

PART I. NO PARTIAL CREDIT GIVEN. Circle the correct answer. (2 points each)

---

1. The *exact* value of  $\cos 30^\circ$  is

(a) 0.866

(b)  $\frac{1}{2}$

(c)  $\frac{\sqrt{3}}{2}$

(d)  $\frac{\sqrt{2}}{2}$

2. For any right triangle,  $\sin \theta =$

(a)  $\cot(90^\circ - \theta)$

(b)  $\tan(90^\circ - \theta)$

(c)  $\cos(90^\circ - \theta)$

(d) None of these

3. Which equation represents a parabola opening to the right?

(a)  $(x - 2)^2 = 8(y - 5)$

(b)  $(y - 5)^2 = 8(x - 2)$

(c)  $(y - 5)^2 = -8(x - 2)$

(d)  $y = x^2$

4. The reference angle for  $-780^\circ$  is

(a)  $30^\circ$

(b)  $45^\circ$

(c)  $60^\circ$

(d) Undefined

5. How many solutions on  $[0, 2\pi)$  are there for  $\cos(2x) = 0$ ?

(a) 0

(b) 2

(c) 4

(d) 6

6. An angle that is co-terminal with  $\frac{2\pi}{3}$  is

(a)  $\frac{5\pi}{3}$

(b)  $-\frac{2\pi}{3}$

(c)  $\frac{7\pi}{3}$

(d)  $\frac{8\pi}{3}$

7. The amplitude of the function  $f(x) = 5 \sin(3x - 2) + 4$  is

(a) 5

(b) 3

(c) 2

(d) 4

8. Given any triangle with angle  $x$ ,  $\sin^2 x + \cos^2 x = 1$ .

(a) True

(b) False

(c) Cannot be determined

9. The domain of  $\sin^{-1} x$  is the same as the range of  $\sin x$ .

(a) True

(b) False

(c) Cannot be determined

10. When converting the rectangular point  $(3, 3)$  to polar coordinates, the angle  $\theta$  would be

(a)  $30^\circ$

(b)  $45^\circ$

(c)  $3^\circ$

(d)  $\frac{\pi}{3}$

---

**PART II. PARTIAL CREDIT. Show all work. (6 points each)**

---

11. Solve the triangle  $\triangle ABC$ . Round to the nearest whole number.

A =

a =

B =

b = 13

C =  $90^\circ$

c = 23

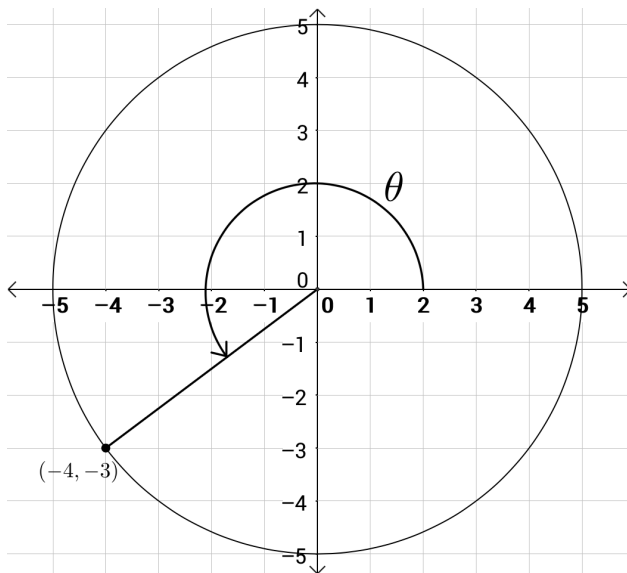
12. Give the **exact** function value of the following.

(a)  $\sin \frac{5\pi}{4}$

(b)  $\cos(-45^\circ)$

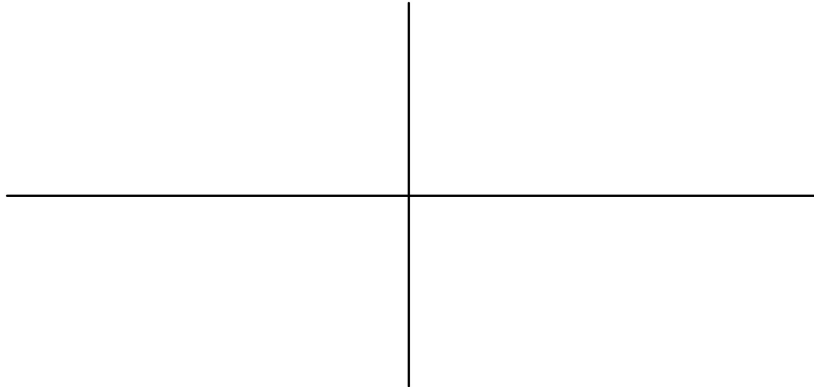
(c)  $\tan \frac{\pi}{3}$

13. Find the six trigonometric functions of angle  $\theta$  in the figure below.



14. Give the **exact** function value of  $2 \sin(22.5^\circ) \cos(22.5^\circ)$ .

15. Graph at least one full period of the function  $f(x) = 3 \sin(2x) + 1$ . Label the max/min on the  $y$ -axis and label all  $x$ -intercepts.



16. Simplify.  $\frac{\sin^4 x - \cos^4 x}{\sin^2 x - \cos^2 x}$

17. Give the **exact** value on  $[0, 2\pi)$ .

(a)  $\sin^{-1}(\cos(120^\circ))$

(b)  $\sin \left( \cos^{-1} \left( \frac{3}{7} \right) \right)$

18. Find all values of  $\theta$  on  $[0, 360^\circ)$  where  $\sin \theta = 0.34202$ . Round to the nearest whole degree.

19. Solve, finding all solutions on  $[0, 2\pi)$ .  $2 \sec x \tan x + 2 \sec x + \tan x + 1 = 0$

20. Determine whether the vectors  $\mathbf{u} = \overrightarrow{AB}$  and  $\mathbf{v} = \overrightarrow{CD}$  are equivalent. Explain your answer using the magnitude and direction.  $A = (2, 4)$ ,  $B = (-1, 3)$ ,  $C = (4, -1)$ ,  $D = (1, -2)$ .

21. Find the trigonometric notation for the complex number.  $1 + i$

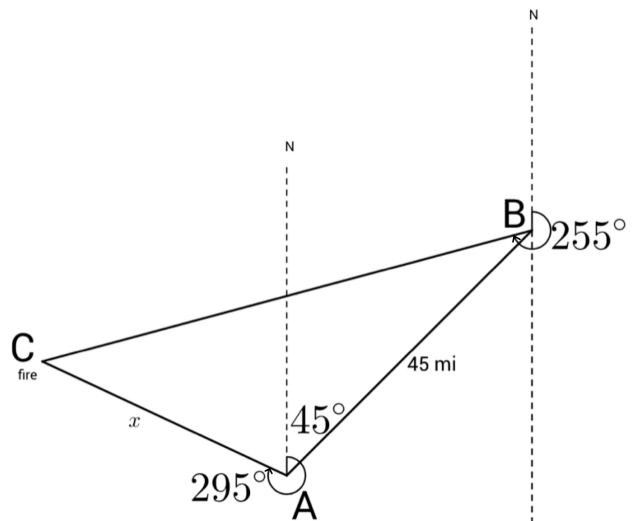
22. Convert the following.

(a) To polar:  $x^2 + y^2 = 25$

(b) To rectangular:  $r = 2 \cos \theta + 5 \sin \theta$

23. Multiply and simplify.  $(1 - \sin x)(1 + \sin x)$

24. A ranger in fire tower A spots a fire at a direction of  $295^\circ$ . A ranger in fire tower B, located 45 mi at a direction of  $45^\circ$  from tower A, spots the same fire at a direction of  $255^\circ$ . How far from tower A is the fire?



25. Let  $z_1 = 4(\cos 45^\circ + i \sin 45^\circ)$  and  $z_2 = 2(\cos 15^\circ + i \sin 15^\circ)$ . Find  $\frac{z_1}{z_2}$ .

Write your answer in standard  $a + bi$  form.

**PART III. PARTIAL CREDIT. Mathematical steps/details required. (12 points each)**

---

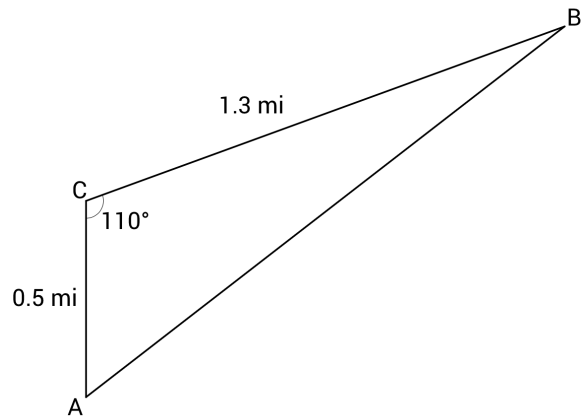
26. Given  $\sin \theta = -\frac{3}{5}$ ,  $\theta$  in quadrant IV, find the exact value of the following.

(a)  $\sin 2\theta$

(b)  $\cos 2\theta$

27. Prove the identity.  $\sin(\alpha + \beta) \sin(\alpha - \beta) = \sin^2 \alpha - \sin^2 \beta$

28. An in-line skater skates on a fitness trail along the Pacific Ocean from point  $A$  to point  $B$ . Two streets intersecting at point  $C$  also intersect the trail at  $A$  and  $B$ . In her car, the skater found the length of  $AC$  to be 0.5 mi and the length of  $BC$  to be 1.3 mi. She estimates the angle  $C$  to be  $110^\circ$ . How far did she skate from point  $A$  to point  $B$ ?



29. Solve  $10 \sin^2 x - 12 \sin x - 7 = 0$  in the interval  $[0, 360^\circ)$ . Round to the nearest whole degree.



30. Find the center, the vertices, and the foci of the ellipse.  $4x^2 + y^2 - 8x - 2y + 1 = 0$

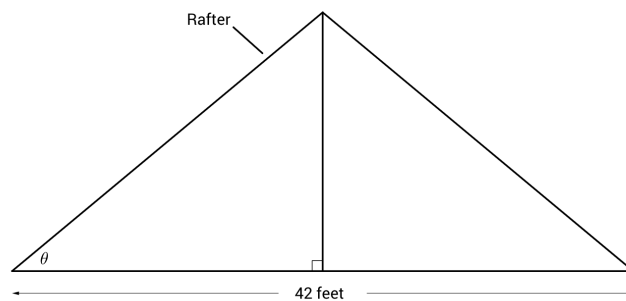
---

**PART IV. PARTIAL CREDIT.** Choose 3 of the following 5 problems. Be sure to mark the 3 that you want graded. If you do not indicate which 3 to grade, the first 3 will be graded. Mathematical steps/details required. (10 points each)

---

GRADE↓

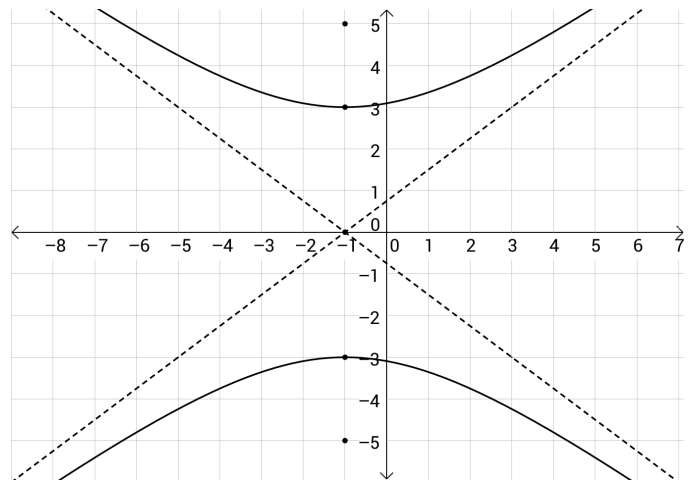
31. José is constructing rafters for a roof with a 10/12 pitch (rise over run) on a house that is 42 feet wide. Find the length of the rafter of the house to the nearest tenth of a foot.



GRADE↓

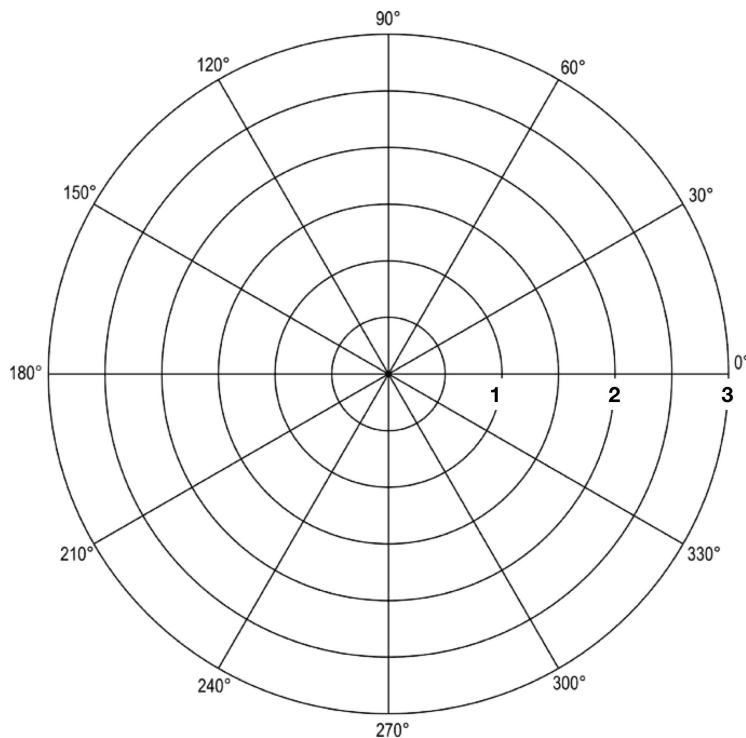
32. Given the graph of a hyperbola, find the following.

- (a) Center
- (b) Vertices
- (c) Foci
- (d) Equation of asymptotes
- (e) Equation of hyperbola



GRADE↓

33. Graph the polar equation  $r = 3 \sin 2\theta$



GRADE↓

34. Find the sixth roots of  $-1$ .

GRADE↓

35. Simplify.  $\sin(\alpha + \beta) + \sin(\alpha - \beta)$