

MA110 #30. 11/2/16.

- Math Excel for MA113
- If you are using an iClicker RF remote, see me.
- Note.
- [www.math.uky.edu/mathexcel](http://www.math.uky.edu/mathexcel)

More trig functions—

$$\sin(x), \cos(x)$$

$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$

$$\sec(x) = \frac{1}{\cos(x)}$$

Secant

~~cos~~  $\csc(x) = \frac{1}{\sin(x)}$   
cosecant

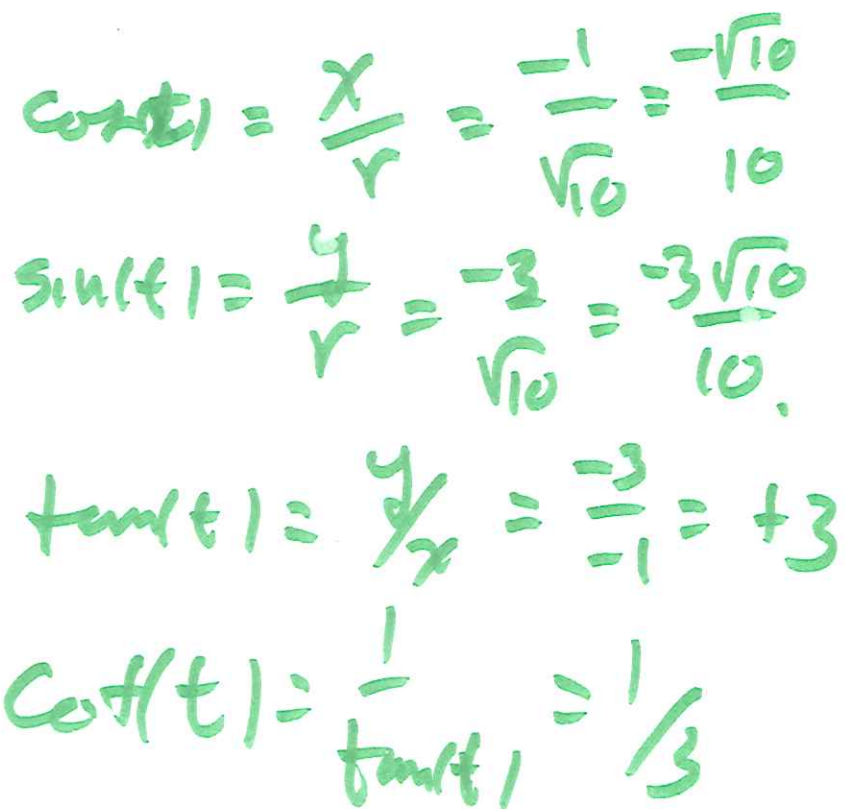
$$\cot(x) = \frac{1}{\tan(x)} = \frac{\cos(x)}{\sin(x)}$$

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Give Angle of measure  $t$ . Angle is in standard position. Terminal side contains  $(-1, -3)$ . Find all 6 trig functions.

$r = \text{dist. to origin}$

$$= \sqrt{3^2 + 1^2} = \sqrt{10}$$



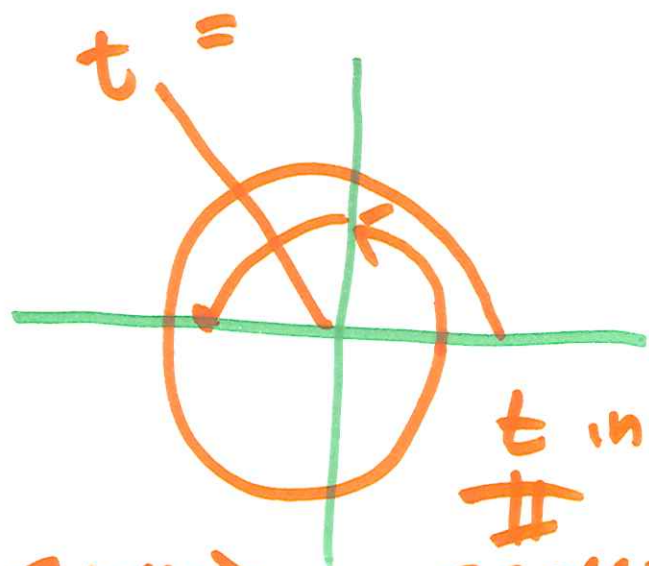
Sech 1 =  $-\sqrt{10}$ .

Hand-drawn diagram of the four quadrants of a Cartesian coordinate system. The x and y axes are green. The quadrants are labeled with Roman numerals I, II, III, and IV. Each quadrant contains its sign conventions for x, y, sin(t), cos(t), and tan(t). Quadrant I (top-right) has  $x > 0, y > 0$ ,  $\sin(t) > 0$ ,  $\cos(t) > 0$ , and  $\tan(t) > 0$ . Quadrant II (top-left) has  $x < 0, y > 0$ ,  $\sin(t) > 0$ ,  $\cos(t) < 0$ , and  $\tan(t) < 0$ . Quadrant III (bottom-left) has  $x < 0, y < 0$ ,  $\sin(t) < 0$ ,  $\cos(t) < 0$ , and  $\tan(t) > 0$ . Quadrant IV (bottom-right) has  $x > 0, y < 0$ ,  $\sin(t) < 0$ ,  $\cos(t) > 0$ , and  $\tan(t) < 0$ . A small orange line segment labeled 't' is drawn in the first quadrant.

Which functions are  
positive & which are  
negative?

$$\frac{5\pi}{2} < t < 3\pi$$

$$2\pi + \frac{\pi}{2} < t < 2\pi + \pi$$



$t$  in Quadrant  
**II**

$$\sin(t) > 0$$

$$\csc(t) > 0$$

$$\cos(t) < 0$$

$$\sec(t) < 0$$

$$\cot(t) < 0$$

$$\tan(t) < 0$$

REF.

$$\cos(t) < 0 \quad x < 0$$

$$\tan(t) = \frac{\sin(t)}{\cos(t)}, \quad \tan > 0$$

$$x < 0 + \frac{y}{x} > 0$$

$$\text{given } y < 0$$

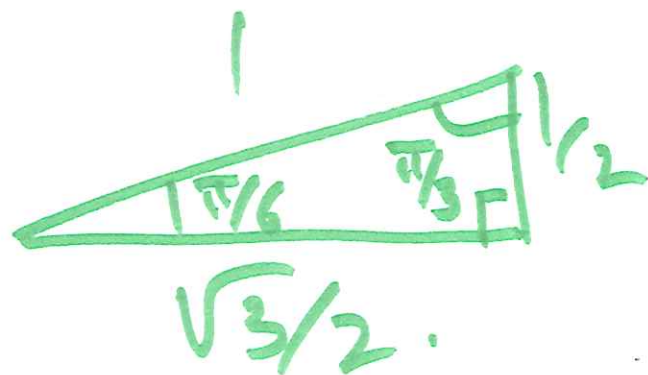
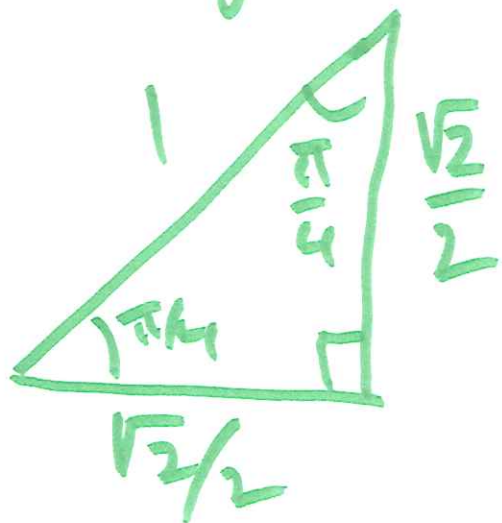
$$x < 0, y < 0, \text{ Quadrant III}$$

$$\pi < t < \frac{3\pi}{2}$$

$$\pi + 2\pi < t < \frac{3\pi}{2} + 2\pi$$

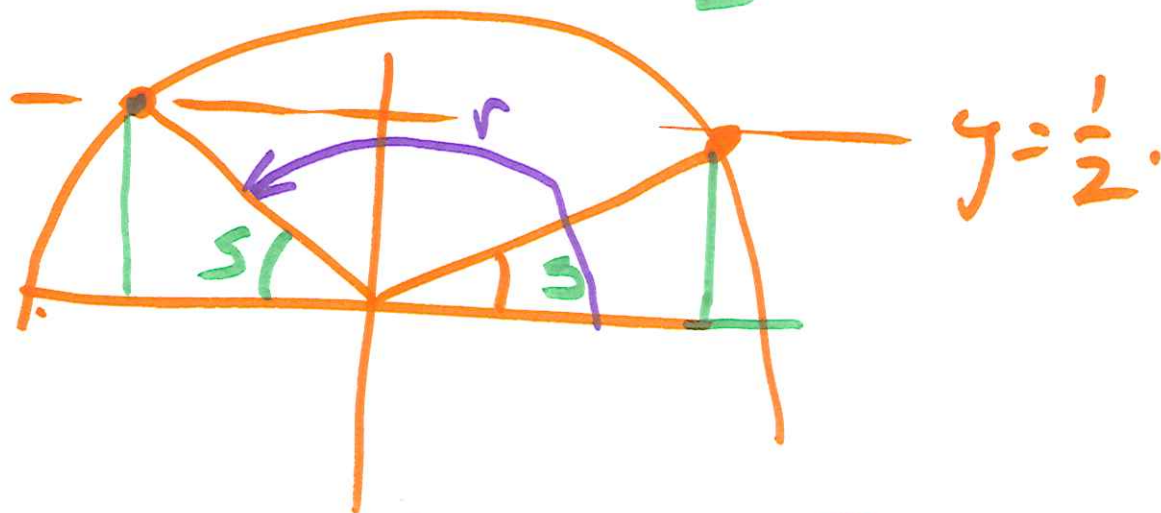
$\vdots$

Recall special triangles.



Solve

$$\sin(\pi t) = \frac{1}{2}, 0 < t < 2.$$



$$\sin(s) = \frac{1}{2} \quad \text{if } s = \frac{\pi}{6}$$

$$\sin(r) = \frac{1}{2} \quad \text{if } r = \frac{\pi}{6}$$

$$\pi t = \frac{\pi}{6}, \text{ then } t = \underline{\underline{\frac{1}{6}}}.$$

$$\pi t = \frac{5\pi}{6}, \text{ then } t = \underline{\underline{\frac{5}{6}}}$$

REF #3.

Solve  $\tan(2x) = 1$ .

w/  $0 < x < \pi$ .

Recall  $\tan(x)$  has period  $\pi$ , so  $\tan(2x)$  has period  $\pi/2$ .

~~$\tan(5) = 1$~~   $\tan(5) = 1$  if

$$S = \frac{\pi}{4}, \frac{\pi}{4} + \pi, \frac{\pi}{4} + 2\pi$$

$$2x = \pi/4, x = \pi/8$$

$$2x = 5\pi/4, x = 5\pi/8$$

Identities.

Definitions

$$\tan(t) = \frac{\sin(t)}{\cos(t)}$$

$$\cot(t) = \frac{\cos(t)}{\sin(t)} = \frac{1}{\tan(t)}$$

$$\sec(t) = \frac{1}{\cos(t)}$$

$$\csc(t) = \frac{1}{\sin(t)}$$

Pythagorean identities

$$\cos^2(t) + \sin^2(t) = 1.$$

Since  $(\cos(t), \sin(t))$  is a point on the unit circle.

$$1 + \tan^2(x)$$

$$= 1 + \frac{\sin^2(x)}{\cos^2(x)}$$

$$= \frac{\cos^2(x) + \sin^2(x)}{\cos^2(x)}$$

$$= \frac{1}{\cos^2(x)} = \sec^2(x)$$

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

$$1 + \cot^2(x) = \csc^2(x)$$

Simp 4/4

$$\cancel{\sin(t)} \cdot \cot(x)$$

$$= \frac{\cancel{\sin(t)}}{\cancel{\cos(t)}} \cdot \frac{\cancel{\cos(t)}}{\cancel{\sin(t)}}$$

$$= 1$$