Math 129: Pre-Calculus **Name (Print):** _____
Fall 2020
Practice Problems for Trig Exam

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1. Convert the angle 160° to radians.

2. Convert the angle $\frac{\pi}{18}$ to degrees.

3. Find an angle between 0 and 2π that is coterminal to $-\frac{19\pi}{7}$.

4. Find the reference angle of $-\frac{19\pi}{7}$.

5. If θ is an angle such that $\sin(\theta) < 0$ and $\tan(\theta) > 0$, in what quadrant must θ lie?

6. Find the terminal point on the unit circle determined by $t = \dfrac{\pi}{6}$.

7. What is the domain of the function $f(x) = \sin^{-1}(x)$?

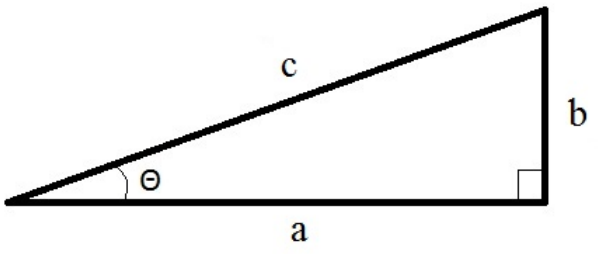
8. What is the range of the function $f(x) = \cos^{-1}(x)$?

9. What is the range of the function $f(x) = \tan^{-1}(x)$?

10. What is the amplitude of the function $f(x) = 3\cos(7x - 2) + 5$?

11. 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:



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

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

14. If $a = 4$ and $\theta = 45°$, find c.

15. If $b = 1$ and $c = 2$, find the value of θ.

16. 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.

17. Suppose that $A = 30°$, $C = 80°$, and $b = 10$. Find the length of side a.

18. Suppose that $A = 40°$, $B = 70°$, and $a = 2$. Find the length of side b.

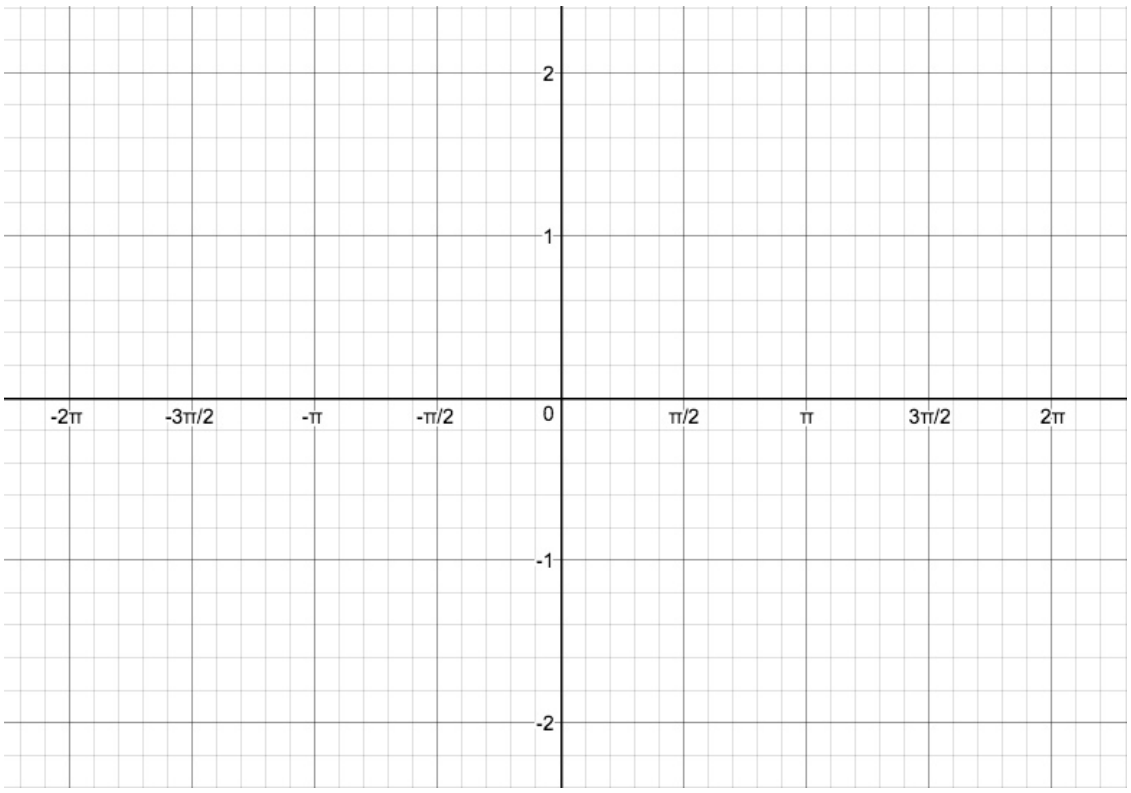
19. Suppose that $a = 8$, $b = 10$, and $c = 12$. Find the measure of angle A.

20. Suppose that $A = 120°$, $b = 8$, $c = 2$. Find the length of side a.

21. Suppose that $A = 35°$, $b = 2$, $c = 7$. Find the area of the triangle.

22. Suppose that $A = 25°$, $a = 12$, and $c = 23$. How many possible solutions are there to this triangle?

23. On the grid below, sketch the graphs of $f(x) = \sin(x)$ and $g(x) = \cos(x)$.



24. 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.)

25. 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) $\sin(\tan^{-1}(-1))$

26. Verify the identity $(1 - \tan x)(1 - \cot x) = 2 - \sec x \csc x$.

27. Verify the identity $\dfrac{\sin 2x}{\sin x} - \dfrac{\cos 2x}{\cos x} = \sec x$.

28. Verify the identity $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 2 + 2\cos(x + y)$.

29. Use a half-angle formula to find the exact value of $\tan(15°)$. (A rounded answer from your calculator will NOT be good enough.)

30. Use a half-angle formula to find the exact value of $\cos\left(\dfrac{\pi}{8}\right)$. (A rounded answer from your calculator will NOT be good enough.)

31. Write the expression $\cos(\sin^{-1} x + \cos^{-1} y)$ as an algebraic expression in terms of x and y.

32. Write the expression $\sin(2\tan^{-1} x)$ as an algebraic expression in terms of x.

33. Solve the equation $4\cos\theta = 1$.

34. Solve the equation $\cos\theta \sin\theta - \cos\theta = 0$.

35. Solve the equation $\tan(3\theta) = 5$

36. Solve the equation $\sin\theta = \cos 2\theta$.

37. Let $z = 1 + i$, let $w = 1 - \sqrt{3}i$.
    (a) Write z and w in polar form.

    (b) Compute zw.

    (c) Compute $(zw)^7$.

    (d) Compute $\frac{z^2}{w^3}$.

38. Consider the point $P = (-\sqrt{6}, \sqrt{2})$ in rectangular coordinates. Convert P to polar coordinates.

39. Consider the point $Q = (3, \pi/6)$ in polar coordinates. Convert Q to rectangular coordinates.

40. Using the variables x and y, convert the polar equation $r = 6\sec\theta$ to rectangular coordinates.

41. Using the variables x and y, convert the polar equation $r = 2\cos\theta$ to rectangular coordinates.

42. Using the variables x and y, convert the polar equation $r = 1+\cos\theta$ to rectangular coordinates.

43. Consider the vector $\mathbf{v} = \langle 7, -2\rangle$, and let $\mathbf{u}$ be the vector with magnitude $\sqrt{8}$ and direction $135°$.
    (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 $\mathbf{u}$.

    (i) Calculate the component of $\mathbf{u}$ along $\mathbf{v}$.

    (j) Calculate the projection of $\mathbf{u}$ onto $\mathbf{v}$, $\text{proj}_{\mathbf{v}}\mathbf{u}$.

44. 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°. One thousand feet closer to the mountain along the plain, it is found that the angle of elevation is 35°. Find the height of the mountain, to the nearest foot.

45. A 96-ft tree casts a shadow that is 120 ft long. What is the angle of elevation of the sun?

46. The Leaning Tower of Pisa leans 5.6° 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°. Find the length of the tower, to the nearest meter.

47. A pilot heads his jet due east. The jet has a speed of 425 miles per hour relative to the air. The wind is blowing due north with a speed of 40 miles per hour. Find the true velocity of the jet as a vector.

48. A boat heads in the direction N 72°E. The speed of the boat relative to the water is 24 miles per hour. The water is flowing directly south at an unknown speed. It is observed that the true direction of the boar is directly east. Find the speed of the flow of the water.

49. 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° from the horizontal. Find the work done.