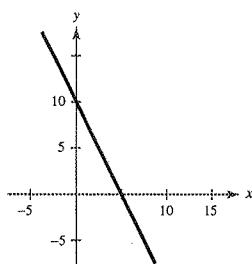


74. $2x + y = 10$

$$y = -2x + 10$$

$$x\text{-intercept: } (5, 0)$$

$$y\text{-intercept: } (0, 10)$$



76. $12x - 7y = 22$

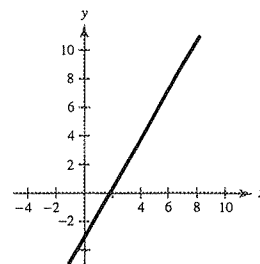
$$y = \frac{12}{7}x - \frac{22}{7}$$

$$x\text{-intercept:}$$

$$12x = 22 \Rightarrow \left(\frac{11}{6}, 0\right)$$

$$y\text{-intercept:}$$

$$-7y = 22 \Rightarrow \left(0, -\frac{22}{7}\right)$$



78. $4^{2\pi} \approx 6065.331$

80. $\sqrt[5]{10,321} \approx 6.350$

Section 5.3 Trigonometric Functions of Any Angle

Solutions to Even-Numbered Exercises

2. (a) $x = 12, y = -5$

$$r = \sqrt{12^2 + (-5)^2} = 13$$

$$\sin \theta = \frac{y}{r} = \frac{-5}{13} = -\frac{5}{13}$$

$$\cos \theta = \frac{x}{r} = \frac{12}{13}$$

$$\tan \theta = \frac{y}{x} = \frac{-5}{12} = -\frac{5}{12}$$

$$\csc \theta = \frac{r}{y} = \frac{13}{-5} = -\frac{13}{5}$$

$$\sec \theta = \frac{r}{x} = \frac{13}{12}$$

$$\cot \theta = \frac{x}{y} = \frac{12}{-5} = -\frac{12}{5}$$

(b) $x = -1, y = 1$

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

$$\sin \theta = \frac{y}{r} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\cos \theta = \frac{x}{r} = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

$$\tan \theta = \frac{y}{x} = \frac{1}{-1} = -1$$

$$\csc \theta = \frac{r}{y} = \frac{\sqrt{2}}{1} = \sqrt{2}$$

$$\sec \theta = \frac{r}{x} = \frac{\sqrt{2}}{-1} = -\sqrt{2}$$

$$\cot \theta = \frac{x}{y} = \frac{-1}{1} = -1$$

4. (a) $x = 2, y = 1$

$$r = \sqrt{2^2 + 1^2} = \sqrt{5}$$

$$\sin \theta = \frac{y}{r} = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5}$$

$$\cos \theta = \frac{x}{r} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

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

$$\csc \theta = \frac{r}{y} = \sqrt{5}$$

$$\sec \theta = \frac{r}{x} = \frac{\sqrt{5}}{2}$$

$$\cot \theta = \frac{x}{y} = 2$$

(b) $x = 2, y = -4$

$$r = \sqrt{2^2 + (-4)^2} = 2\sqrt{5}$$

$$\sin \theta = \frac{y}{r} = \frac{-4}{2\sqrt{5}} = -\frac{2\sqrt{5}}{5}$$

$$\cos \theta = \frac{x}{r} = \frac{2}{2\sqrt{5}} = \frac{\sqrt{5}}{5}$$

$$\tan \theta = \frac{y}{x} = \frac{-4}{2} = -2$$

$$\csc \theta = \frac{r}{y} = \frac{2\sqrt{5}}{-4} = -\frac{\sqrt{5}}{2}$$

$$\sec \theta = \frac{r}{x} = \frac{2\sqrt{5}}{2} = \sqrt{5}$$

$$\cot \theta = \frac{x}{y} = \frac{2}{-4} = -\frac{1}{2}$$

$$6. x = 8, y = 15, r = \sqrt{8^2 + 15^2} = 17$$

$$\sin \theta = \frac{y}{r} = \frac{15}{17}$$

$$\cos \theta = \frac{x}{r} = \frac{8}{17}$$

$$\tan \theta = \frac{y}{x} = \frac{15}{8}$$

$$\csc \theta = \frac{r}{y} = \frac{17}{15}$$

$$\sec \theta = \frac{r}{x} = \frac{17}{8}$$

$$\cot \theta = \frac{x}{y} = \frac{8}{15}$$

$$10. x = -5, y = -2, r = \sqrt{(-5)^2 + (-2)^2} = \sqrt{29}$$

$$\sin \theta = \frac{y}{r} = \frac{-2}{\sqrt{29}} = \frac{-2\sqrt{29}}{29}$$

$$\cos \theta = \frac{x}{r} = \frac{-5}{\sqrt{29}} = \frac{-5\sqrt{29}}{29}$$

$$\tan \theta = \frac{y}{x} = \frac{2}{5}$$

$$\csc \theta = \frac{r}{y} = -\frac{\sqrt{29}}{2}$$

$$\sec \theta = \frac{r}{x} = -\frac{\sqrt{29}}{5}$$

$$\cot \theta = \frac{x}{y} = \frac{5}{2}$$

$$14. \sin \theta > 0 \text{ and } \cos \theta > 0$$

$$\frac{y}{r} > 0 \text{ and } \frac{x}{r} > 0$$

Quadrant I

$$18. \cos \theta = \frac{x}{r} = \frac{-4}{5} \Rightarrow y = |3|$$

$$\theta \text{ in Quadrant III} \Rightarrow y = -3$$

$$\sin \theta = \frac{y}{r} = -\frac{3}{5} \quad \csc \theta = -\frac{5}{3}$$

$$\cos \theta = \frac{x}{r} = -\frac{4}{5} \quad \sec \theta = -\frac{5}{4}$$

$$\tan \theta = \frac{y}{x} = \frac{3}{4} \quad \cot \theta = \frac{4}{3}$$

$$8. x = -24, y = 10, r = \sqrt{(-24)^2 + (10)^2} = 26$$

$$\sin \theta = \frac{y}{r} = \frac{10}{26} = \frac{5}{13}$$

$$\cos \theta = \frac{x}{r} = \frac{-24}{26} = -\frac{12}{13}$$

$$\tan \theta = \frac{y}{x} = \frac{10}{-24} = -\frac{5}{12}$$

$$\csc \theta = \frac{r}{y} = \frac{13}{5}$$

$$\sec \theta = \frac{r}{x} = -\frac{13}{12}$$

$$\cot \theta = \frac{x}{y} = -\frac{12}{5}$$

$$12. x = 6, y = -14,$$

$$r = \sqrt{6^2 + (-14)^2} = \sqrt{232} = 2\sqrt{58}$$

$$\sin \theta = \frac{y}{r} = \frac{-14}{2\sqrt{58}} = \frac{-7}{\sqrt{58}} = \frac{-7\sqrt{58}}{58}$$

$$\cos \theta = \frac{x}{r} = \frac{6}{2\sqrt{58}} = \frac{3}{\sqrt{58}} = \frac{3\sqrt{58}}{58}$$

$$\tan \theta = \frac{y}{x} = \frac{-14}{6} = -\frac{7}{3}$$

$$\csc \theta = \frac{r}{y} = -\frac{\sqrt{58}}{7}$$

$$\sec \theta = \frac{r}{x} = \frac{\sqrt{58}}{3}$$

$$\cot \theta = \frac{x}{y} = \frac{-3}{7}$$

$$16. \tan \theta > 0 \text{ and } \csc \theta < 0$$

$$\frac{y}{x} > 0 \text{ and } \frac{r}{y} < 0$$

Quadrant III

$$20. \csc \theta = \frac{r}{y} = \frac{4}{1} \Rightarrow x = \pm\sqrt{15}$$

$$\cot \theta < 0 \Rightarrow x = -\sqrt{15}$$

$$\sin \theta = \frac{y}{r} = \frac{1}{4} \quad \csc \theta = 4$$

$$\cos \theta = \frac{x}{r} = -\frac{\sqrt{15}}{4} \quad \sec \theta = -\frac{4\sqrt{15}}{15}$$

$$\tan \theta = \frac{y}{x} = -\frac{\sqrt{15}}{15} \quad \cot \theta = -\sqrt{15}$$

$$22. \sin \theta = 0 \text{ and } \sec \theta = \frac{1}{\cos \theta} = -1 \Rightarrow \theta = \pi + n\pi$$

$$\sin \theta = 0$$

$$\cos \theta = -1$$

$$\tan \theta = 0$$

$$\csc \theta \text{ undefined}$$

$$\sec \theta = -1$$

$$\cot \theta \text{ undefined}$$

$$24. \tan \theta \text{ undefined and } \pi \leq \theta \leq 2\pi \Rightarrow \theta = \frac{3\pi}{2}$$

$$\sin \theta = -1$$

$$\cos \theta = 0$$

$$\tan \theta \text{ undefined}$$

$$\csc \theta = -1$$

$$\sec \theta \text{ undefined}$$

$$\cot \theta = 0$$

$$26. \left(-x, -\frac{1}{3}x\right) \text{ Quadrant III, } x > 0$$

$$r = \sqrt{x^2 + \frac{1}{9}x^2} = \frac{\sqrt{10}x}{3}$$

$$\sin \theta = \frac{y}{r} = \frac{(-x/3)}{(\sqrt{10}x)/3} = -\frac{\sqrt{10}}{10}$$

$$\cos \theta = \frac{x}{r} = \frac{-x}{(\sqrt{10}x)/3} = -\frac{3\sqrt{10}}{10}$$

$$\tan \theta = \frac{y}{x} = \frac{(-1/3)x}{-x} = \frac{1}{3}$$

$$\csc \theta = \frac{r}{y} = \frac{(\sqrt{10}x)/3}{(-1/3)x} = -\sqrt{10}$$

$$\sec \theta = \frac{r}{x} = \frac{(\sqrt{10}x)/3}{-x} = -\frac{\sqrt{10}}{3}$$

$$\cot \theta = \frac{x}{y} = \frac{-x}{(-1/3)x} = 3$$

$$28. 4x + 3y = 0 \Rightarrow y = -\frac{4}{3}x$$

$$\left(x, -\frac{4}{3}x\right) \text{ Quadrant IV, } x > 0$$

$$r = \sqrt{x^2 + \frac{16}{9}x^2} = \frac{5}{3}x$$

$$\sin \theta = \frac{y}{r} = \frac{(-4/3)x}{(5/3)x} = -\frac{4}{5}$$

$$\cos \theta = \frac{x}{r} = \frac{x}{(5/3)x} = \frac{3}{5}$$

$$\tan \theta = \frac{y}{x} = \frac{(-4/3)x}{x} = -\frac{4}{3}$$

$$\csc \theta = -\frac{5}{4}$$

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

$$\tan \theta = -\frac{3}{4}$$

$$30. \tan \frac{\pi}{2} = \frac{y}{x} = \frac{1}{0} \Rightarrow \text{undefined}$$

since $\frac{\pi}{2}$ corresponds to $(0, 1)$.

$$32. \csc \pi = \frac{r}{y} = \frac{1}{0} \Rightarrow \text{undefined}$$

since π corresponds to $(-1, 0)$.

$$34. \csc \frac{3\pi}{2} = \frac{1}{\sin \frac{3\pi}{2}} = \frac{1}{-1} = -1$$

$$36. \csc \frac{\pi}{2} = \frac{1}{\sin \frac{\pi}{2}} = \frac{1}{1} = 1$$