THE UNIVERSITY OF AKRON
Theoretical and Applied Mathematics

Flash Cards

Introduction to Angles

Katie Jones
and
Tom Price

Instructions: Click on the Begin button to view the first randomly selected card. Click on FS to view the cards in full screen mode (works only outside a web browser). The Home button on the first page goes to the WebTrig home page; otherwise, the Home button returns to this page. The Close button closes the document (use outside a web browser).

Last Revision Date: April 10, 2003 Version 1.0

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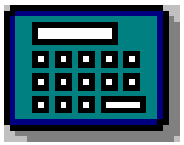
Convert 176° to radian measure.

Convert 423° to radian measure.

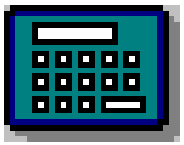
Convert 394° to radian measure.

Convert $\frac{5\pi}{8}$ radians to degrees.



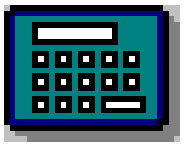
Convert $\dfrac{3\pi}{11}$ radians to degrees.

Hint Soln
Next Home



Convert 1.9024 radians to degrees.

Hint Soln
Next Home



Convert -3.45 radians to degrees.

Determine an angle of degree measure between 0° and 360° that is coterminal with an angle of measure 795°.

Hint Soln
Next Home

Determine an angle of degree measure between 0° and 360° that is coterminal with an angle of measure -165°.

Determine an angle of radian measure between $0\,\text{rad}$ and $2\pi\,\text{rad}$ that is coterminal with an angle of measure $\dfrac{23\pi}{3}\,\text{rad}$.

Are the angles $\frac{7\pi}{12}$ radians and $-\frac{19\pi}{12}$ radians coterminal?

Are the angles -190° and 170° coterminal?

Give the smallest positive and largest negative angles which are coterminal with but not equal to $\frac{\pi}{3}$ rad.

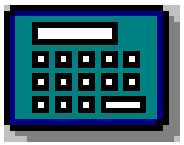
Are the angles $\frac{\pi}{12}$ radians and $15\,^\circ$ coterminal?

Draw a graph of the angle $-495°$ using an arrow to indicate direction.

Draw a graph of the angle $\frac{5\pi}{3}$ rad .

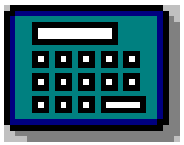
What is the radian measure of an angle that subtends a 14 unit arc on a circle of radius 5?

What is the radian measure of an angle that subtends a 6 unit arc on a circle of radius 3?



Determine the length of an arc subtended by an angle measuring 1.15 radians if the circle has a radius of 149 units.

Hint Soln
Next Home



Determine the length of an arc on a circle of radius $\frac{1}{6}$ which is subtended by an angle of measure 0.21 rad.

Hint Soln
Next Home

HINT

To convert 176° to radian measure recall that 180° describes an angle of measure π radians.

Answer: $\boxed{t = \frac{44}{45}\pi \text{ rad}}$

Solution: To convert $176\,^\circ$ to radian measure we use the conversion formula

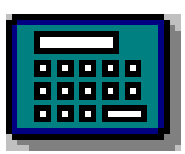
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{t}{\pi} = \frac{176}{180}$$

$$\Longrightarrow \qquad t = \frac{176\pi}{180} = \frac{44}{45}\pi \text{ rad}$$

or $\qquad t = 3.0718 \text{ rad}$



HINT

To convert 423° to radian measure recall that 360° describes an angle of measure 2π radians.

Answer: $\boxed{t = \frac{423}{180}\pi \text{ rad}}$

Solution: To convert 423° to radian measure we use the conversion formula

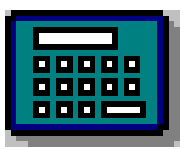
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{t}{\pi} = \frac{423}{180}$$

$$\Longrightarrow \qquad t = \frac{423}{180}\pi \text{ rad}$$

or $\qquad t = 7.3827 \text{ rad}$



HINT

To convert 394° to radian measure use the conversion formula.

Answer: $\boxed{t = \frac{197}{90}\pi}$

Solution: To convert $394\,^\circ$ to radian measure we use the conversion formula

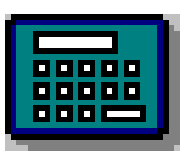
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{t}{\pi} = \frac{394}{180}$$

$$\Longrightarrow \qquad t = \frac{394}{180}\pi\,\text{rad} = \frac{197}{90}\pi\,\text{rad}$$

or $\qquad t = 6.876\,6\,\text{rad}$



HINT

To convert $\frac{5\pi}{8}$ rad to degree measure use the conversion formula

$$\frac{t}{\pi} = \frac{\theta}{180}.$$

Answer: $\boxed{\theta = 112.5\,^\circ}$

Solution: To convert $\frac{5\pi}{8}$ rad to degree measure we use the conversion formula

$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{\frac{5\pi}{8}}{\pi} = \frac{\theta}{180}$$

$$\Longrightarrow \qquad \theta = 180 \cdot \frac{5}{8} = \frac{225\,^\circ}{2}$$

$$\Longrightarrow \qquad \theta = 112.5\,^\circ$$

HINT

To convert $\dfrac{3\pi}{11}$ rad to degree measure recall that 180° describes an angle of measure π radians.

Answer: $\boxed{\theta = 49.091\,^\circ}$

Solution: To convert $\dfrac{3\pi}{11}$ rad to degree measure we use the conversion formula

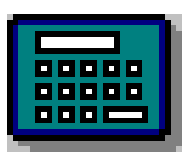
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{\frac{3\pi}{11}}{\pi} = \frac{\theta}{180}$$

$$\Longrightarrow \qquad \theta = 180 \cdot \frac{3}{11} = \frac{540\,^\circ}{11}$$

$$\Longrightarrow \qquad \theta = 49.091\,^\circ$$



HINT

To convert 1.9024 rad to degree measure recall that 360° describes an angle of measure 2π radians.

Answer: $\boxed{\theta = 109\,^\circ}$

Solution: To convert 1.9024 rad to degree measure we use the conversion formula

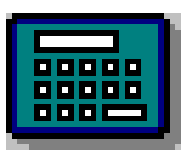
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{1.9024}{\pi} = \frac{\theta}{180}$$

$$\Longrightarrow \qquad \theta = 180 \cdot \frac{1.9024}{\pi}$$

$$\Longrightarrow \qquad \theta = 109\,^\circ$$



HINT

To convert $-3.45\,\text{rad}$ to degree measure use the conversion formula

$$\frac{t}{\pi} = \frac{\theta}{180}.$$

Answer: $\boxed{\theta = -197.67^\circ}$

Solution: To convert -3.45 rad to degree measure we use the conversion formula

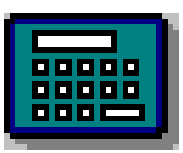
$$\frac{t}{\pi} = \frac{\theta}{180}.$$

We have

$$\frac{-3.45}{\pi} = \frac{\theta}{180}$$

$$\Longrightarrow \qquad \theta = 180 \cdot \frac{-3.45}{\pi}$$

$$\Longrightarrow \qquad \theta = -197.67^\circ$$



HINT

To find the angle coterminal with an angle measuring 795° recall that there are 360° in one full revolution of a circle.

Answer: $\boxed{\theta = 75\,^\circ}$

Solution: Determine how many full revolutions of the unit circle there are in $795\,^\circ$ by dividing $795\,^\circ$ by $360\,^\circ$.

$$\frac{795}{360} = 2 + \frac{75}{360}.$$

The quotient of 2 means that the given angle completes two revolutions of the unit circle while the remainder of 75 indicates that the given angle is coterminal to one of measure $75\,^\circ$.

HINT

To find the angle coterminal with an angle measuring -165° recall that negative angles are measured in a clockwise direction.

Answer: $\boxed{\theta = 195\,^\circ}$

Solution: Subtract $165\,^\circ$ from $360\,^\circ$ to find the measure that will complete one revolution of a circle.

$$360 - 165 = 195\,^\circ$$

HINT

To find the angle coterminal with an angle measuring $\frac{23\pi}{3}$ rad recall that there are 2π radians in one full revolution of a circle.

Answer: $\boxed{t = \frac{5}{3}\pi \text{ rad}}$

Solution: Determine how many full revolutions of the unit circle there are in $\frac{23\pi}{3}$ rad by dividing $\frac{23\pi}{3}$ rad by 2π rad.

$$\frac{\frac{23\pi}{3}}{2\pi} = \frac{23}{6} = 3 + \frac{5}{6}.$$

The quotient of 3 means that the given angle completes three revolutions of the unit circle ($3 \cdot 2\pi = 6\pi$ rad), while the remainder of $\frac{5}{6}$ indicates that the given angle is coterminal to one of measure $\frac{5}{6} \cdot 2\pi = \frac{5}{3}\pi$ rad, since $\frac{5}{6}$ of a full revolution ot the unit circle is left over. ◀

HINT

To determine if the angles $\frac{7\pi}{12}$ rad and $-\frac{19\pi}{12}$ rad are coterminal recall that coterminal angles have the same terminal sides.

Answer: No

Solution: The difference of the two angles

$$\frac{7\pi}{12} - \frac{-19\pi}{12} = \frac{13}{6}\pi$$

is not an integer multiple of 2π, so the angles are NOT coterminal.

HINT

To determine if the angles -190° and 170° are coterminal recall that coterminal angles have the same terminal sides.

Answer: Yes

Solution: The difference of the two angles

$$-190 - 170 = -360$$

is an integer multiple of 360° , so the angles are coterminal.

HINT

To determine the smallest positive and largest negative angles coterminal with but not equal to $\frac{\pi}{3}$ rad, remember that to have the same terminal side angles must have a difference that is an integer multiple of 2π.

Answer: $\boxed{\frac{7\pi}{3}\text{ rad and } -\frac{5\pi}{3}\text{ rad}}$

Solution: Add 2π rad to $\frac{\pi}{3}$ rad for the positive angle.

$$2\pi + \frac{\pi}{3} = \frac{7\pi}{3}\text{ rad}$$

Subtract 2π rad from $\frac{\pi}{3}$ rad for the negative angle.

$$\frac{\pi}{3} - 2\pi = -\frac{5\pi}{3}\text{ rad}$$

HINT

To determine if the angles $\frac{\pi}{12}$ rad and 15° are coterminal they must be measured in the same units.

Answer: Yes

Solution: Convert $\frac{\pi}{12}$ radians to degree measure using the conversion formula.

$$\frac{\frac{\pi}{12}}{\pi} = \frac{\theta}{180}$$

$$\Longrightarrow \qquad \theta = 180 \cdot \frac{1}{12}$$

$$\Longrightarrow \qquad \theta = 15\,^\circ$$

The difference of the two angles

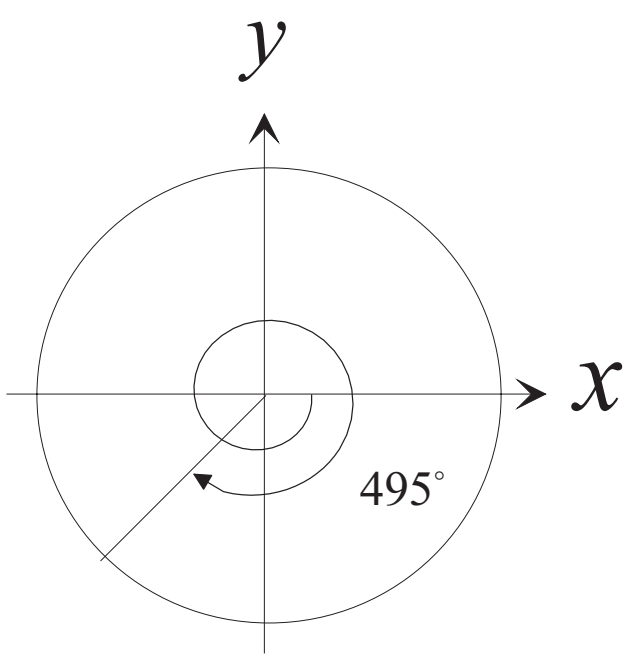
$$15 - 15 = 0.$$

is an integer multiple of $360\,^\circ$, so the angles are coterminal. Or without any calculations, an angle is always coterminal to itself, so $15\,^\circ$ is coterminal with $15\,^\circ$.

HINT

To draw a graph of the angle -495° remember negative angles are measured in a clockwise direction.

Answer:



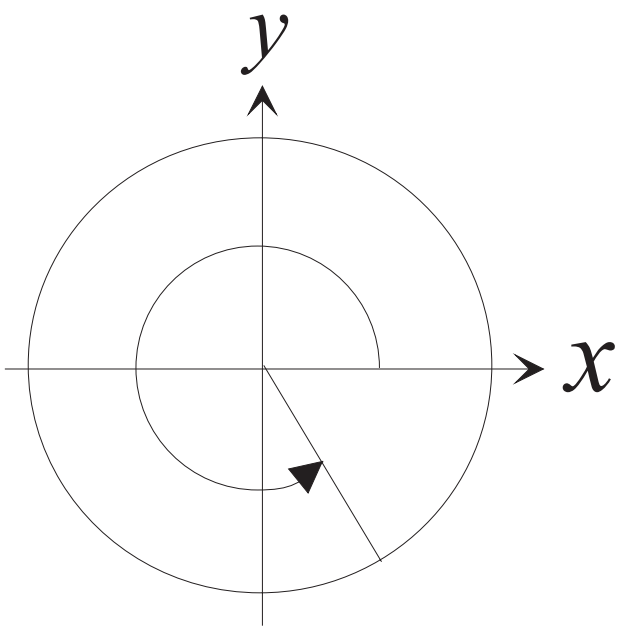
Solution: Starting at 0 ° and moving clockwise, make one full revolution then continue for another 135 ° because $135 = 495 - 360$.

Hint Soln
Next Home

HINT

To draw a graph of the angle $\frac{5\pi}{3}$ rad divide π rad into three equal parts.

Answer:



Solution: Starting at 0 rad, move counter-clockwise by thirds of π rad. Note, π rad $= \frac{3\pi}{3}$ rad which is half of a circle. ◀

HINT

To determine the angle that subtends a 14 unit arc on a circle of radius 5, recall that t radians subtends an arc of length $t \cdot r$, on a circle of radius r.

Answer: $\boxed{t = 2.8\,\text{rad}}$

Solution: The length, L, of a subtended arc is equal to the angle's radian measure multiplied by the radius of the circle, giving the equation

$$L = t \cdot r.$$

We have,

$$14 = t \cdot 5$$

$$\Longrightarrow \qquad t = \frac{14}{5} = 2.8\,\text{rad}$$

HINT

To determine the angle that subtends a 6 unit arc on a circle of radius 3, recall that t radians subtends an arc of length $t \cdot r$, on a circle of radius r.

Answer: $\boxed{2\,\text{rad}}$

Solution: The length, L, of a subtended arc is equal to the angle's radian measure multiplied by the radius of the circle, giving the equation

$$L = t \cdot r.$$

We have,

$$6 = t \cdot 3$$

$$\Longrightarrow \qquad t = 2\,\text{rad}$$

HINT

To find the length of an arc subtended by an angle measuring 1.15 rad on a circle with a radius of 149 units, recall that arc length is determined by multiplying the angle subtending it with the radius of the circle.

Answer: $\boxed{L = 171.35 \text{ units}}$

Solution: The length of a subtended arc, L, is equal to the angle's radian measure multiplied by the radius of the circle, giving the equation

$$L = t \cdot r.$$

We have,

$$\begin{aligned} L &= 1.15 \cdot 149 \\ &= 171.35 \text{ units} \end{aligned}$$

HINT

To find the length of an arc on a circle of radius $\frac{1}{6}$ which is subtended by an angle measuring 0.21 rad, recall that arc length is determined by multiplying the angle subtending it by the radius of the circle.

Answer: $\boxed{L = 0.035 \text{ units}}$

Solution: The length of a subtended arc, L, is equal to the angle's radian measure multiplied by the radius of the circle, giving the equation

$$L = t \cdot r.$$

We have,

$$\begin{aligned} L &= 0.21 \cdot \frac{1}{6} \\ &= 0.035 \text{ units} \end{aligned}$$