3}$$



$$\text{opp} = \sqrt{2.5^2 - 2^2} = 1.5$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{1.5}{2.5} = \frac{3}{5}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{2}{2.5} = \frac{4}{5}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{1.5}{2} = \frac{3}{4}$$

$$\csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{2.5}{1.5} = \frac{5}{3}$$

$$\sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{2.5}{2} = \frac{5}{4}$$

$$\cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{2}{1.5} = \frac{4}{3}$$

The function values are the same since the triangles are similar and the corresponding sides are proportional.

9. Given: $\sin \theta = \frac{2}{3}$

$$2^2 + (\text{adj})^2 = 3^2$$

$$\text{adj} = \sqrt{5}$$

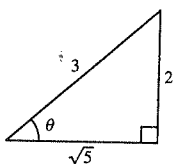
$$\cos \theta = \frac{\sqrt{5}}{3}$$

$$\sec \theta = \frac{3}{\sqrt{5}} = \frac{3\sqrt{5}}{5}$$

$$\tan \theta = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

$$\cot \theta = \frac{\sqrt{5}}{2}$$

$$\csc \theta = \frac{3}{2}$$



11. Given: $\sec \theta = 4 = \frac{4}{1} = \frac{\text{hyp}}{\text{adj}}$

$$(\text{opp})^2 + 1^2 = 4^2$$

$$\text{opp} = \sqrt{15}$$

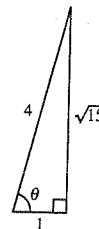
$$\sin \theta = \frac{\sqrt{15}}{4}$$

$$\cos \theta = \frac{1}{4}$$

$$\tan \theta = \sqrt{15}$$

$$\cot \theta = \frac{1}{\sqrt{15}} = \frac{\sqrt{15}}{15}$$

$$\csc \theta = \frac{4}{\sqrt{15}} = \frac{4\sqrt{15}}{15}$$



13. Given: $\tan \theta = 3 = \frac{3}{1} = \frac{\text{opp}}{\text{adj}}$

$$3^2 + 1^2 = (\text{hyp})^2$$

$$\text{hyp} = \sqrt{10}$$

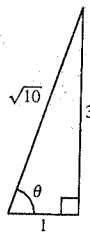
$$\sin \theta = \frac{3\sqrt{10}}{10}$$

$$\cos \theta = \frac{\sqrt{10}}{10}$$

$$\cot \theta = \frac{1}{3}$$

$$\sec \theta = \sqrt{10}$$

$$\csc \theta = \frac{\sqrt{10}}{3}$$



15. Given: $\cot \theta = \frac{9}{4} = \frac{\text{adj}}{\text{hyp}}$

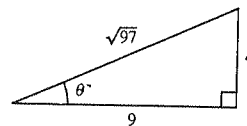
$$4^2 + 9^2 = (\text{hyp})^2$$

$$\text{hyp} = \sqrt{97}$$

$$\sin \theta = \frac{4}{\sqrt{97}} = \frac{4\sqrt{97}}{97}$$

$$\cos \theta = \frac{9}{\sqrt{97}} = \frac{9\sqrt{97}}{97}$$

$$\tan \theta = \frac{4}{9}$$



$$\sec \theta = \frac{\sqrt{97}}{9}$$

$$\csc \theta = \frac{\sqrt{97}}{4}$$

Function	θ (deg)	θ (rad)	Function Value
17. sin	30°	$\frac{\pi}{6}$	$\frac{1}{2}$
19. tan	60°	$\frac{\pi}{3}$	$\sqrt{3}$
21. cot	60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{3}$
23. cos	30°	$\frac{\pi}{6}$	$\frac{\sqrt{3}}{2}$
25. cot	45°	$\frac{\pi}{4}$	1

$$27. \sin 60^\circ = \frac{\sqrt{3}}{2}, \cos 60^\circ = \frac{1}{2}$$

$$(a) \tan 60^\circ = \frac{\sin 60^\circ}{\cos 60^\circ} = \sqrt{3}$$

$$(c) \cos 30^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$(b) \sin 30^\circ = \cos 60^\circ = \frac{1}{2}$$

$$(d) \cot 60^\circ = \frac{\cos 60^\circ}{\sin 60^\circ} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$29. \csc \theta = 3, \sec \theta = \frac{3\sqrt{2}}{4}$$

$$(a) \sin \theta = \frac{1}{\csc \theta} = \frac{1}{3}$$

$$(c) \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{1/3}{(2\sqrt{2})/3} = \frac{\sqrt{2}}{4}$$

$$(b) \cos \theta = \frac{1}{\sec \theta} = \frac{2\sqrt{2}}{3}$$

$$(d) \sec(90^\circ - \theta) = \csc \theta = 3$$

$$31. \cos \alpha = \frac{1}{4}$$

$$(a) \sec \alpha = \frac{1}{\cos \alpha} = 4$$

$$(c) \cot \alpha = \frac{\cos \alpha}{\sin \alpha} \\ = \pm \frac{1/4}{\sqrt{15}/4} \\ = \pm \frac{1}{\sqrt{15}} \\ = \pm \frac{\sqrt{15}}{15}$$

$$(b) \sin^2 \alpha + \cos^2 \alpha = 1$$

$$\sin^2 \alpha + \left(\frac{1}{4}\right)^2 = 1$$

$$\sin^2 \alpha = \frac{15}{16}$$

$$\sin \alpha = \pm \frac{\sqrt{15}}{4}$$

$$(d) \sin(90^\circ - \alpha) = \cos \alpha = \frac{1}{4}$$

$$33. \tan \theta \cot \theta = \tan \theta \left(\frac{1}{\tan \theta}\right) = 1$$

$$35. \tan \theta \cos \theta = \left(\frac{\sin \theta}{\cos \theta}\right) \cos \theta = \sin \theta$$