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## Unit 5

# Angle Measures, Arc Lengths, Area of Sectors, & Circular Motion

$S(\text{arc length}) = r\theta$  (in radians) r Lengths,  
Area of sectors, & Circular Motion

Write the following angle measures in radians.

1.  $165^\circ$  2.  $-300^\circ$   
 $165 \cdot \frac{\pi}{180}$   $-300 \cdot \frac{\pi}{180}$

Write the following angle measures in degrees.

3.  $-\frac{\pi}{10}$  4.  $\frac{7\pi}{6}$   
 $-\frac{\pi}{10} \cdot \frac{180}{\pi}$   $\frac{7\pi}{6} \cdot \frac{180}{\pi}$

Give one positive and one negative coterminal angle for each given angle.

5.  $135^\circ$  6.  $\frac{\pi}{4}$   
 $135 + 360$   $\frac{\pi}{4} + 2\pi$   
 $135 - 360$   $\frac{\pi}{4} - 2\pi$

Write the following angle measures in degree-minute-second (DMS) form.

7.  $42.25^\circ$  8.  $-210.615^\circ$   
 $.25(60) = 15$   $.615(60) = 36.9$   
 $.9(60) = 54$

Write the following angle measures in decimal degree form.

9.  $164^\circ 39'$  10.  $8^\circ 15' 54''$   
 $39/60 = .65$   $15/60 = .25$   
 $54/3600 = .015$

Find the length of the intercepted arc given the central angle and radius of the circle. Round your answer to the nearest tenth.

11.  $\theta = \frac{4\pi}{3}; r = 9 \text{ cm}$  12.  $\theta = 345^\circ; r = 2.5 \text{ ft}$   
 $S = 9 \left( \frac{4\pi}{3} \right)$   $\hookrightarrow \frac{23\pi}{12}$   
 $= 22.6$   $S = 2.5 \left( \frac{23\pi}{12} \right)$   
 $= 15.1$

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### Chapter Test Form A

Chapter 14

Graph each algebraic expression.

1.  $y = x^2 + 4$  2.  $y = x^2 - 4$   
 3.  $y = x^2 + 2x$  4.  $y = x^2 - 2x$

Verify each identity.

5.  $\sin^2 \theta + \cos^2 \theta = 1$  6.  $\sec^2 \theta - \tan^2 \theta = 1$   
 7.  $\sin^2 \theta + \cos^2 \theta = 1$  8.  $\sec^2 \theta - \tan^2 \theta = 1$

Use a unit circle and  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  angles to find the value in degrees of each expression.

9.  $\sin^{-1} \left( \frac{1}{2} \right)$  10.  $\cos^{-1} \left( \frac{\sqrt{3}}{2} \right)$   
 11.  $\sin^{-1} \left( -\frac{1}{2} \right)$  12.  $\cos^{-1} \left( -\frac{\sqrt{3}}{2} \right)$

Solve each equation for  $\theta$  in  $0^\circ < \theta < 360^\circ$ .

13.  $\tan \theta = \sqrt{3}$  14.  $\sqrt{2} \cos \theta = 1$   
 15.  $\tan \theta = -\sqrt{3}$  16.  $\cos \theta = -\frac{1}{2}$


In  $\triangle ABC$ , find each value or a function and an unknown. Round to the nearest tenth.

17.  $\sin A$  18.  $\cos A$  19.  $\tan B$   
 20.  $\sin C$  21.  $\cos B$  22.  $\tan B$

23. In  $\triangle ABC$ ,  $\angle C$  is a right angle.  $\angle A = 33^\circ$  and  $c = 13$ . Round your answer to the nearest tenth.

24. Find the area of  $\triangle ABC$  if  $a = 12$ ,  $b = 17$ , and  $\angle C = 112^\circ$ . Round your answer to the nearest tenth.

25. Find  $x$  using the triangle below. Round your answer to the nearest whole number.



Algebra 2 Chapter 14 Form A Test 23

# PreCalc - Trigonometry Review

Use the given information to find the missing side lengths and angle measures for each given right triangle. Express your answers in degrees.

1)  $\theta = 30^\circ$     2)  $\theta = 45^\circ$     3)  $\theta = 60^\circ$     4)  $\theta = 45^\circ$

Express the following angles in radians assuming an arc length of  $s$  and a radius of  $r$  units.

5)  $30^\circ$     6)  $45^\circ$     7)  $60^\circ$     8)  $90^\circ$

9)  $120^\circ$     10)  $135^\circ$     11)  $150^\circ$     12)  $180^\circ$

Express the following angles in degrees using  $\pi$ .

13)  $\frac{\pi}{6}$     14)  $\frac{\pi}{4}$     15)  $\frac{\pi}{3}$     16)  $\frac{\pi}{2}$

17)  $\frac{\pi}{3}$     18)  $\frac{\pi}{4}$     19)  $\frac{\pi}{6}$     20)  $\frac{\pi}{2}$

Determine all six trigonometric functions for the angle  $\theta$  formed by joining the two given points.

21)  $P(1, 2)$     22)  $P(2, 2)$     23)  $P(1, 1)$     24)  $P(1, 1)$

Express the quadrants in which  $\theta$  lies.

25)  $\sin \theta < 0$  and  $\cos \theta < 0$     26)  $\sin \theta < 0$  and  $\cos \theta > 0$

27)  $\sin \theta > 0$  and  $\cos \theta < 0$     28)  $\sin \theta > 0$  and  $\cos \theta > 0$

Prove the following trigonometric identities.

29)  $\theta \text{ acute} \Rightarrow \sin \theta = \frac{\text{opp}}{\text{hyp}}$     30)  $\theta \text{ acute} \Rightarrow \cos \theta = \frac{\text{adj}}{\text{hyp}}$     31)  $\theta \text{ acute} \Rightarrow \tan \theta = \frac{\text{opp}}{\text{adj}}$

32)  $\theta \text{ acute} \Rightarrow \csc \theta = \frac{\text{hyp}}{\text{opp}}$     33)  $\theta \text{ acute} \Rightarrow \sec \theta = \frac{\text{hyp}}{\text{adj}}$     34)  $\theta \text{ acute} \Rightarrow \cot \theta = \frac{\text{adj}}{\text{opp}}$

Express the sine, cosine, and tangent of the following angles without using a calculator.

35)  $30^\circ$     36)  $45^\circ$     37)  $\frac{\pi}{6}$     38)  $\frac{\pi}{4}$

39)  $120^\circ$     40)  $135^\circ$     41)  $\frac{2\pi}{3}$     42)  $\frac{3\pi}{4}$

43)  $150^\circ$     44)  $180^\circ$     45)  $\frac{5\pi}{6}$     46)  $\pi$

## TRIGONOMETRIC IDENTITIES

**The six trigonometric functions:**  
 $\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{y}{r}$      $\theta = \frac{\text{hyp}}{\text{opp}} = \frac{r}{y}$   
 $\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{x}{r}$      $\theta = \frac{\text{hyp}}{\text{adj}} = \frac{r}{x}$   
 $\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{y}{x}$      $\theta = \frac{\text{adj}}{\text{opp}} = \frac{x}{y}$

**Sum or difference of two angles:**  
 $\sin(\theta \pm \phi) = \sin \theta \cos \phi \pm \cos \theta \sin \phi$   
 $\cos(\theta \pm \phi) = \cos \theta \cos \phi \mp \sin \theta \sin \phi$   
 $\tan(\theta \pm \phi) = \frac{\tan \theta \pm \tan \phi}{1 \mp \tan \theta \tan \phi}$

**Double angle formulas:**  
 $\sin 2\theta = 2 \sin \theta \cos \theta$      $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$   
 $\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$

**Pythagorean Identities:**  
 $\sin^2 \theta + \cos^2 \theta = 1$   
 $\tan^2 \theta + 1 = \sec^2 \theta$      $\sec^2 \theta - 1 = \tan^2 \theta$

**Half angle formulas:**  
 $\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}}$      $\cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}}$   
 $\tan \frac{\theta}{2} = \frac{1 - \cos \theta}{\sin \theta} = \frac{\sin \theta}{1 + \cos \theta}$

**Sum and product formulas:**  
 $\sin \theta \sin \phi = \frac{1}{2} [\cos(\theta - \phi) - \cos(\theta + \phi)]$   
 $\cos \theta \cos \phi = \frac{1}{2} [\cos(\theta - \phi) + \cos(\theta + \phi)]$   
 $\sin \theta \cos \phi = \frac{1}{2} [\sin(\theta + \phi) + \sin(\theta - \phi)]$   
 $\cos \theta \sin \phi = \frac{1}{2} [\sin(\theta + \phi) - \sin(\theta - \phi)]$

**Law of cosines:**  
 $a^2 = b^2 + c^2 - 2bc \cos A$   
 where  $A$  is the angle of a scalene triangle opposite side  $a$ .

**Radian measure:**  
 $s = r\theta$      $1 \text{ radian} = \frac{180^\circ}{\pi}$

**Reduction formulas:**  
 $\sin(-\theta) = -\sin \theta$      $\cos(-\theta) = \cos \theta$   
 $\sin(\theta + \pi) = -\sin \theta$      $\cos(\theta + \pi) = -\cos \theta$   
 $\tan(-\theta) = -\tan \theta$      $\tan(\theta + \pi) = \tan \theta$

**Complex Numbers:**  
 $e^{i\theta} = \cos \theta + i \sin \theta$      $e^{-i\theta} = \cos \theta - i \sin \theta$

TRIGONOMETRIC VALUES FOR COMMON ANGLES

Degrees	Radians	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\cot \theta$	$\sec \theta$	$\csc \theta$
$0^\circ$	0	0	1	0	Undefined	1	Undefined
$30^\circ$	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\sqrt{3}$	$\frac{2}{\sqrt{3}}$	$2$
$45^\circ$	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1	$\sqrt{2}$	$\sqrt{2}$
$60^\circ$	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{1}{\sqrt{3}}$	$\frac{2}{\sqrt{3}}$	$2$
$90^\circ$	$\frac{\pi}{2}$	1	0	Undefined	0	Undefined	Undefined
$120^\circ$	$\frac{2\pi}{3}$	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\frac{1}{\sqrt{3}}$	$-\frac{2}{\sqrt{3}}$	$-2$
$135^\circ$	$\frac{3\pi}{4}$	$\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	-1	-1	$-\sqrt{2}$	$-\sqrt{2}$
$150^\circ$	$\frac{5\pi}{6}$	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{3}}$	$-\sqrt{3}$	$-\frac{2}{\sqrt{3}}$	$-2$
$180^\circ$	$\pi$	0	-1	0	Undefined	1	Undefined
$210^\circ$	$\frac{7\pi}{6}$	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\sqrt{3}$	$-\frac{2}{\sqrt{3}}$	$-2$
$225^\circ$	$\frac{5\pi}{4}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1	1	$-\sqrt{2}$	$-\sqrt{2}$
$240^\circ$	$\frac{4\pi}{3}$	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\frac{1}{\sqrt{3}}$	$-\frac{2}{\sqrt{3}}$	$-2$
$270^\circ$	$\frac{3\pi}{2}$	-1	0	Undefined	0	Undefined	Undefined
$300^\circ$	$\frac{5\pi}{3}$	$-\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$-\sqrt{3}$	$-\frac{1}{\sqrt{3}}$	$-\frac{2}{\sqrt{3}}$	$-2$
$315^\circ$	$\frac{7\pi}{4}$	$-\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	-1	-1	$-\sqrt{2}$	$-\sqrt{2}$
$330^\circ$	$\frac{11\pi}{6}$	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\sqrt{3}$	$-\frac{2}{\sqrt{3}}$	$-2$
$360^\circ$	$2\pi$	0	1	0	Undefined	1	Undefined







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