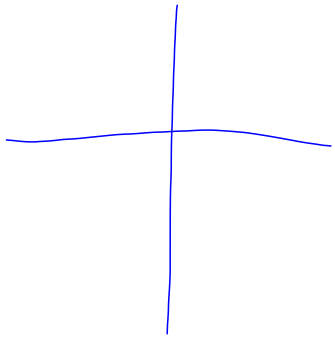
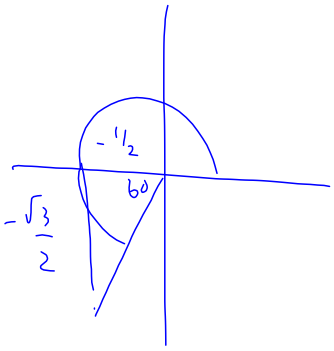


$\frac{5\pi}{4}$

Nov 15-8:59 AM

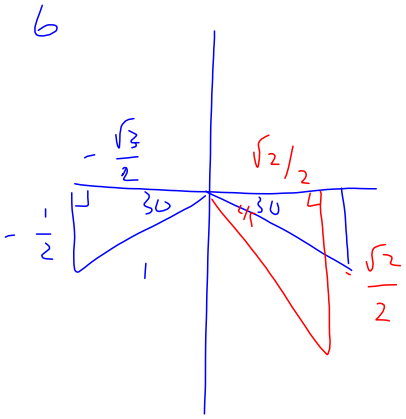
$\frac{4\pi}{3}$



$\frac{7\pi}{4}$

$\frac{7\pi}{6}$

$\frac{11\pi}{6}$



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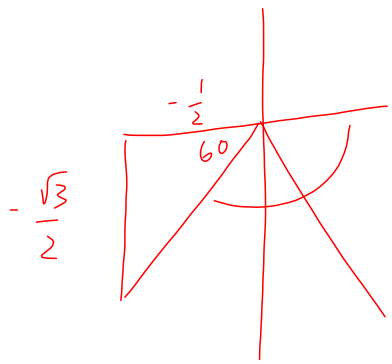


sin cos tan

csc sec cot

$-\frac{2\pi}{3}$

Nov 15-9:08 AM

4.3 Right Triangle Trigonometry

4.4 Trigonometric Functions of Any Angle

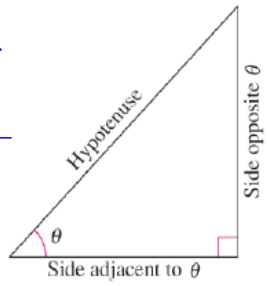
PART I

Right Triangle Definitions of Trigonometric Functions

Let θ be an *acute* angle of a right triangle. The six trigonometric functions of the angle θ are defined as follows:

$\sin\theta = \frac{O}{H}$ $\cos\theta = \frac{A}{H}$ $\tan\theta = \frac{O}{A}$

$\csc\theta = \frac{H}{O}$ $\sec\theta = \frac{H}{A}$ $\cot\theta = \frac{A}{O}$



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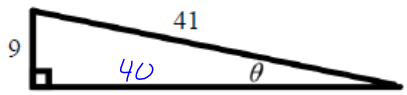
Find the exact values of the six trigonometric functions of the angle shown in the figure.

1.



$x^2 + 9^2 = 41^2$

$\sin\theta = \frac{9}{41}$

$\cos\theta = \frac{40}{41}$

$\tan\theta = \frac{9}{40}$

$\csc\theta = \frac{41}{9}$

$\sec\theta = \frac{41}{40}$

$\cot\theta = \frac{40}{9}$

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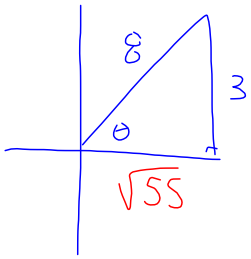
In 2 – 3, sketch a right triangle corresponding to the trigonometric function of the acute angle. Use the Pythagorean Theorem to determine the third side of the triangle and then find the other five trigonometric functions of the angle.

2. $\sin\theta = \frac{3}{8}$ $\frac{O}{H}$



$\sin\theta = \frac{3}{8}$

$\cos\theta = \frac{\sqrt{55}}{8}$

$\tan\theta = \frac{3}{\sqrt{55}} \cdot \frac{\sqrt{55}}{\sqrt{55}} = \frac{3\sqrt{55}}{55}$

$\csc\theta = 8/3$

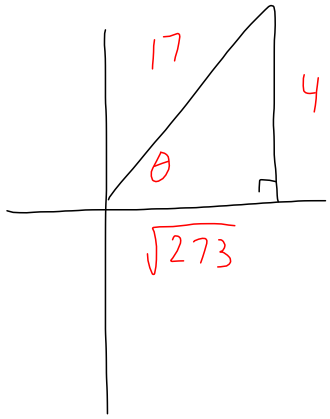
$\sec\theta = \frac{8}{\sqrt{55}} = \frac{8\sqrt{55}}{55}$

$\cot\theta = \frac{\sqrt{55}}{3}$

3. $\csc\theta = \frac{17}{4}$

Mar 2-12:20 PM

$$\csc\theta = \frac{17}{4}$$



$\sin\theta = \frac{4}{17}$

$\cos\theta = \frac{\sqrt{273}}{17}$

$\tan\theta = \frac{4\sqrt{273}}{273}$

$\csc\theta = 17/4$

$\sec\theta = \frac{17\sqrt{273}}{273}$

$\cot\theta = \frac{\sqrt{273}}{4}$

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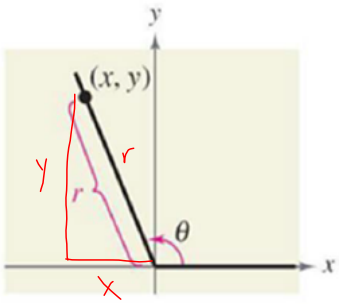
Definitions of Trigonometric Functions of Any Angle

Let θ be an angle in standard position with (x, y) a point on the terminal side of θ and $r = \sqrt{x^2 + y^2} \neq 0$.

$\sin\theta = \frac{y}{r}$ $\cos\theta =$ $\tan\theta =$

$\csc\theta =$ $\sec\theta =$ $\cot\theta =$

Just use SOH CAH TOA



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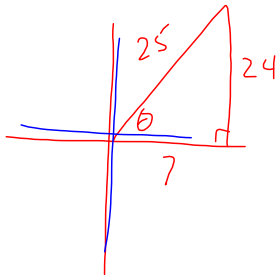
In 4 – 5, the given point is on the terminal side of an angle in standard position. Determine the exact values of the six trigonometric functions of the angle.

4. (7, 24)

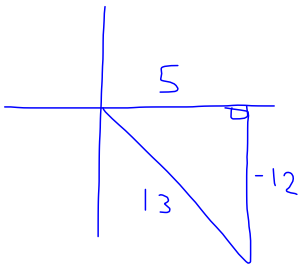


$\sin\theta = \frac{24}{25}$ $\csc\theta = \frac{25}{24}$

$\cos\theta = 7/25$ $\sec\theta = \frac{25}{7}$

$\tan\theta = \frac{24}{7}$ $\cot\theta = \frac{7}{24}$

5. (5, -12)



$5^2 + 12^2 = c^2$

$\sin\theta = \frac{-12}{13}$

$\cos\theta = \frac{5}{13}$

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

$\csc\theta = -13/12$

$\sec\theta = 13/5$

$\cot = -5/12$

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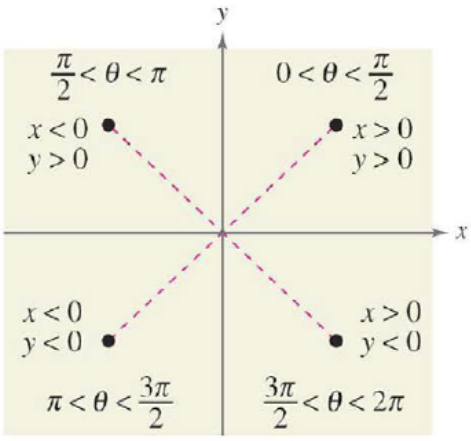
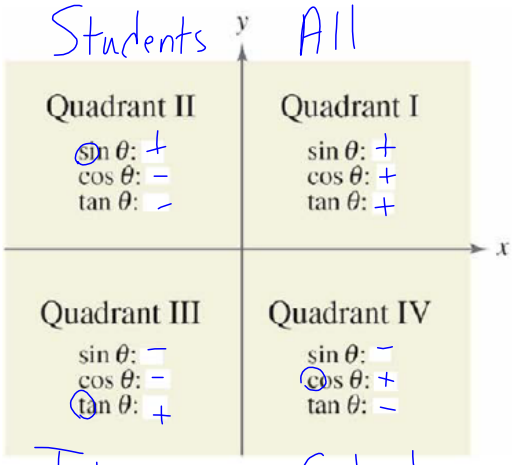
Determining the Signs of Trigonometric Functions



Students



All

Take Calculus

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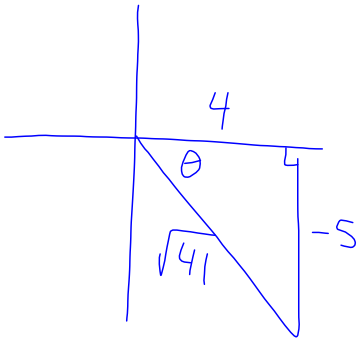
6. Given $\tan\theta = -\frac{5}{4}$ and $\cos\theta > 0$, find $\sin\theta$ and $\sec\theta$.

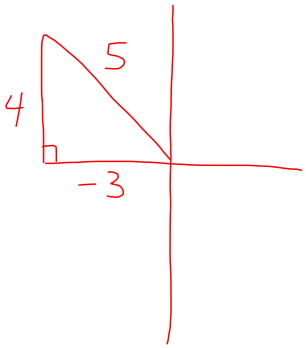


$\sin\theta = \frac{-5}{\sqrt{41}} \cdot \frac{\sqrt{41}}{\sqrt{41}} = \frac{-5\sqrt{41}}{41}$

$\sec\theta = \frac{\sqrt{41}}{4}$

Mar 2-12:21 PM

7. Given $\sin\theta = \frac{4}{5}$ and $\tan\theta < 0$, find $\cos\theta$ and $\tan\theta$.



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

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

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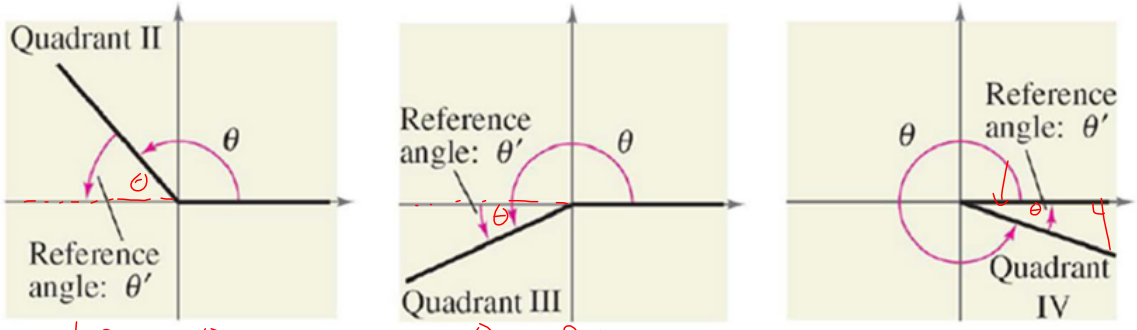
Reference Angles

Let θ be an angle in standard position. Its reference angle is the acute angle θ' formed by the terminal side of θ and the horizontal axis.



$180 - \theta$ $\qquad$ $\theta - 180$ $\qquad$ $360 - \theta$

$\pi - \theta$ $\qquad$ $\theta - \pi$ $\qquad$ $2\pi - \theta$

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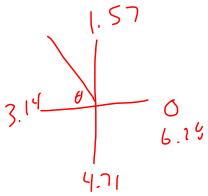
In 8 – 13, find the reference angle for each angle.

8. 300°

60°

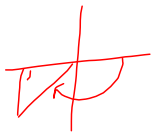
9. 2.3

.84



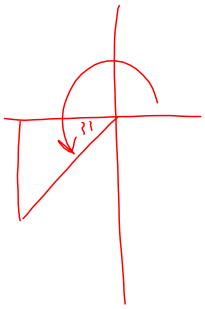
10. -135°

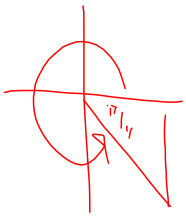
45°



11. $\frac{7\pi}{4} + \frac{\pi}{4} = 2\pi$

$\frac{\pi}{4}$





12. 213°

33°

13. 1.7

1.44

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Using Reference Angles: Evaluate the Trigonometric Function

14. $\cos\frac{4\pi}{3}$

$-\frac{1}{2}$

15. $\tan(-210^\circ)$

$\frac{\pi}{6}$

$-\frac{\sqrt{3}}{3}$

16. $\csc\frac{11\pi}{4}$

$\frac{\sqrt{2}}{2}$

$\frac{1}{\frac{\sqrt{2}}{2}} = \frac{2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\cancel{2}\sqrt{2}}{\cancel{2}} = \sqrt{2}$

17. $\sin\frac{5\pi}{3}$

$-\frac{\sqrt{3}}{2}$

18. $\cos(-60^\circ)$

$\frac{1}{2}$

19. $\tan\frac{11\pi}{6}$

$-\frac{\sqrt{3}}{3}$

$\frac{\sqrt{3}}{2}$

$-\frac{1}{2}$

$\frac{-\frac{1}{2}}{\frac{\sqrt{3}}{2}} = -\frac{1}{\cancel{2}} \cdot \frac{\cancel{2}}{\sqrt{3}} = \frac{-1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{-\sqrt{3}}{3}$

Nov 14-1:33 PM

Nov 15-10:35 AM