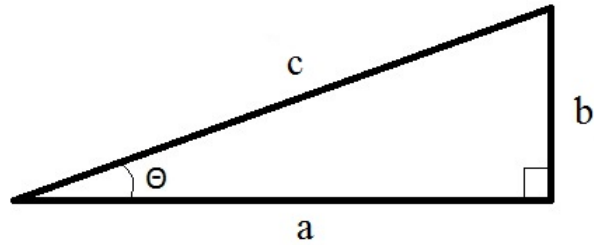


**Math 129: Pre-Calculus**  
**Fall 2024**  
**Practice Problems for Trig Exam**

**Name (Print):** \_\_\_\_\_

- 
1. Convert the angle  $160^\circ$  to radians.
  2. Convert the angle  $\frac{\pi}{18}$  to degrees.
  3. Find an angle between 0 and  $2\pi$  that is coterminal to  $-\frac{19\pi}{7}$ .
  4. Find the reference angle of  $-\frac{19\pi}{7}$ .
  5. If  $\theta$  is an angle such that  $\sin(\theta) < 0$  and  $\tan(\theta) > 0$ , in what quadrant must  $\theta$  lie?
  6. Find the terminal point on the unit circle determined by  $t = \frac{\pi}{6}$ .
  7. A circle with radius 3 has a sector with area  $6\pi$ . Find the length of the arc surrounding this sector.
  8. What is the domain of the function  $f(x) = \sin^{-1}(x)$ ?
  9. What is the range of the function  $f(x) = \cos^{-1}(x)$ ?
  10. What is the range of the function  $f(x) = \tan^{-1}(x)$ ?
  11. What is the amplitude of the function  $f(x) = 3 \cos(7x - 2) + 5$ ?
  12. What is the period of the function  $f(x) = 3 \cos(7x - 2) + 5$ ?

The following questions are based on a triangle of this form:



13. If  $b = 3$  and  $c = 4$ , find  $a$ .

14. If  $a = 5$  and  $c = 7$ , find  $\tan \theta$ .

15. If  $a = 4$  and  $\theta = 45^\circ$ , find  $c$ .

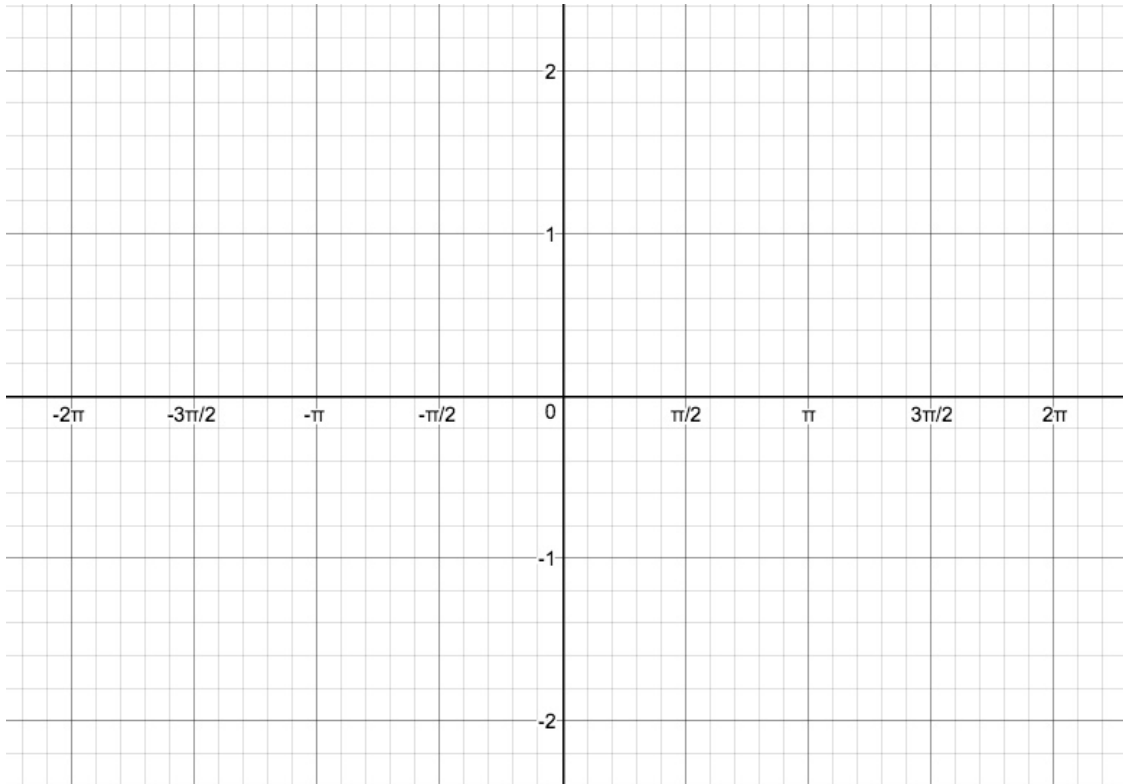
16. If  $b = 1$  and  $c = 2$ , find the value of  $\theta$ .

17. If  $b = 1$  and  $c = 3$ , find the area of the triangle.

In these problems, you are given three parts of an oblique triangle, where side  $a$  is opposite angle  $A$ , side  $b$  is opposite angle  $B$ , and side  $c$  is opposite angle  $C$ . In each problem, follow the instructions to give the desired information.

18. Suppose that  $A = 30^\circ$ ,  $C = 80^\circ$ , and  $b = 10$ . Find the length of side  $a$ .
  
  
  
  
  
  
  
  
  
  
19. Suppose that  $A = 40^\circ$ ,  $B = 70^\circ$ , and  $a = 2$ . Find the length of side  $b$ .
  
  
  
  
  
  
  
  
  
  
20. Suppose that  $a = 8$ ,  $b = 10$ , and  $c = 12$ . Find the measure of angle  $A$ .
  
  
  
  
  
  
  
  
  
  
21. Suppose that  $A = 120^\circ$ ,  $b = 8$ ,  $c = 2$ . Find the length of side  $a$ .
  
  
  
  
  
  
  
  
  
  
22. Suppose that  $A = 35^\circ$ ,  $b = 2$ ,  $c = 7$ . Find the area of the triangle.
  
  
  
  
  
  
  
  
  
  
23. Suppose that  $A = 25^\circ$ ,  $a = 12$ , and  $c = 23$ . How many possible solutions are there to this triangle?

24. On the grid below, sketch the graphs of  $f(x) = 2\sin(3x)$  and  $g(x) = \cos(x) - 1$ .



25. Review what the graphs of  $\tan(x)$ ,  $\cot(x)$ ,  $\sec(x)$ , and  $\csc(x)$  look like. (For example, redo the graph-matching problem from Exam 3.)

26. Consider each of the following angles, expressed with inverse trig functions. Determine the quadrant of each angle.

(a)  $\sin^{-1}\left(-\frac{2}{3}\right)$

(b)  $\tan^{-1}\left(-\frac{2}{3}\right)$

(c)  $\cos^{-1}\left(-\frac{2}{3}\right)$

27. For each of the following, find the exact value of the expression (that is, a rounded answer from your calculator will NOT be good enough).
- (a)  $\sin^{-1}(\sin(\frac{2\pi}{3}))$
  
  - (b)  $\tan(\tan^{-1}(-4))$
  
  - (c)  $\csc(\sin^{-1}(0))$
  
  - (d)  $\sin(\tan^{-1}(-1))$
28. Verify the identity  $(1 - \tan x)(1 - \cot x) = 2 - \sec x \csc x$ .
29. Verify the identity  $\frac{\sin 2x}{\sin x} - \frac{\cos 2x}{\cos x} = \sec x$ .
30. Verify the identity  $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 2 + 2 \cos(x + y)$ .
31. Use a half-angle formula to find the exact value of  $\tan(15^\circ)$ . (A rounded answer from your calculator will NOT be good enough.)
32. Use a half-angle formula to find the exact value of  $\sin\left(\frac{\pi}{8}\right)$ . (A rounded answer from your calculator will NOT be good enough.)
33. Write the expression  $\csc(\tan^{-1} x)$  as an algebraic expression in terms of  $x$ .
34. Write the expression  $\tan(\cos^{-1} x)$  as an algebraic expression in terms of  $x$ .
35. Write the expression  $\cos(\sin^{-1} x + \cos^{-1} y)$  as an algebraic expression in terms of  $x$  and  $y$ .
36. Write the expression  $\sin(2 \tan^{-1} x)$  as an algebraic expression in terms of  $x$ .

37. Find the general solution of the equation  $6 \sin(\theta) + 10 = 7$ .
38. Find the general solution of the equation  $4 \cos(\theta) = 1$ .
39. Find the general solution of the equation  $11 - \tan(\theta) = 3$ .
40. Find the general solution of the equation  $\cos(\theta) \sin(\theta) - \cos(\theta) = 0$ .
41. Find the general solution of the equation  $\sin(\theta) = \cos(2\theta)$ .
42. Let  $z = 1 + i$ , let  $w = 1 - \sqrt{3}i$ .
- Write  $z$  and  $w$  in polar form.
  - Compute  $zw$ .
  - Compute  $(zw)^7$ .
  - Compute  $\frac{z^2}{w^3}$ .
43. Consider the point  $P = (-\sqrt{6}, \sqrt{2})$  in rectangular coordinates. Convert  $P$  to polar coordinates.
44. Consider the point  $Q = (3, \pi/6)$  in polar coordinates. Convert  $Q$  to rectangular coordinates.
45. Using the variables  $x$  and  $y$ , convert the polar equation  $r = 6 \sec \theta$  to rectangular coordinates.
46. Using the variables  $x$  and  $y$ , convert the polar equation  $r = 2 \cos \theta$  to rectangular coordinates.
47. Using the variables  $x$  and  $y$ , convert the polar equation  $r = 1 + \cos \theta$  to rectangular coordinates.

48. Consider the vector  $\mathbf{v} = \langle 7, -2 \rangle$ , and let  $\mathbf{u}$  be the vector with magnitude  $\sqrt{8}$  and direction  $135^\circ$ .
- (a) Write  $\mathbf{v}$  in terms of  $\mathbf{i}$  and  $\mathbf{j}$ .
  - (b) Compute the magnitude of  $\mathbf{v}$ .
  - (c) Compute the direction of  $\mathbf{v}$ .
  - (d) Write  $\mathbf{u}$  in component form.
  - (e) Compute the dot product  $\mathbf{u} \cdot \mathbf{v}$ .
  - (f) Compute the angle between  $\mathbf{u}$  and  $\mathbf{v}$ .
  - (g) Compute the vector  $9\mathbf{u} + 4\mathbf{v}$  in component form.
  - (h) Determine whether  $9\mathbf{u} + 4\mathbf{v}$  is orthogonal to  $\mathbf{u}$ .
49. To estimate the height of a mountain above a level plain, the angle of elevation to the top of the mountain is measured to be  $32^\circ$ . One thousand feet closer to the mountain along the plain, it is found that the angle of elevation is  $35^\circ$ . Find the height of the mountain, to the nearest foot.
50. A 96-ft tree casts a shadow that is 120 ft long. What is the angle of elevation of the sun?
51. The Leaning Tower of Pisa leans  $5.6^\circ$  from the vertical. A tourist stands 105 m from its base with the tower leaning directly towards her. She measures the angle of elevation to the top of the tower to be  $29.2^\circ$ . Find the length of the tower, to the nearest meter.
52. A lawn mower is pushed a distance of 200 ft along a horizontal path by a constant force of 50 lb. The handle of the lawn mower is at an angle of  $30^\circ$  from the horizontal. Find the work done.