\[
\begin{align*}
\sin(u + v) &= \sin u \cos v + \cos u \sin v \\
\cos(u + v) &= \cos u \cos v - \sin u \sin v \\
\tan(u + v) &= \frac{\tan u + \tan v}{1 - \tan u \tan v} \\
\sin(2u) &= 2\sin u \cos u \\
\cos(2u) &= \cos^2 u - \sin^2 u \\
\tan(2u) &= \frac{2\tan u}{1 - \tan^2 u} \\
\sin^2 \theta + \cos^2 \theta &= 1 \\
1 + \tan^2 \theta &= \sec^2 \theta \\
1 + \cot^2 \theta &= \csc^2 \theta
\end{align*}
\]
1. Given $\triangle ABC$ with $\gamma = 90^\circ$, $\alpha = 30^\circ$, and $b = 15$, find the exact value of side $a$.
   
   A. $15\sqrt{3}$
   
   B. $10\sqrt{3}$
   
   C. $\frac{5}{\sqrt{3}}$
   
   D. $\frac{15}{2}$
   
   E. $5\sqrt{3}$

2. Given $\triangle ABC$ with $\gamma = 90^\circ$, angle $\alpha = 21^\circ$, and side $b = 8.6$, approximate the perimeter of the triangle to the nearest tenth.
   
   A. 17.4
   
   B. 21.1
   
   C. 19.9
   
   D. 18.1
   
   E. 23.6

3. Given the indicated parts of $\triangle ABC$ with $\gamma = 90^\circ$, express the third part in terms of the first two.
   
   $a, \beta; \ c$
   
   A. $c = a \tan \beta$
   
   B. $c = a \csc \beta$
   
   C. $c = a \sec \beta$
   
   D. $c = a \cos \beta$
   
   E. $c = a \sin \beta$
4. From a distance of 1 mile on level ground, a certain tower has an angle of elevation of $8^\circ$. Determine its height to the nearest foot. (1 mile = 5280 feet)

A. 742 feet
B. 836 feet
C. 734 feet
D. 826 feet
E. None of the above

5. A ladder, 30 feet long, leans against the side of a building, and the angle between the ladder and the building is $16^\circ$.

If the distance from the bottom of the ladder to the building is increased by 3.0 feet, approximate the angle the ladder now makes with the building to the nearest 0.1°.

A. 10.1°
B. 10.5°
C. 22.1°
D. 21.7°
E. None of the above
6. To the nearest whole mile, approximately how far apart are the ships at 6:00 pm?

A. 136 miles
B. 126 miles
C. 175 miles
D. 168 miles
E. None of the above

7. What is the bearing, to the nearest degree, from the first ship to the second?

A. S78°W
B. S66°W
C. S69°W
D. S13°W
E. None of the above
8. Find all solutions of the equation using $n$ as an arbitrary integer.

$$\tan \theta = -\sqrt{3}$$

A. $\theta = \frac{2\pi}{3} + \pi n$

B. $\theta = \frac{\pi}{3} + 2\pi n$

C. $\theta = \frac{2\pi}{3} + 2\pi n$

D. $\theta = \frac{\pi}{3} + \pi n$

E. None of the above

9. Find all solutions of the equation using $n$ as an arbitrary integer.

$$\sin(2x) = \frac{\sqrt{3}}{2}$$

A. $\theta = \frac{\pi}{8} + \pi n, \frac{3\pi}{8} + \pi n$

B. $\theta = \frac{\pi}{6} + \pi n, \frac{\pi}{3} + \pi n$

C. $\theta = \frac{2\pi}{3} + \pi n, \frac{5\pi}{6} + \pi n$

D. $\theta = \frac{\pi}{6} + \pi n, \frac{5\pi}{6} + \pi n$

E. None of the above
10. Find all solutions of the equation in the interval \([0, 2\pi)\)

\[ \cos \left( 2x - \frac{\pi}{4} \right) = 0 \]

A. \[ \theta = \frac{5\pi}{24}, \frac{17\pi}{24}, \frac{29\pi}{24}, \frac{41\pi}{24} \]

B. \[ \theta = \frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8} \]

C. \[ \theta = \frac{7\pi}{24}, \frac{19\pi}{24}, \frac{31\pi}{24}, \frac{43\pi}{24} \]

D. \[ \theta = \frac{3\pi}{8}, \frac{7\pi}{8}, \frac{11\pi}{8}, \frac{15\pi}{8} \]

E. None of the above

11. Find all solutions of the equation in the interval \([0, 2\pi)\)

\[ 2\sin^2 \theta - 3\sin \theta + 1 = 0 \]

A. \[ \theta = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2} \]

B. \[ \theta = \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{\pi}{2} \]

C. \[ \theta = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{\pi}{2} \]

D. \[ \theta = \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{3\pi}{2} \]

E. None of the above
12. Express as a trigonometric function of one angle.

\[ \sin(35^\circ)\cos(15^\circ) - \cos(35^\circ)\sin(15^\circ) \]

A. \( \cos(50^\circ) \)

B. \( \sin(20^\circ) \)

C. \( \cos(20^\circ) \)

D. \( \sin(50^\circ) \)

E. None of the above

13. Find all solutions of the equation in the interval \([0, 2\pi)\).

\[ \sin t - \sin 2t = 0 \]

A. \( t = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{2\pi}{3}, \frac{4\pi}{3} \)

B. \( t = 0, \pi, \frac{5\pi}{3} \)

C. \( t = \frac{\pi}{2}, \frac{3\pi}{2}, 2, \frac{5\pi}{3} \)

D. \( t = 0, \pi, \frac{2\pi}{3}, \frac{4\pi}{3} \)

E. None of the above
14. If $\sin \alpha = -\frac{4}{5}$ and $\cos \beta = \frac{7}{25}$, for a third-quadrant angle $\alpha$ and a first-quadrant angle $\beta$, find $\cos(\alpha + \beta)$.

A. $\frac{-4}{5}$

B. $\frac{-117}{125}$

C. $\frac{44}{125}$

D. $\frac{3}{5}$

E. None of the above

15. Find the exact value of $\cos 2\theta$ if $\tan \theta = -\frac{5}{6}$ and $270^\circ < \theta < 360^\circ$

A. $\frac{-11}{61}$

B. $\frac{-60}{61}$

C. $\frac{5}{61}$

D. $\frac{60}{61}$

E. None of the above
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<td>8.</td>
<td>$\theta = \frac{2\pi}{3} + \pi n$</td>
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