1. [4] Find (if possible) the supplementary angle of $\theta = \frac{7\pi}{11}$.

2. [4] Find the least positive coterminal angle of $\alpha = \frac{29\pi}{7}$.

3. [12] Determine which quadrant the following angle $\theta$ and $\alpha$ lie:

   a) $\theta = \frac{19\pi}{6}$  Quadrant _______  
   b) $\alpha = -570^\circ$  Quadrant _______

   c) Find the exact value (no decimals).
      
      $\cos \frac{19\pi}{6} =$

   d) Find the exact value (no decimals).
      
      $\csc(-570^\circ) =$

4. [6] Find the exact length (not in decimal) of the arc intercepted by a central angle of $75^\circ$ in a circle with the radius of 36 feet.

\[ \text{Diagram of circle with arc} \]
5. [6] **Circle** True or False:

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) If angle $A$ and angle $B$ are complementary then $\tan A = \cot B$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>b) If angle $\theta$ lies in Quadrant III, then $\cot \theta &gt; 0$ and $\sec \theta &lt; 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>c) $\cos(A - B) = \cos A - \cos B$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>d) $-\frac{\pi}{2}$ is in the range of $\tan^{-1} x$.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>e) $\cos^2 x - \sin^2 x = -1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>f) Dot product of two vectors is a vector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
</tbody>
</table>

6. [8] Find the following for $f(x) = -4 \sin \left(3x + \frac{\pi}{3}\right) - 5$.

| Amplitude: | |
| Period:    | |
| Phase shift: | |
| Range:     | |

7. [8] **Sketch** the graph of $y = -2 \cos x + 1$ for **only one period**. **Label** all the tick marks on both $x$ and $y$ axis where necessary.
8. [8] a) State the **Sum identity** for \( \cos(\alpha + \beta) \).

\[
\cos(\alpha + \beta) =
\]

b) Assuming that \( \cos \alpha = -\frac{3}{5} \) where \( \alpha \) is in **quadrant II** and \( \cos \beta = \frac{12}{13} \) where \( \beta \) is in **quadrant IV**. Find the **exact value** of \( \cos(\alpha + \beta) \).

9. [8] Find the **exact value** of the following:

a) \( \cos^{-1}\left( \cos \frac{5\pi}{6} \right) = \)

b) \( \sin\left( \cos^{-1}\left( \frac{x}{2} \right) \right) = \)

10. [8] Given the following graph of a function, find the following

a) [1] Amplitude: 

b) [1] Period: 

c) [1] Phase shift: 

d) [1] Axis of oscillation: 

e) [4] Equation:
11. [8] Complete the following trigonometric identities:

a) \(1 - \sin^2 x = \)____________________

b) \(1 + \tan^2 x = \)____________________

c) \(\sin(2x) = \)____________________

d) \(\cos(2x) = \)____________________

12. [6] Given \(\sin x = -\frac{4}{5}\) and \(x\) is in Quadrant III. Find the exact value of the following.

a) \(\sin(2x) = \)____________________

b) \(\cos(2x) = \)____________________

13. [8] Prove that following identity by starting with one side and obtaining the other through writing a sequence of equivalent expressions.

\[
\frac{\cot^2 x}{\cot^2 x + 1} = \cos^2 x
\]
14. [6] Use the given substitution to express the given radical expression as a trigonometric function without radicals. Assume $\theta$ is in quadrant I.

a) Let $x = 2\sin \theta$ then find and simplify $\sqrt{4-x^2}$.

b) Then find $\tan \theta$.

15. [8] Solve: $\tan x = -\sqrt{3}$ where $x$ is in radians. (Exact value, no decimals) (General solutions)

16. [6] Solve: $\cos^2 x = \frac{1}{4}$ in $[0, 2\pi)$ (Exact value, no decimals)
17. [8] Solve: \(6 \cos^2 x + \cos x - 2 = 0\) on \([0, 2\pi)\). **Round your answers to 4 decimal places where necessary.**

18. [8] A pole leans away from the sun at an angle of 12° to the vertical. When the angle of elevation of the sun is 58°, the pole casts a shadow 52 ft long on level ground. How long is the pole? Round to the nearest foot.
19. [8] Determine which law applies. Then solve the triangle ABC, if possible.

Round your answers to one decimal place. \( a = 18.2 \text{ in} \), \( b = 13.7 \text{ in} \), \( A = 75.2^\circ \)

Law of \___________

---

20. [8] a) Write the complex number \(1 - i\) in trigonometric form.

b) Use De Moivre’s theorem to raise the complex number in part a) to the given power. Write your answer in standard notation, \( a + bi \).

\((1 - i)^8\)
21. [8] Find the square roots of the complex number \(-16i\). Write your answer in standard notation, \(a + bi\).

22. [6] Convert the rectangular coordinate \((2, -2)\) to polar coordinate. (Exact and do not use decimals.)

23. [6] Convert to Polar equation: \(y = x^2\)
24. [8] Complete the table (round to one decimal place) and graph \( r = 3 \sin(3\theta) \).

<table>
<thead>
<tr>
<th>(\theta)</th>
<th>0°</th>
<th>15°</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>75°</th>
<th>90°</th>
<th>105°</th>
<th>120°</th>
<th>135°</th>
<th>150°</th>
<th>165°</th>
<th>180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

25. [6] Perform the following if \( \vec{u} = \langle 5, -2 \rangle \) and \( \vec{v} = \langle -4, 7 \rangle \)

   a) \( \vec{u} - 2\vec{v} \)  
   b) \( \vec{u} \cdot \vec{v} \)
26. [8] **Classify** the graph of the equation circle, a parabola, or an ellipse for part a). Find the necessary information as given and write N/A for any that do not pertain to this type of conic and **sketch the graph**:

\[
\frac{(x+1)^2}{16} + \frac{(y-2)^2}{4} = 1
\]

a) Type of Conic: ________________

b) Center: ________________

c) Vertices: ________________

d) Foci: ________________

27. [6] Graph: \( f(x) = \tan^{-1} x \). State the domain and range of \( f(x) \).

Label the necessary tick marks on both axes clearly.

Domain: ________________ Range: ________________
CHOOSE 1 OF THE 2 REMAINING PROBLEMS. IF YOU DON’T CHECK A BOX, THE FIRST 1 WILL BE GRADED.

28. [6] Find the magnitude of the resultant vector \( \mathbf{u} + \mathbf{v} \) given that \( |\mathbf{u}| = 2 \), \( |\mathbf{v}| = 3 \) and that the angle between the vectors is 42°. Round to the nearest tenth.

29. [6] After taking off, an airplane reaches a speed of 130 \( km/h \) on a course of 53°. A wind of 20 \( km/h \) is blowing from 320°. What is the groundspeed of the plane? Round your answer to two decimal places.