

PART I. True/False. Circle the correct answer. No partial credit given. 2 points each.

1. **TRUE** **FALSE** The Law of Cosines can be used to solve a triangle when all 3 angles are known, but no sides are known.

2. **TRUE** **FALSE** The vectors $\langle 1, -5 \rangle$ and $\langle -5, 1 \rangle$ are equivalent.

3. **TRUE** **FALSE** For all values of x , $\sin^2 x + \cos^2 x = 1$.

4. **TRUE** **FALSE** The range of $\sin^{-1} x$ is $[0, \pi)$.

5. **TRUE** **FALSE** For all values of α and β , $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$.

6. **TRUE** **FALSE** For any right triangle where θ is an acute angle, $\sin \theta = \cos(90^\circ - \theta)$.

7. **TRUE** **FALSE** The equation $\frac{x^2}{4} - \frac{y^2}{4} = 1$ represents a circle.

8. **TRUE** **FALSE** The exact value of $\sin 60^\circ = 0.8660254038$.

9. **TRUE** **FALSE** The reference angle for $\cos 480^\circ$ is 60° .

10. **TRUE** **FALSE** Given the vectors \vec{u} and \vec{v} where $|\vec{v}| = 3$ and $|\vec{u}| = 4$, then $\vec{u} + \vec{v} = 7$.

PART II. Mathematical steps/details required. Points vary as shown.
Unless otherwise indicated, give an exact value or expression.

11. (6 points) Given $y = 3 \sin \left(3x + \frac{\pi}{2} \right) + 5$, determine the following.

(a) Amplitude _____

(b) Period _____

(c) Phase shift _____

12. (12 points) Given vectors $\vec{v} = 3\mathbf{i} - 4\mathbf{j}$, $\vec{w} = 2\mathbf{i} + 2\mathbf{j}$ and θ the angle between \vec{v} and \vec{w} .

(a) Find the length of \vec{v} . _____

(b) Find the length of \vec{w} . _____

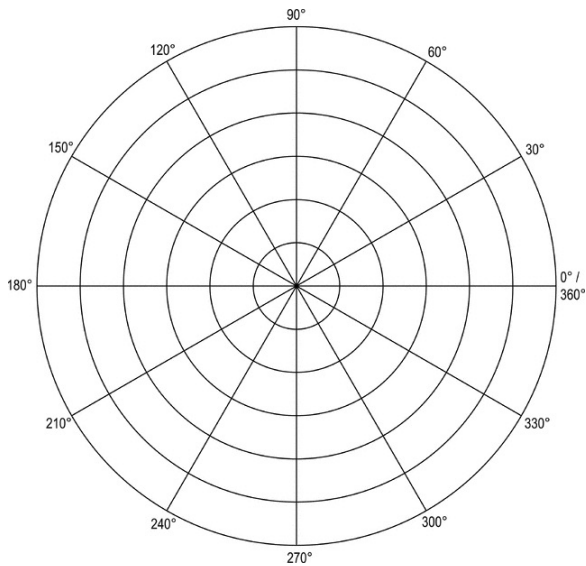
(c) Find $\vec{v} \cdot \vec{w}$. _____

(d) Give an exact value for $\cos \theta$. _____

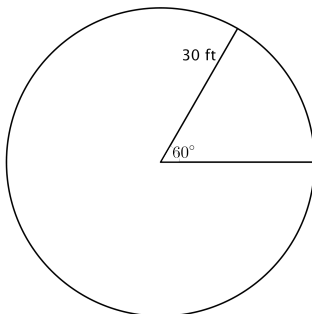
13. (12 points) Prove the following identity by starting with one side and obtaining the other side by writing a sequence of equivalent expressions. (No credit will be given if work is done on both sides of the equal sign.)

$$\frac{\tan^2 x}{\tan^2 x + 1} = \sin^2 x$$

14. (10 points) Graph the following equation in polar form. $r = \cos(3\theta)$



15. (8 points) Find the length of the arc intercepted by a central angle of 60° in a circle with a radius of 30 feet.



16. (13 points) Given $\sin \theta = \frac{3}{5}$ and $\sin \beta = -\frac{12}{13}$ with θ in Quadrant I and β in Quadrant IV, find the exact value of the following.

(a) $\cos(\theta + \beta)$

(b) $\sin(2\theta)$

17. (5 points) Find the exact value of the following: $\cos(\tan^{-1}(-1))$.

18. (6 points) Add and write as a single fraction: $\frac{1}{\sin x} + \frac{1}{\cos x}$.

19. (14 points) Solve the following on $[0, 2\pi)$. Answer in exact values.

(a) $\sin(3x) + 1 = 0$

(b) $2 \cos^2 x - 3 \cos x + 1 = 0$

20. (6 points) Convert the following from rectangular to polar.

(a) $y^2 = 36 - x^2$

(b) $(0, -3)$

21. (6 points) Graph the equation $f(x) = 2 \sin\left(x - \frac{\pi}{2}\right)$ over 1 period.

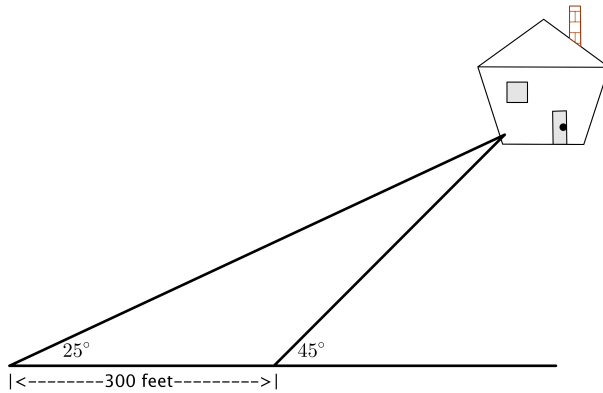
22. (10 points) Given the complex number $(1 - i)$, complete the following.

(a) Write in trigonometric notation.

(b) Find $(1 - i)^5$.

23. (10 points) Solve for θ , where $0 \leq \theta < 2\pi$: $\sin(2\theta) + \cos \theta = 0$.

24. (10 points) A hiker estimated the angle of elevation to a cabin at the top of the hill to be 25° . After walking 300 feet closer (still on level ground), the hiker estimated the angle of elevation to now be 45° . Approximately how high is the hill? State your answer to the nearest foot.



25. (10 points) Given $\sin \theta = -\frac{1}{3}$ and θ lies in Quadrant III, find the following.

(a) $\cos \theta =$

(b) $\tan \theta =$

26. (12 points) Determine whether Law of Sines or Law of Cosines applies, then solve the triangle, if possible.

(a) $A = 70^\circ, B = 12^\circ, b = 21.4$

(c) $a = 15, c = 7, B = 62^\circ$

(b) $A = 40.2^\circ, B = 39.8^\circ, C = 100^\circ$

PART III. 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. (10 points each.)

GRADE↓

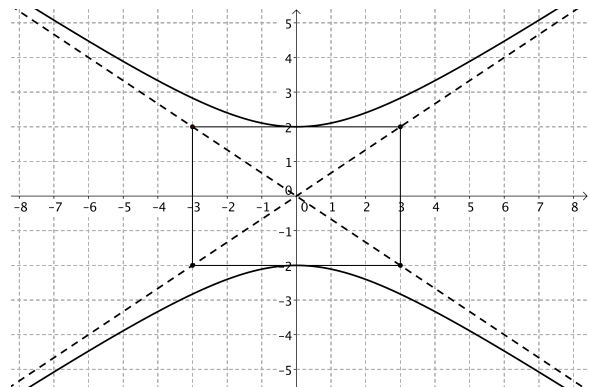
27. Given the equation $y^2 - 2y - 8x - 31 = 0$, find the following.
Cross out items that do not pertain to this type of conic.

- (a) Type of conic _____
- (b) Vertex/Vertices _____
- (c) Focus/Foci _____
- (d) Directrix _____
- (e) Center _____
- (f) Asymptotes _____

GRADE↓

28. Given the following graph, find the following.

- (a) Equation of the conic
- (b) Coordinates of the foci
- (c) Equations of the asymptotes

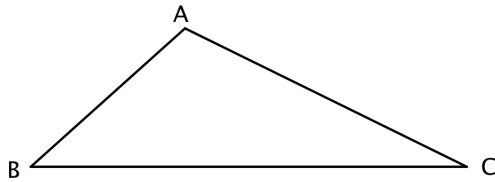


GRADE↓

29. Find all complex solutions of the equation: $x^4 + 81 = 0$.

GRADE↓

30. Find the area of the triangle $\triangle ABC$: $a = 7.2$ feet, $c = 3.4$ feet and $B = 42^\circ$.



GRADE↓

31. Prove the following identity. Remember to work only on one side of the equal sign.

$$\frac{\cos x}{\sec x} + \frac{\sin x}{\csc x} = \sec^2 x - \tan^2 x$$

DID YOU INDICATE WHICH 3 PROBLEMS TO GRADE??!