

5.3 Trig Functions of Any Angle

GOALS:

1. Identify angles using a point (x,y) on the terminal ray.
2. Evaluate trig functions for all angles using a point (x,y) on the terminal ray.
3. Understand that the reference angle is formed by the x-axis and the terminal ray of the angle.
4. Identify the reference angle for angles in all 4 quadrants.

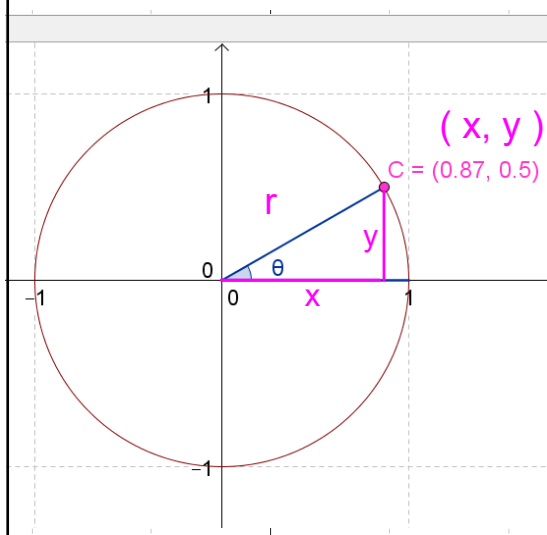
Study 5.3 CVC # 1-7; # 1, 5 - 23, 27, 29, 33 - 45, 57, 61, 63, 69, 71, 73

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5.3 Trig Functions of Any Angle



Definitions of Trig. Functions

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

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

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

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

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

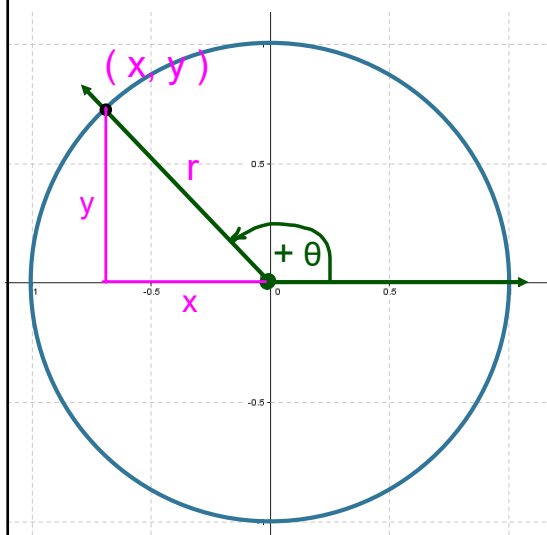
$$\cot \theta = \frac{x}{y}$$

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5.3 Trig Functions of Any Angle



Definitions of Trig. Functions

$\sin \theta = \frac{y}{r}$	$\csc \theta = \frac{r}{y}$
$\cos \theta = \frac{x}{r}$	$\sec \theta = \frac{r}{x}$
$\tan \theta = \frac{y}{x}$	$\cot \theta = \frac{x}{y}$

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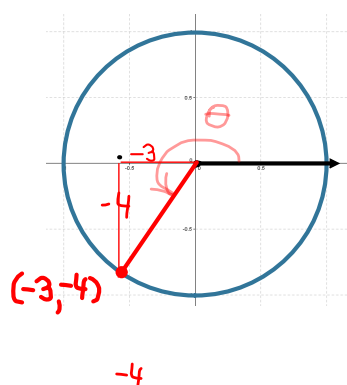
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5.3 Trig Functions of Any Angle

G: (-3, -4) on terminal ray of θ F: all 6 trig functions of θ

$r = \sqrt{x^2 + y^2}$ Identify x, y, and r
Then substitute.

x = __, y = __, r = __



$\sin \theta = \frac{y}{r} = \underline{\hspace{1cm}}$	$\csc \theta = \underline{\hspace{1cm}}$
$\cos \theta = \frac{x}{r} = \underline{\hspace{1cm}}$	$\sec \theta = \underline{\hspace{1cm}}$
$\tan \theta = \frac{y}{x} = \underline{\hspace{1cm}}$	$\cot \theta = \underline{\hspace{1cm}}$

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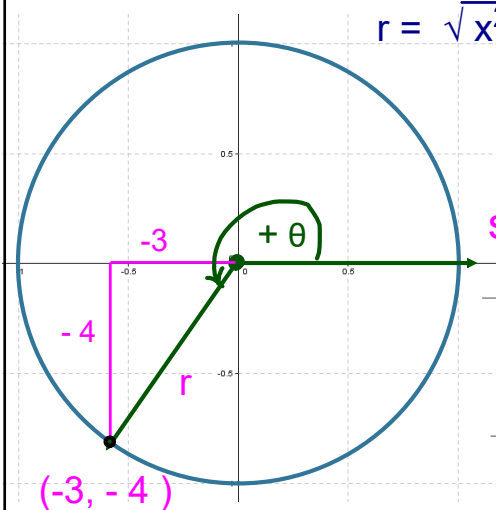
5.3 Trig Functions of Any Angle

G: $(-3, -4)$ on terminal ray of θ F: all 6 trig functions of θ

$$r = \sqrt{x^2 + y^2}$$

Identify x , y , and r
Then substitute.

$$x = -3, y = -4, r = 5$$



$$\sin \theta = \frac{y}{r} = \underline{\hspace{2cm}}$$

$$\csc \theta = \underline{\hspace{2cm}}$$

$$\cos \theta = \frac{x}{r} = \underline{\hspace{2cm}}$$

$$\sec \theta = \underline{\hspace{2cm}}$$

$$\tan \theta = \frac{y}{x} = \underline{\hspace{2cm}}$$

$$\cot \theta = \underline{\hspace{2cm}}$$

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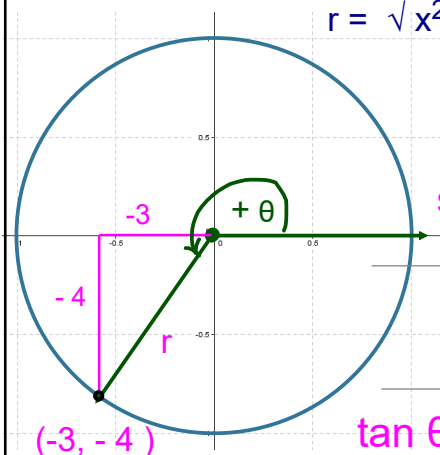
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G: $(-3, -4)$ on terminal ray of θ F: all 6 trig functions of θ

$$r = \sqrt{x^2 + y^2}$$

Identify x , y , and r
Then substitute.

$$x = -3, y = -4, r = 5$$



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

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

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

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

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

$$\cot \theta = \frac{3}{4}$$

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5.3 Trig Functions of Any Angle

G: (5, -5) on terminal ray of θ F: all 6 trig functions of θ

$$r = \sqrt{x^2 + y^2}$$

Identify x, y, and r
Then substitute.

$$x = \underline{\hspace{1cm}}, y = \underline{\hspace{1cm}}, r = \underline{\hspace{1cm}}$$

$$\sin \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \csc \theta = \underline{\hspace{1cm}}$$

$$\cos \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \sec \theta = \underline{\hspace{1cm}}$$

$$\tan \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \cot \theta = \underline{\hspace{1cm}}$$

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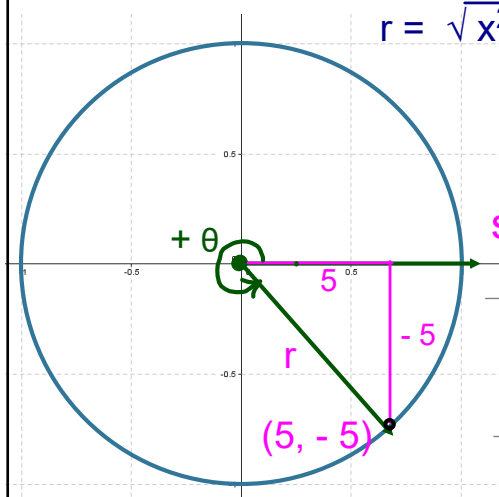
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5.3 Trig Functions of Any Angle

G: (5, -5) on terminal ray of θ F: all 6 trig functions of θ

$$r = \sqrt{x^2 + y^2}$$

Identify x, y, and r
Then substitute.



$$x = 5, y = -5, r = \underline{\hspace{1cm}}$$

$$\sin \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \csc \theta = \underline{\hspace{1cm}}$$

$$\cos \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \sec \theta = \underline{\hspace{1cm}}$$

$$\tan \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \cot \theta = \underline{\hspace{1cm}}$$

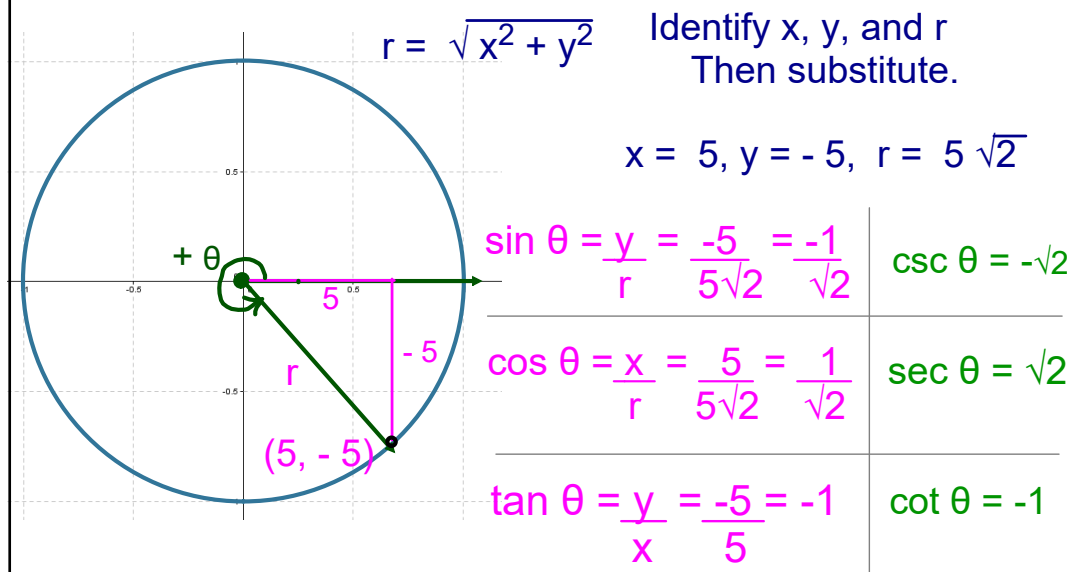
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5.3 Trig Functions of Any Angle

G: (5, -5) on terminal ray of θ F: all 6 trig functions of θ



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5.3 Trig Functions of Any Angle

G: $\sin \theta = -12/13$, Q III F: 5 other trig functions of θ

$\sin \theta = \frac{y}{r} = \frac{-12}{13}$ $x = \sqrt{r^2 - y^2}$ Identify x, y, and r
Then substitute.

$x = \underline{\hspace{1cm}}, y = \underline{\hspace{1cm}}, r = \underline{\hspace{1cm}}$

$\sin \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$	$\csc \theta = \underline{\hspace{1cm}}$
$\cos \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$	$\sec \theta = \underline{\hspace{1cm}}$
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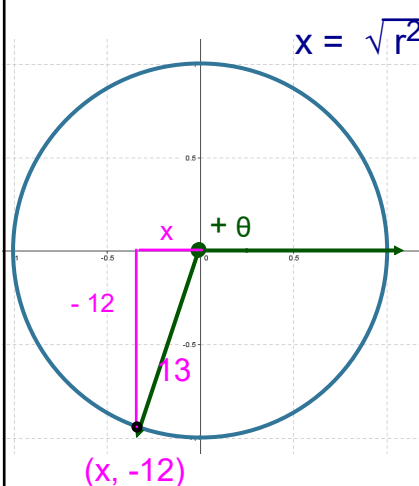
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$$r = \sqrt{x^2 + y^2}$$

$$y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

G: $\sin \theta = -12/13$, Q III F: 5 other trig functions of θ



Identify x, y, and r
Then substitute.

$$x = \underline{\hspace{1cm}}, y = -12, r = 13$$

$$x = -\sqrt{13^2 - (-12)^2} = \underline{\hspace{1cm}}$$

$$\sin \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \csc \theta = \underline{\hspace{1cm}}$$

$$\cos \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \sec \theta = \underline{\hspace{1cm}}$$

$$\tan \theta = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \quad \cot \theta = \underline{\hspace{1cm}}$$

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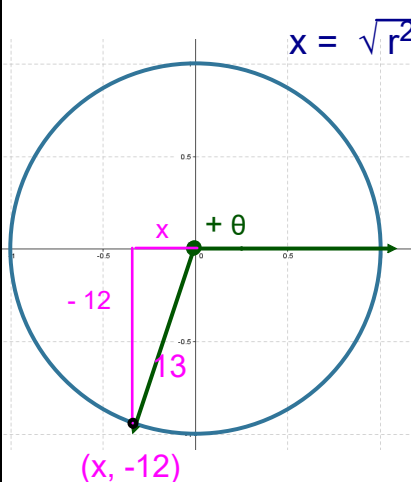
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$$r = \sqrt{x^2 + y^2}$$

$$y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

G: $\sin \theta = -12/13$, Q III F: 5 other trig functions of θ



Identify x, y, and r
Then substitute.

$$x = \underline{-5}, y = -12, r = 13$$

$$x = -\sqrt{13^2 - (-12)^2} = \underline{-5}$$

$$\sin \theta = \frac{y}{r} = \frac{-12}{13} \quad \csc \theta = \frac{-13}{12}$$

$$\cos \theta = \frac{x}{r} = \frac{-5}{13} \quad \sec \theta = \frac{-13}{5}$$

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

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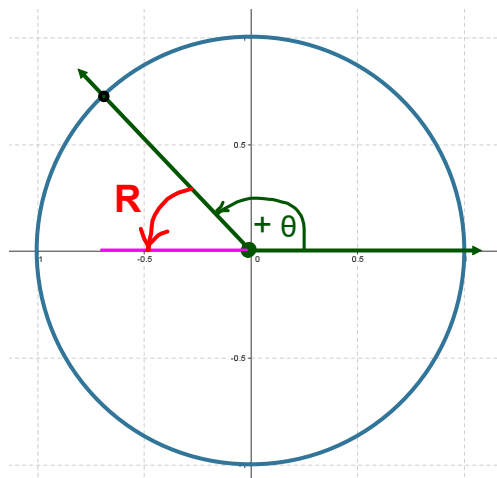
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$$r = \sqrt{x^2 + y^2}$$

$$y = \sqrt{r^2 - x^2}$$

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Reference angle is: the positive acute angle between the terminal ray of θ and the x-axis



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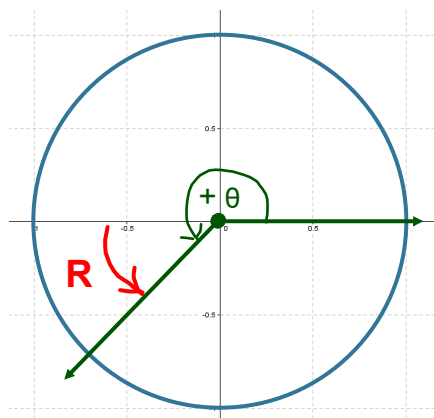
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

Reference angle is: the positive acute angle between the terminal ray and the x-axis



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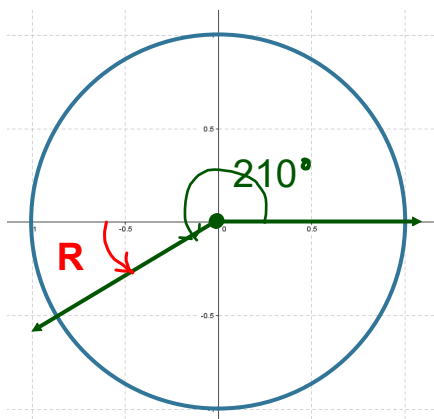
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

G: 210° F: Reference angle



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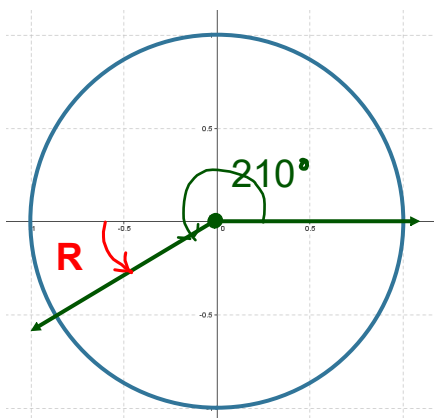
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

G: 210° F: Reference angle



$$R = 210^\circ - 180^\circ \\ = 30^\circ$$

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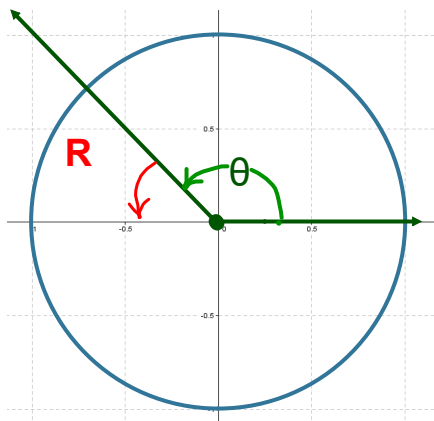
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

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G: $\frac{5\pi}{7}$

F: Reference angle



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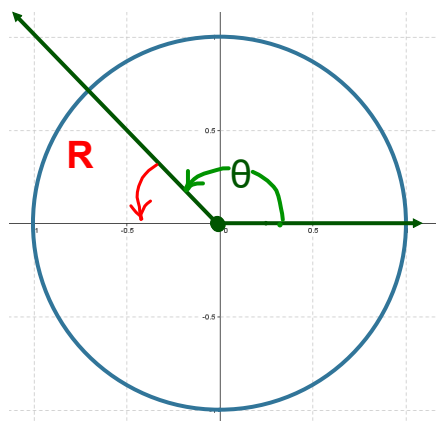
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

G: $\frac{5\pi}{7}$

F: Reference angle



$$\begin{aligned} R &= \pi - \frac{5\pi}{7} \\ &= \frac{7\pi}{7} - \frac{5\pi}{7} \\ &= \frac{2\pi}{7} \end{aligned}$$

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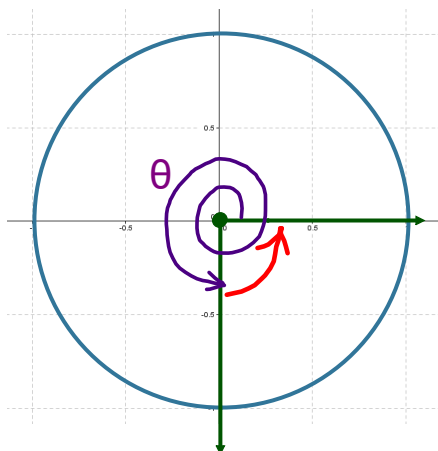
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

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$$F: \cos \frac{7\pi}{2}$$



Looks like $R = 90^\circ = \pi/2$,
BUT not R , since not
acute

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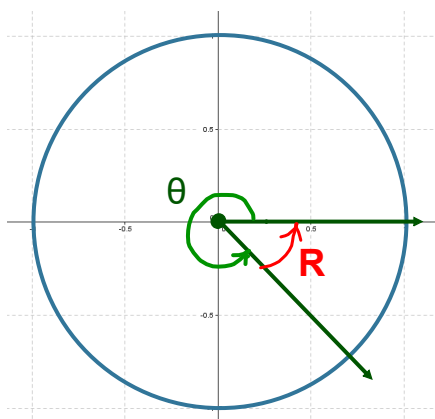
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

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$$F: \cos \frac{7\pi}{4}$$



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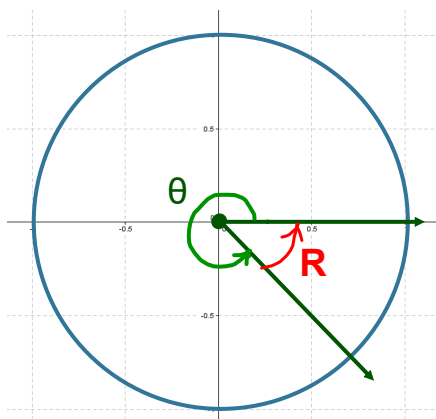
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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

5.3 Trig Functions of Any Angle

F: $\cos \frac{7\pi}{4}$



$$\begin{aligned} R &= 2\pi - \frac{7\pi}{4} \\ &= \frac{8\pi}{4} - \frac{7\pi}{4} \\ &= \frac{\pi}{4} \end{aligned}$$

$$\cos \frac{7\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}}$$

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$$x = \sqrt{r^2 - y^2} \quad r = \sqrt{x^2 + y^2} \quad y = \sqrt{r^2 - x^2}$$

Attachments

basic_angles.mp4

trig_functions_unitCircle.mp4