



8. Given two vectors  $\mathbf{u}$  and  $\mathbf{v}$  where  $\mathbf{u} = \langle 0, 3 \rangle$  and  $\mathbf{v} = \langle 4, 0 \rangle$ , then the dot product  $\mathbf{u} \cdot \mathbf{v} =$

- (a)  $\langle 4, 3 \rangle$                       (b)  $\langle 0, 0 \rangle$                       (c) 12                      (d) 7                      (e) None of these

9. Evaluate and simplify.  $\sin^{-1} \left( \sin \left( \frac{5\pi}{4} \right) \right)$

- (a)  $-\frac{\sqrt{2}}{2}$                       (b)  $\frac{\pi}{4}$                       (c)  $-\frac{\pi}{4}$                       (d)  $\frac{5\pi}{4}$                       (e) None of these

10. Given any right triangle with an acute angle  $\alpha$ ,  $\sin^2 \alpha + \cos^2 \alpha = 1$ .

- (a) True                                      (b) False                                      (c) Cannot be determined

**PART II. PARTIAL CREDIT.**

Show all work where applicable. (6 points each)

11. Find all values of  $x \in [0, 360^\circ)$  where  $\sin x = 0.848$ . Approximate to the nearest whole degree.

12. Find the exact function value of the following.

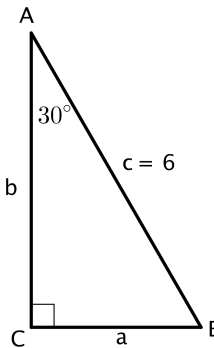
- (a)  $\sin 330^\circ$                                       (b)  $\cos 45^\circ$                                       (c)  $\tan 225^\circ$

13. Solve the following right triangle. Give exact values.

A =  $30^\circ$                       a =

B =                                      b =

C =  $90^\circ$                       c = 6



14. Find the reference angle and the exact function value if it exists.

$$\sin 300^\circ$$

Reference angle \_\_\_\_\_

Function value \_\_\_\_\_

15. Convert the angles.

(a) Convert to radian measure:  $120^\circ$

(b) Convert to degree measure:  $\frac{\pi}{3}$

16. Sketch the graph of  $y = 2 \sin \left( x - \frac{\pi}{4} \right)$  over 1 period. Label the  $x$ -axis with intercepts and max/min values.

17. Given  $y = 3 \sin \left( 2x + \frac{\pi}{2} \right) + 1$ , find the following.

(a) Amplitude \_\_\_\_\_ (b) Period \_\_\_\_\_ (c) Phase Shift \_\_\_\_\_

18. Simplify.  $\frac{30 \sin^2 x \cos x}{6 \cos^2 x \sin x}$

19. Complete the identity.

(a)  $\sin\left(\frac{\pi}{2} - x\right) =$                       (b)  $\cos\left(\frac{\pi}{2} - x\right) =$                       (c)  $\tan\left(\frac{\pi}{2} - x\right) =$

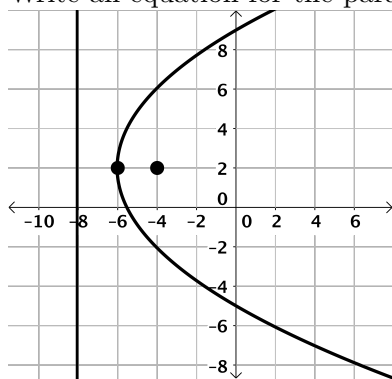
20. State the domain and range (in interval notation) of the following inverse functions.

(a)  $\sin^{-1} \theta$                       (b)  $\cos^{-1} \theta$                       (c)  $\tan^{-1} \theta$

Domain \_\_\_\_\_                      Domain \_\_\_\_\_                      Domain \_\_\_\_\_

Range \_\_\_\_\_                      Range \_\_\_\_\_                      Range \_\_\_\_\_

21. Write an equation for the parabola with the given focus and directrix in the graph below.



22. Find the absolute value of the complex number.  $z = -2 - i$

23. Convert to a rectangular equation:  $r = 3 \cos \theta - \sin \theta$

24. Given the vectors  $\mathbf{u} = \langle -3, 2 \rangle$  and  $\mathbf{v} = \langle 5, -9 \rangle$ , find  $\mathbf{u} + \mathbf{v}$ .

25. Solve, finding all solutions on  $[0, 2\pi)$ .  $\sec^2 \theta - 2 \tan^2 \theta = 0$

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**PART III. PARTIAL CREDIT.**

**Mathematical steps/details required. (12 points each)**

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

(a)  $\sin 2\theta$

(b)  $\cos 2\theta$

27. Prove the identity.  $\frac{\sin 2x}{\sin x} - \frac{\cos 2x}{\cos x} = \sec x$

28. Find all the complex solutions of the equation:  $x^4 - 1 = 0$ . (i.e. Find the fourth roots of 1.)  
Write your answer in standard form.

29. Solve the triangle.

$$A =$$

$$a =$$

$$B = 29^\circ$$

$$b = 15$$

$$C =$$

$$c = 20$$

30. Find the equation of a hyperbola satisfying the given conditions. Sketch the graph and label the vertices, the foci, and the asymptotes.

Vertices at  $(0, 3)$  and  $(0, -3)$

Foci at  $(0, 5)$  and  $(0, -5)$

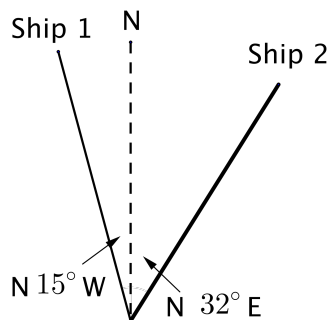
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**PART IV. Choose 3 of the following 5 problems Be sure to mark the 3 that you want graded. If you do not indicate which 3 to grade, the first 3 will be graded. Mathematical steps/details required. (10 points each)**

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**GRADE↓**

31. Two ships leave harbor at the same time. The first sails  $N15^\circ W$  at 25 knots. The second sails  $N32^\circ E$  at 20 knots. (A knot is one nautical mile per hour.) After 2 hours, how far apart are the ships? (Answer in nautical miles.)



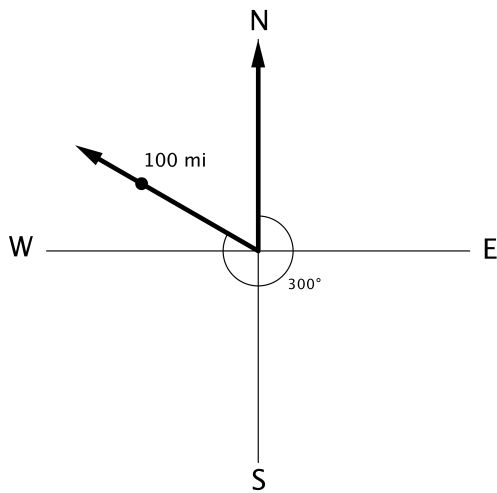


**GRADE↓**

32. Solve  $5 \sin^2 \theta - 8 \sin \theta = 3$  in the interval  $[0^\circ, 360^\circ)$ . Round to the nearest tenth of a degree.

**GRADE↓**

33. An airplane leaves an airport and travels for 100 miles in a direction of  $300^\circ$ . Answer the following to the nearest whole mile.

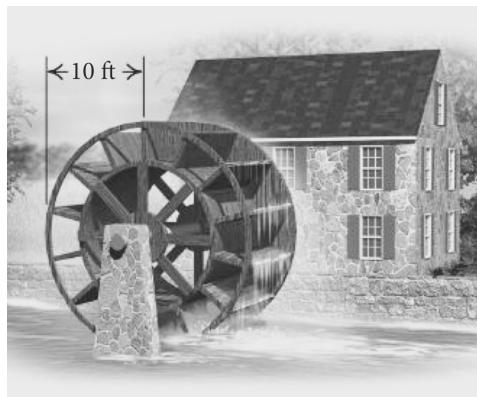


(a) How far north of the airport is the plane?

(b) How far west of the airport is the plane?

**GRADE**↓

34. A waterwheel has a 10-ft radius. To get a good approximation of the speed of the river, you count the revolutions of the wheel and find that it makes 14 revolutions per minute. What is the speed of the river, in miles per hour? (1 mile = 5280 feet)



**GRADE**↓

35. Given the equation  $4x^2 + y^2 + 24x - 2y + 21 = 0$ , find the following. Cross out items that do not pertain to this type of conic.

Type of conic	Directrix	Vertex/Vertices
Center	Asymptotes	Focus/Foci