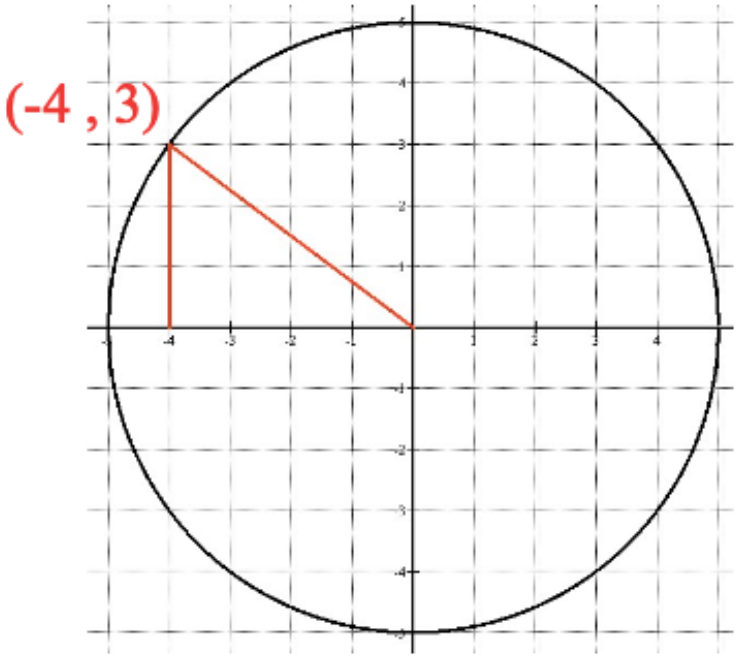
Chapter 3
Radian Measure and the Unit Circle

1. **Radian Measure**
2. Arc Length and Area of a Circular Sector
3. Linear and Angular Speeds
4. Unit Circle Approach

3.1 - Radian Measure

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

θ is in the second quadrant



Find the other 5 trig functions

$$\sin\theta = \frac{3}{5} \qquad \csc\theta = \frac{5}{3}$$

$$\cos\theta = -\frac{4}{5} \qquad \sec\theta = -\frac{5}{4}$$

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

3.1 - Radian Measure

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

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

Practice - Find the other 5 trig functions

1) $\cos x = \frac{24}{25}, -\frac{\pi}{2} < x < 0$

$\sin x = -\frac{7}{25}, \ \tan x = -\frac{7}{24}$

$\sec x = \frac{25}{24}, \ \csc x = -\frac{25}{7}, \ \cot x = -\frac{24}{7}$

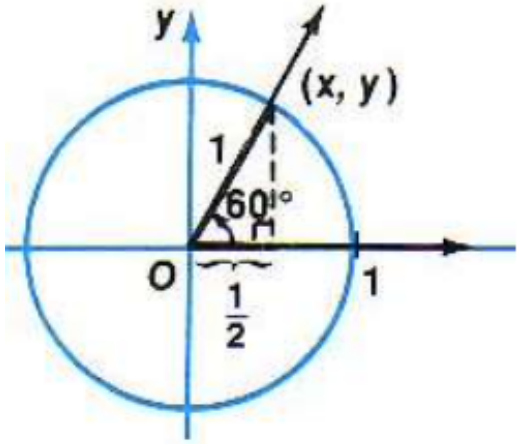
2) $\cot x = \frac{12}{5}, \ 0 < x < \pi$

$\sin x = \frac{5}{13}, \ \cos x = \frac{12}{13}$

$\csc x = \frac{13}{5}, \ \sec x = \frac{13}{12}, \ \tan x = \frac{5}{12}$

3.1 - Radian Measure

Find the sin, cos, tan of 60°

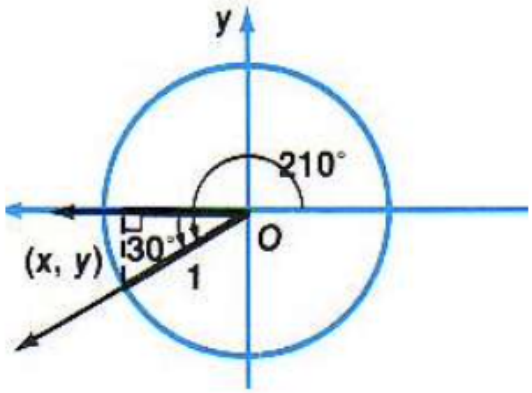


$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 60^\circ = \frac{1}{2}$$

$$\tan 60^\circ = \sqrt{3}$$

Find the sin, cos, tan of 210°



$$\sin 210^\circ = -\frac{1}{2}$$

$$\cos 210^\circ = -\frac{\sqrt{3}}{2}$$

$$\tan 210^\circ = \frac{\sqrt{3}}{3}$$

Practice - Find the exact value

1. $\dfrac{\cos(-405^\circ) + 2\sin(5010^\circ)}{\tan(-480^\circ)}$

$\dfrac{\sqrt{6} - 2\sqrt{3}}{6}$

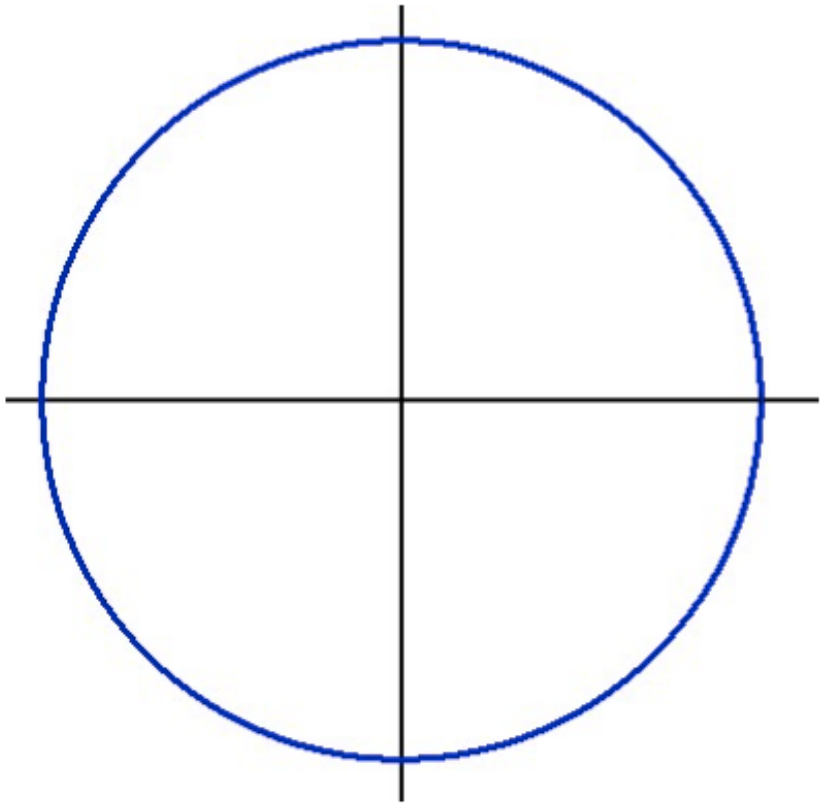
2. $\dfrac{\sec(-405^\circ) - 2\csc(5010^\circ)}{3\cot(-480^\circ)}$

$\dfrac{\sqrt{6} + 4\sqrt{3}}{3}$

1.4 - Evaluating Trigonometric Functions

Reference Angle

The acute positive angle formed by the terminal ray of an angle and the x-axis.



Express in terms of its reference angle

$\sin 100^\circ = \sin 80^\circ$

$\cos 200^\circ = -\cos 20^\circ$

$\cot 300^\circ = -\cot 60^\circ$

Practice - Find the reference angle

1. $\cos(2222^\circ)$ $\cos(62^\circ)$

2. $\csc(1005^\circ)$ $-\csc(75^\circ)$

3. $\sin(19.2)$ $\sin(0.35)$

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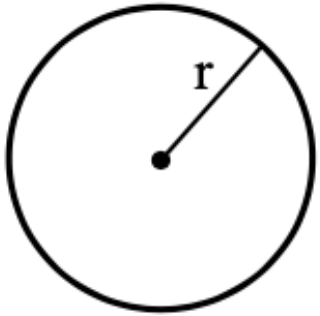
3.2 - Arc Length and Area of a Circular Sector

Remember circles?

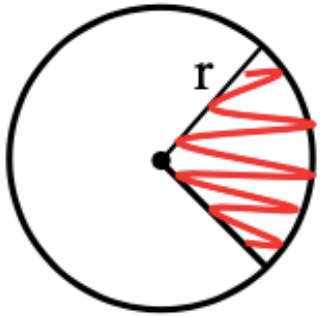


Area = πr^2

Circumference =

$$2\pi r = \pi d$$

What about sectors?



Area =

$$\frac{\theta^\circ}{360}\pi r^2 = \frac{\theta}{2\pi}\pi r^2 = \frac{1}{2}r^2\theta$$

Radians

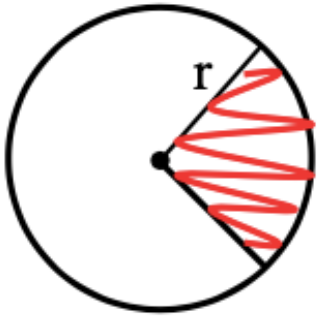
Arc length =

$$\frac{\theta^\circ}{360}2\pi r = \frac{\theta}{2\pi}2\pi r = r\theta$$

Radians

3.2 - Arc Length and Area of a Circular Sector

What about sectors?



Area = (Radians)

$$\frac{\theta^\circ}{360}\pi r^2 = \frac{\theta}{2\pi}\pi r^2 = \frac{1}{2}r^2\theta$$

Arc length = (Radians)

$$\frac{\theta^\circ}{360}2\pi r = \frac{\theta}{2\pi}2\pi r = r\theta$$

Practice - Find the area and arc length of the sector.

1) $r = 4$
$\theta = 25^\circ$

$Area = 3.49$

$Arc\ L = 1.75$

2) $r = 3$
$\theta = 2.3\ rads$

$Area = 10.35$

$Arc\ L = 6.9$

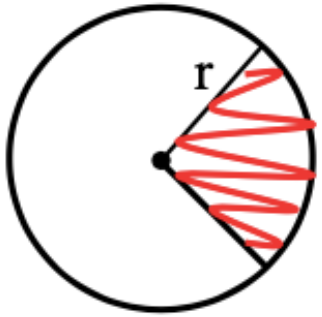
3) $r = 6x10^{15}$
$\theta = 1.5^\circ$

$Area = 4.71x10^{29}$

$Arc\ L = 1.57x10^{14}$

3.2 - Arc Length and Area of a Circular Sector

A sector has perimeter of 12 and area of 8. Find all possible radii.



Area = $\frac{1}{2}r^2\theta$

$8 = \frac{1}{2}r^2\theta$

$8 = \frac{1}{2}r^2\left(\frac{12-2r}{r}\right)$

$8 = 6r - r^2$

$r^2 - 6r + 8 = 0$

$(r-4)(r-2) = 0$

Perimeter = $r + r + r\theta$

$12 = r + r + r\theta$

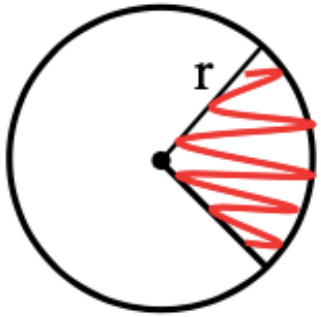
$12 - 2r = r\theta$

$\frac{12-2r}{r} = \theta$

$r = 4, 2$

3.2 - Arc Length and Area of a Circular Sector

A sector has perimeter of 12 and area of 8. Find all possible radii.



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$\frac{12-2r}{r} = \theta$

$8 = 6r - r^2$

$r^2 - 6r + 8 = 0$

$(r-4)(r-2) = 0$ $r = 4,\ 2$

Practice

1) A sector has area of $90cm^2$ and central angle of 0.2 rads. Find its radius and arc length.

$r = 30\ cm$

$Arc\ L = 6\ cm$

2) A sector has a perimeter of 24 and area of 20. Find all possible radii.

$r = 2,\ 10$

Graphing Sine and Cosine

4.1 - Graphing Sine and Cosine

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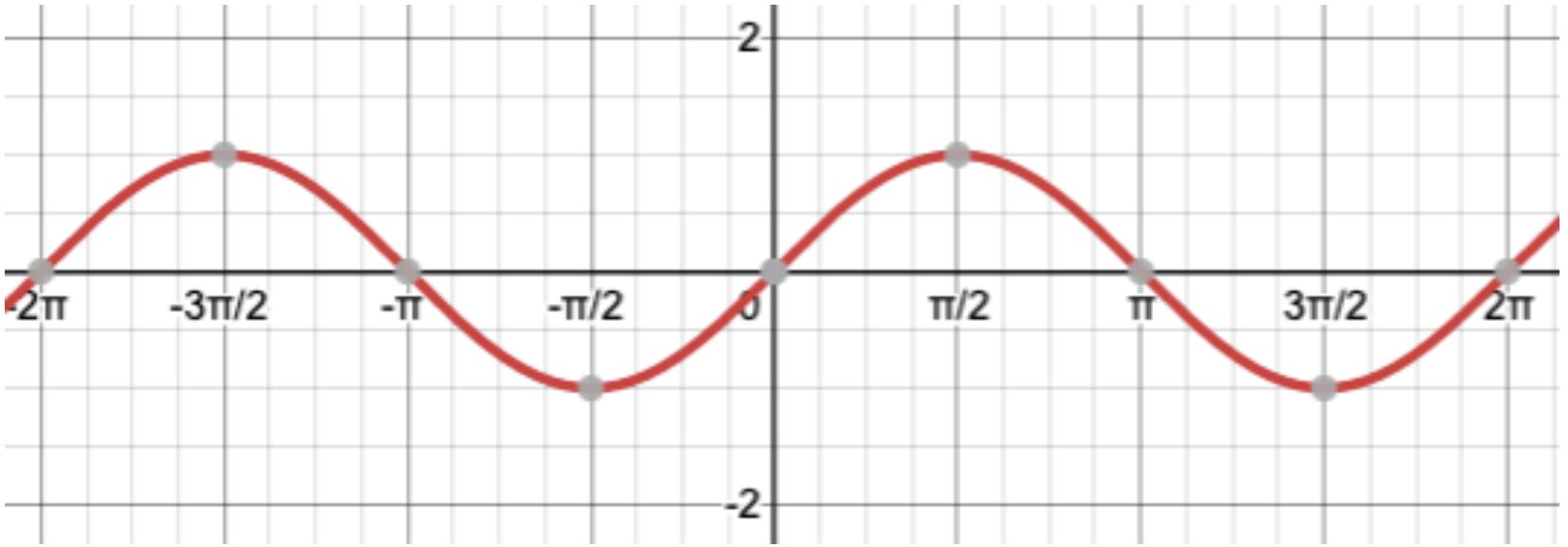
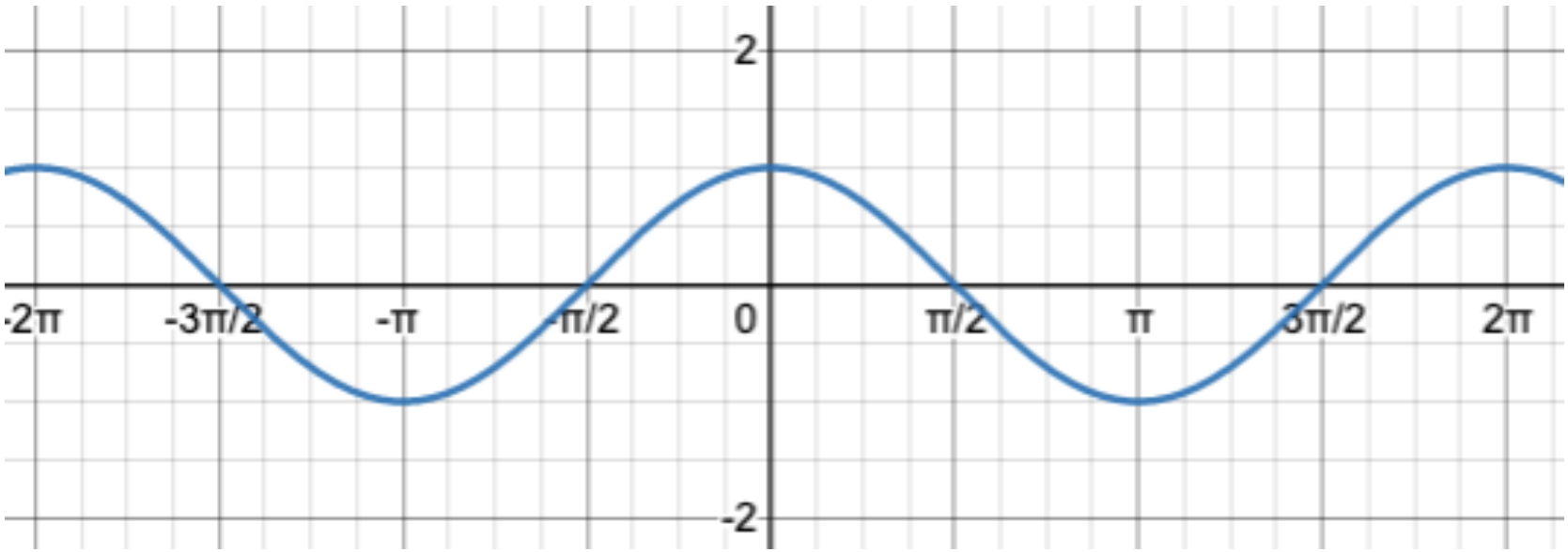
Which is sine or cosine? How can you tell?



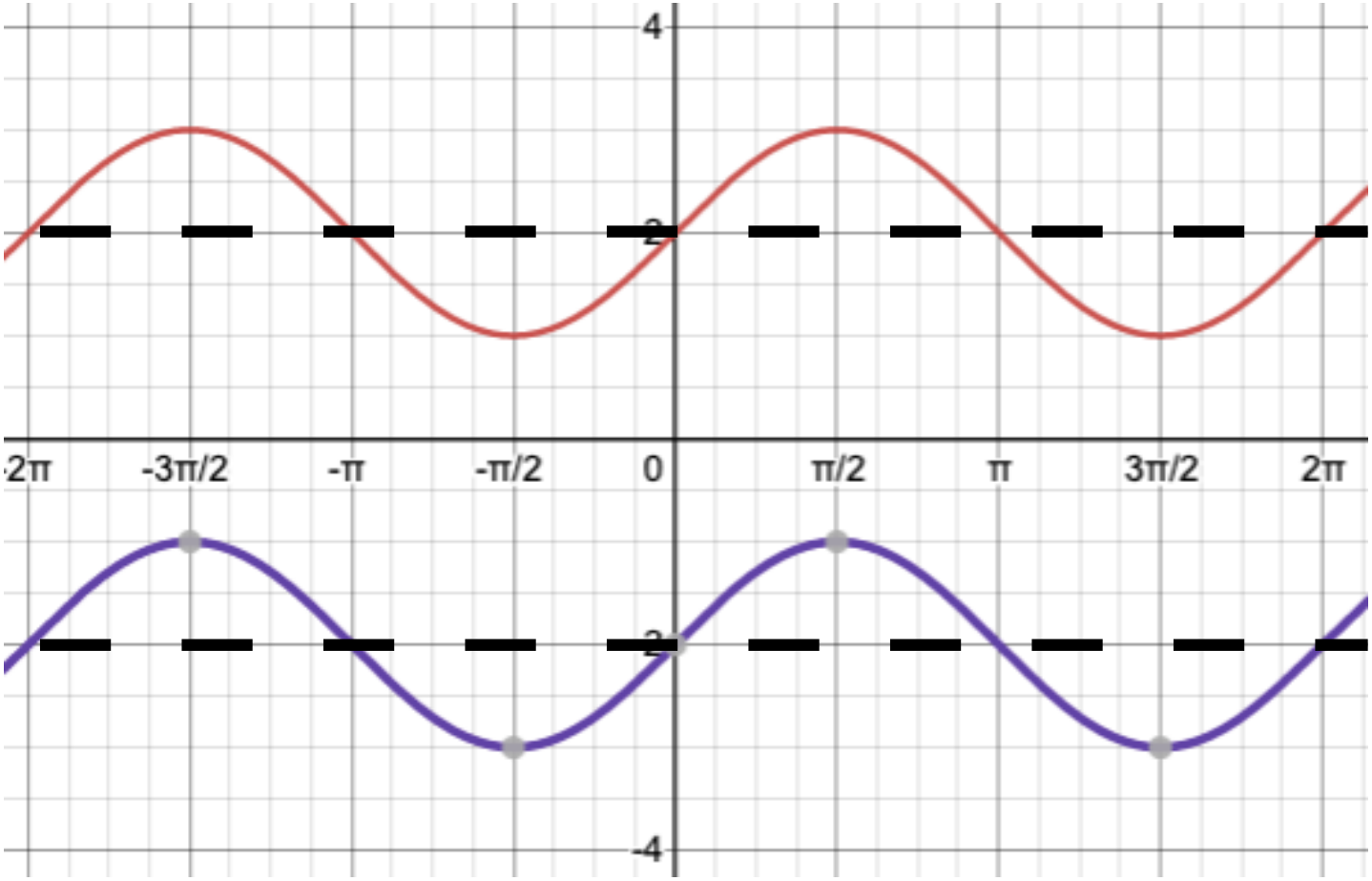


4.1 - Graphing Sine and Cosine

Does period change? Does amplitude change?

sin(x) + 2

sin(x) - 2



4.1 - Graphing Sine and Cosine

2cos(x) + 3

cos(x)

2cos(x) - 3