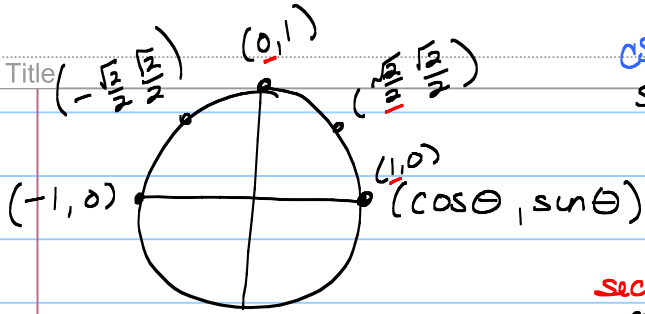
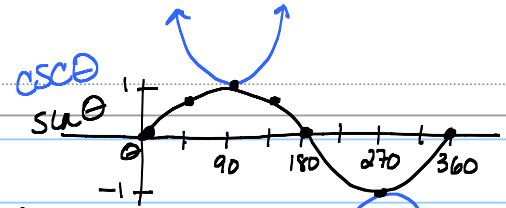
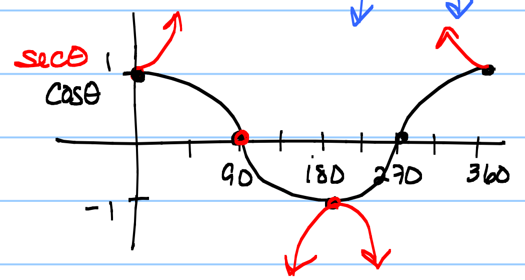
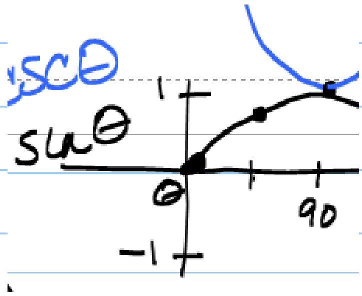
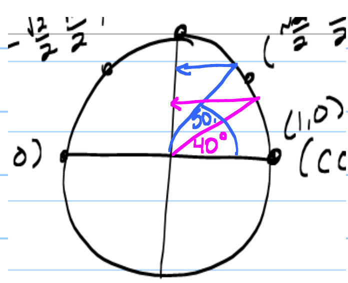






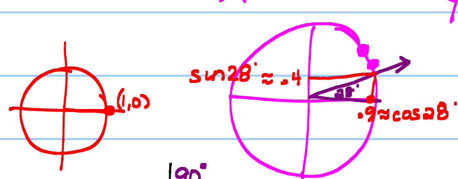
37. sin 50° > sin 40 True

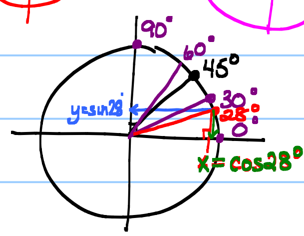




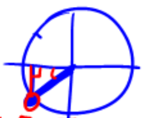
40. cos 28° < sin 28°

x y





Find the exact value of each expression.

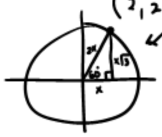


36. sin 1305° ⇒ least pos. coterm. ∠ = 225° ⇒ ref ∠ = 45° = $-\frac{\sqrt{2}}{2}$

$\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

38. tan(-1020°) LPC ∠ = 60° ⇒ ref ∠ = 60° ⇒ $\sqrt{3}$

$\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$



40. sec(-495°) $\frac{1}{\cos(225°)}$ → $\frac{H}{A}$ $= \frac{x\sqrt{2}}{-x} = -\sqrt{2}$

225° $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

42. cot(2280°)

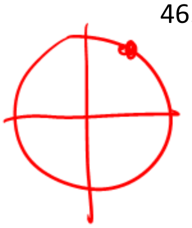
Determine whether each statement is true or false. If false, tell why.

44. sin 30° + sin 60° = sin (30° + 60°) (no operation in betw)

$\frac{1}{2} + \frac{\sqrt{3}}{2} \neq \sin 90°$

$\frac{1+\sqrt{3}}{2} \neq 1$

46. cos 60° = 2 cos^2 30° - 1

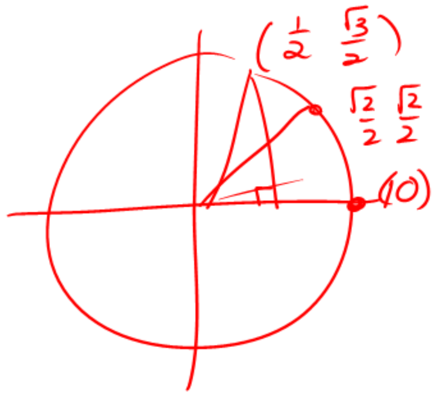


$\frac{1}{2} = 2\left(\frac{\sqrt{3}}{2}\right)^2 - 1$

$\frac{1}{2} = 2\left(\frac{3}{4}\right) - 1$

$\frac{1}{2} = \frac{3}{2} - 1$

$\frac{1}{2} = 1/2$



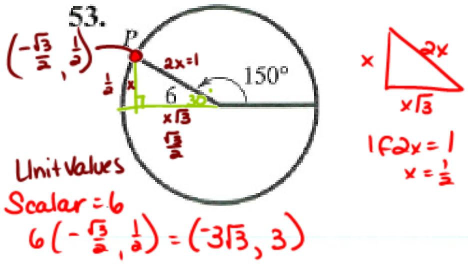
48. sin 120° = sin 150° - sin 30°

50. sin(2·30°) = 2 sin 30° · cos 30°

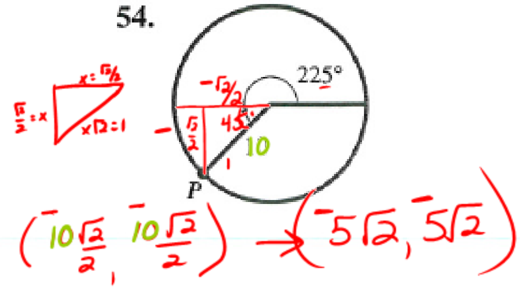
52. $\tan^2 60° + 1 = \sec^2 60°$

Concept Check *Find the coordinates of the point P on the circumference of each circle. (Hint: Add x- and y-axes, assuming that the angle is in standard position.)*

53.

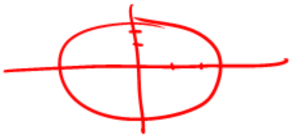


54.



55. *Concept Check* Does there exist an angle θ with the function values $\cos\theta = \frac{2}{3}$ and $\sin\theta = \frac{3}{4}$?

56. *Concept Check* Does there exist an angle θ with the function values $\cos\theta = 0.6$ and $\sin\theta = -0.8$?



55. Use Pyth thm:
$\cos^2\theta + \sin^2\theta = 1$
$(2/3)^2 + (3/4)^2 = 1$
$4/9 + 9/16 \neq 1$ ∴ FALSE

56. $\cos^2\theta + \sin^2\theta = 1$
$.6^2 + (-.8)^2$
$.36 + .64 = 1$ true

Suppose θ is in the interval $(90°, 180°)$. Find the sign of each of the following.

57. $\cos\frac{\theta}{2}$

cos 45, cos 90

58. $\sin\frac{\theta}{2}$

59. $\sec(\theta + 180°)$ (270, 360)

60. $\cot(\theta + 180°)$

61. $\sin(-\theta)$

62. $\cos(-\theta)$

63. Explain why $\cos\theta = \cos(\theta + n \cdot 360°)$ for any angle θ and any integer n.

64. Explain why $\sin\theta = \sin(\theta + n \cdot 360°)$ for any angle θ and any integer n.

Concept Check

65. For what angles θ between 0° and 360° does $\cos\theta = \sin\theta$?

66. For what angles θ between 0° and 360° does $\cos\theta = -\sin\theta$?

Find all values of θ, if θ is in the interval $[0°, 360°)$ and has the given function value. See Example 6.

67. $\sin\theta = \frac{1}{2}$

68. $\cos\theta = \frac{\sqrt{3}}{2}$

69. $\tan\theta = -\sqrt{3}$

70. $\sec\theta = -\sqrt{2}$

71. $\cos\theta = \frac{\sqrt{2}}{2}$

72. $\cot\theta = -\frac{\sqrt{3}}{3}$

73. $\csc\theta = -2$

74. $\sin\theta = -\frac{\sqrt{3}}{2}$

75. $\tan\theta = \frac{\sqrt{3}}{3}$

76. $\cos\theta = -\frac{1}{2}$

77. $\csc\theta = -\sqrt{2}$

78. $\cot\theta = -1$

15.3 Finding Trigonometric Functions with a Calculator

CAUTION ***When evaluating trigonometric functions of angles given in degrees, remember that the calculator must be set in degree mode.*** Get in the habit of always starting work by entering sin 90. If the displayed answer is 1, then the calculator is set for degree measure. Remember that most calculator values of trigonometric functions are *approximations*.

EXAMPLE 1 Finding Function Values with a Calculator

Approximate the value of each expression.

(a) $\sin 49° 12'$ **(b)** $\sec 97.977°$ **(c)** $\dfrac{1}{\cot 51.4283°}$ **(d)** $\sin(-246°)$

Solution

(a) $49° 12' = 49\frac{12°}{60} = 49.2°$ Convert 49° 12′ to decimal degrees.

$\sin 49° 12' = \sin 49.2° \approx 0.75699506$ To eight decimal places

(b) Calculators do not have secant keys. However, $\sec \theta = \frac{1}{\cos \theta}$ for all angles θ where $\cos \theta \neq 0$. First find $\cos 97.977°$, and then take the reciprocal to get

$$\sec 97.977° \approx -7.20587921.$$

(c) Use the reciprocal identity $\tan \theta = \frac{1}{\cot \theta}$ from **Section 14.4** to get

$$\frac{1}{\cot 51.4283°} = \tan 51.4283° \approx 1.25394815.$$

(d) $\sin(-246°) \approx 0.91354546$

NOW TRY **Exercises 5, 7, 13, and 17.**

Use a calculator to find a decimal approximation for each value. Give as many digits as your calculator displays. In Exercises 16–22, simplify the expression before using the calculator. See Example 1.

5. $\sin 38° 42'$

7. $\sec 13° 15'$

13. $\sin(-317° 36')$

15. $\cos(-15')$

17. $\dfrac{1}{\cot 23.4°}$

19. $\dfrac{\cos 77°}{\sin 77°}$

EXAMPLE 2 Using Inverse Trigonometric Functions to Find Angles

Use a calculator to find an angle θ in the interval $[0°, 90°]$ that satisfies each condition.

(a) $\sin \theta \approx 0.9677091705$

(b) $\sec \theta \approx 1.0545829$

Solution

(a) Using degree mode and the inverse sine function, we find that an angle θ having sine value 0.9677091705 is 75.4°. (While there are infinitely many such angles, the calculator gives only this one.) We write this result as

$$\theta \approx \sin^{-1} 0.9677091705 \approx 75.4°.$$

(b) Use the identity $\cos \theta = \frac{1}{\sec \theta}$. Find the reciprocal of 1.0545829 to get $\cos \theta \approx 0.9482421913$. Now find θ as shown in part (a), using the inverse cosine function. The result is

$$\theta \approx \cos^{-1} (0.9482421913) \approx 18.514704°.$$

See Figure 16.

NOW TRY **Exercises 25 and 29.**

Find a value of θ in the interval $[0°, 90°]$ that satisfies each statement. Leave answers in decimal degrees. See Example 2.

25. $\sin \theta = 0.27843196$

29. $\sec \theta = 2.7496222$

AMDG

Name ________________ Chapter 15 Ms. Kresovic

Acc Alg 2 – 2 Date ________________

EXAMPLE 3 **Finding Grade Resistance**

When an automobile travels uphill or downhill on a highway, it experiences a force due to gravity. This force F in pounds is called **grade resistance** and is modeled by the equation $F = W \sin \theta$, where θ is the grade and W is the weight of the automobile. If the automobile is moving uphill, then $\theta > 0°$; if downhill, then $\theta < 0°$. See Figure 17. (*Source:* Mannering, F. and W. Kilareski, *Principles of Highway Engineering and Traffic Analysis,* Second Edition, John Wiley & Sons, 1998.)

(a) Calculate F to the nearest 10 lb for a 2500-lb car traveling an uphill grade with $\theta = 2.5°$.

(b) Calculate F to the nearest 10 lb for a 5000-lb truck traveling a downhill grade with $\theta = -6.1°$.

(c) Calculate F for $\theta = 0°$ and $\theta = 90°$. Do these answers agree with your intuition?

Solution

(a) $F = W \sin \theta = 2500 \sin 2.5° \approx 110$ lb

(b) $F = W \sin \theta = 5000 \sin(-6.1°) \approx -530$ lb
F is negative because the truck is moving downhill.

(c) $F = W \sin \theta = W \sin 0° = W(0) = 0$ lb
$F = W \sin \theta = W \sin 90° = W(1) = W$ lb

This agrees with intuition because if $\theta = 0°$, then there is level ground and gravity does not cause the vehicle to roll. If $\theta = 90°$, the road would be vertical and the full weight of the vehicle would be pulled downward by gravity, so $F = W$.

NOW TRY Exercises 55 and 57.

55. What is the grade resistance of a 2100-lb car traveling on a 1.8° uphill grade?

57. A 2600-lb car traveling downhill has a grade resistance of −130 lb. What is the angle of the grade?