1. In the given right triangle $b = 9$ and $B = 62^\circ$. Find the length of leg $a$.

(a) $9 \tan 62^\circ$  
(b) $9 \cot 62^\circ$  
(c) $9 \sin 28^\circ$  
(d) $9 \csc 62^\circ$  
(e) $9 \cos 62^\circ$  
(f) $9 \cot 28^\circ$  

(Drawing not to scale)

2. Use fundamental identities and/or the complementary angle theorem to find the value of the following expression: $\sin(80^\circ) \cdot \cos(10^\circ) + \sin(10^\circ) \cdot \cos(80^\circ) - 1$

(a) $1$  
(b) $2 \sin(80^\circ) - 1$  
(c) $\frac{\sqrt{3}}{4}$  
(d) $0$  
(e) $\frac{\sqrt{2}}{2}$  
(f) $\frac{1}{2}$

3. A straight trail leads up to an overlook. At the end of the trail, the elevation is 0.8 miles higher than at the beginning of the trail. The inclination (grade) of the trail is $13^\circ$. What is the length of the trail in miles?

(a) $\frac{0.8}{\sin(13^\circ)}$ mi.  
(b) $0.8 \tan(13^\circ)$ mi.  
(c) $\frac{0.8}{\cos(13^\circ)}$ mi.  
(d) $\frac{0.8}{\tan(13^\circ)}$ mi.  
(e) $0.8 \sin(13^\circ)$ mi.  
(f) $0.8 \cos(13^\circ)$ mi.

4. Given the following triangle, find the measure of the missing side length $x$. Simplify where possible.

(a) $6 \cos 20^\circ$  
(b) $2\sqrt{3} \sin 20^\circ$  
(c) $2 \sin 20^\circ$  
(d) $6 \sin 130^\circ$  
(e) $2\sqrt{3} \cos 130^\circ$  
(f) $6 \sin 20^\circ$  

(Drawing not to scale)

5. Scott is trying to make a triangle with sides $a$, $b$, and $c$ so that $b = 12$, $c = 5$, and $C = 30^\circ$. How many triangles does the given information produce? (assume that in this triangle, side $a$ opposite of angle $A$, side $b$ is opposite of angle $B$, and side $c$ is opposite of angle $C$)

(a) No triangles  
(b) One triangle  
(c) Two triangles  
(d) None of these  
(e) Not enough information to tell

6. Given the following triangle, find the measure of the missing side length $x$. Simplify where possible.

(a) $4 \sin \left(\frac{2^\circ}{19^\circ}\right)$  
(b) $\frac{4 \sin 10^\circ}{\sin 95^\circ}$  
(c) $\frac{4 \sin 95^\circ}{\sin 75^\circ}$  
(d) $\frac{4 \sin 95^\circ}{\sin 10^\circ}$  
(e) $\frac{4 \sin 75^\circ}{\sin 95^\circ}$  
(f) $\frac{\sin 95^\circ}{4 \sin 10^\circ}$  

(Drawing not to scale)
7. Given the following triangle, use the law of cosines to find the measure of the missing angle $\theta$. Simplify where possible.

(a) $\cos^{-1} \frac{3}{4}$  
(b) $\cos^{-1} \frac{3}{32}$  
(c) $\cos^{-1} \frac{25}{32}$  
(d) $\cos^{-1} \frac{25}{16}$  
(e) none of these

8. Sam is trying to build a triangular cage for her new baby hamster. She knows that hamsters prefer $120^\circ$ angles (don’t ask how she knows this, she’s just smart like that), so she wants to make one of the angles in her triangular cage $120^\circ$. If the sides forming this $120^\circ$ angle are 4 ft. long and 1 ft. long, how long is the third side of the cage? (See the picture)

(b) $\sqrt{17 + 4\sqrt{3}}$ ft.  
(c) 21 ft.  
(d) $\sqrt{17 - 4\sqrt{3}}$ ft.  
(e) $\sqrt{21}$ ft.  
(f) $\sqrt{13}$ ft.

9. Find the area of the hamster cage described and shown in the previous problem (#8).

(a) 1 ft$^2$  
(b) 2 ft$^2$  
(c) $\sqrt{3}$ ft$^2$  
(d) 4 ft$^2$  
(e) $2\sqrt{3}$ ft$^2$  
(f) none of these

10. Find the area of a triangle with side lengths 7 miles, 12 miles, and 13 miles.

(a) $1728$ mi$^2$  
(b) $40\sqrt{190}$ mi$^2$  
(c) $42$ mi$^2$  
(d) $24\sqrt{3}$ mi$^2$  
(e) $16$ mi$^2$  
(f) none of these

11. An old fashioned metronome is used to keep time for Tom as he plays the piano. A weight at the end of the arm of the metronome is oscillating under simple harmonic motion. At the rate it is beating, it takes 3 seconds for the weight to go back and forth once (one full oscillation). The weight is 2 inches away from the center rest position at its farthest point. Write an equation that relates the horizontal displacement of the weight from its rest position at any given time $t$ (in seconds).

(a) $d(t) = 2\cos\left(\frac{2\pi t}{3}\right)$  
(b) $d(t) = \cos\left(\frac{2\pi t}{3}\right)$  
(c) $d(t) = 3\cos(\pi t)$  
(d) $d(t) = 2\cos(3t)$

12. An object with a mass of 14 kilograms is attached to the end of a coil spring and is pulled down a distance of 17 m. from its rest position and then released. There is a damping factor of .7 kilograms/second. Assume that the positive direction of motion is up and the object takes 5 seconds to go one full oscillation (under simple harmonic motion). Write an equation that relates the displacement $d(t)$ (in meters) of the object from its rest position after $t$ seconds.

(a) $d(t) = -17e^{-7t/14} \cos\left(\sqrt{5^2 - \frac{(7)^2}{196}} t\right)$  
(b) $d(t) = 17e^{-7t/28} \cos\left(\sqrt{\frac{2\pi^2}{5}} - \frac{(7)^2}{784} t\right)$  
(c) $d(t) = -17e^{-28t/7} \cos\left(\sqrt{\frac{2\pi^2}{5}} - \frac{28^2}{4(7)^2} t\right)$  
(d) $d(t) = -17e^{-7t/28} \cos\left(\sqrt{\frac{2\pi^2}{5}} - \frac{(7)^2}{784} t\right)$
13. Sketch the graph of the following damped vibration curve: \( d(t) = e^{-t/3\pi} \cos(4t) \)

![Graphs](image)

14. Which of the following polar coordinates describe the same point as the point \((-3, \frac{2\pi}{3})\) given in polar coordinates.

\[
\begin{align*}
(a) & \left(3, -\frac{4\pi}{3}\right) \\
(b) & \left(3, \frac{5\pi}{3}\right) \\
(c) & \left(-3, -\frac{\pi}{3}\right) \\
(d) & \left(-3, \frac{4\pi}{3}\right) \\
(e) & \text{none of these}
\end{align*}
\]

15. Which of the following are rectangular coordinates of the point whose polar coordinates are \((8, -\frac{5\pi}{6})\).

\[
\begin{align*}
(a) & (-4, -4\sqrt{3}) \\
(b) & (4, -4\sqrt{3}) \\
(c) & (-4\sqrt{3}, -4) \\
(d) & (-4\sqrt{3}, 4) \\
(e) & \text{none of these}
\end{align*}
\]

16. Convert the following equation from an equation using polar coordinates to an equation using rectangular coordinates: \( r = \cos \theta - \sin \theta \)

\[
\begin{align*}
(a) & \quad x - y = 0 \\
(b) & \quad x^2 + x + y^2 - y = 0 \\
(c) & \quad x^2 - x + y^2 + y = 0 \\
(d) & \quad \text{none of these}
\end{align*}
\]
17. Identify the graph of the following polar equation: \( r = 5 + 3 \sin \theta \)

![Graphs](a), (b), (c), (d), (e), (f)

18. Identify the graph of the following polar equation: \( r = 7 \cos(4\theta) \)

![Graphs](a), (b), (c), (d), (e), (f)

19. If \( z = 6(\cos 75^\circ + i \sin 75^\circ) \) and \( w = 3(\cos 10^\circ + i \sin 10^\circ) \) are complex numbers, find the quotient \( \frac{z}{w} \) (leave your answer in polar form).

(a) \( 2(\cos 65^\circ + i \sin 65^\circ) \)  
(b) \( 18(\cos 85^\circ + i \sin 85^\circ) \)  
(c) \( 18(\cos 65^\circ + i \sin 65^\circ) \)  
(d) \( 2(\cos 7.5^\circ + i \sin 7.5^\circ) \)

20. Using De Moivre’s Theorem, identify the complex number \( \left[ \sqrt{2} \left( \cos \left( \frac{5\pi}{16} \right) + i \sin \left( \frac{5\pi}{16} \right) \right) \right]^4 \) written in the standard rectangular form \( a + bi \).

(a) \( 4\sqrt{2} - 4\sqrt{2}i \)  
(b) \( -2\sqrt{2} + 2\sqrt{2}i \)  
(c) \( -4 - 4i \)  
(d) \( -4 + 4i \)  
(e) \( -2\sqrt{2} - 2\sqrt{2}i \)
Answers:
1. B
2. D
3. A
4. F
5. A
6. B
7. C
8. E
9. C
10. D
11. A
12. D
13. B
14. B
15. C
16. C
17. D
18. E
19. A
20. E