Coterminal Angles: Degree and Radian Worksheet

1. Define what is meant by coterminal angles. Provide one example in degrees and one in radians.

2. Given an angle of $45°$, find one positive and one negative coterminal angle.

3. Determine two positive and two negative coterminal angles for $210°$.

4. For the angle $\frac{\pi}{4}$ radians, calculate one positive and one negative coterminal angle.

5. Convert $120°$ to radians. Show your work.

6. Convert $-\frac{3\pi}{2}$ radians to degrees. Show your work.

7. Find the smallest positive coterminal angle for $-330°$.

8. Find the largest negative coterminal angle for $\frac{7\pi}{6}$ radians.

9. A clock hand rotates $150°$ clockwise. Determine a coterminal angle in the counterclockwise direction.

10. If a wheel rotates $\frac{5\pi}{3}$ radians, calculate its coterminal angle between 0 and 2π radians.

11. Verify if $1080°$ and $0°$ are coterminal.

12. Determine if $-\frac{11\pi}{6}$ radians and $\frac{\pi}{6}$ radians are coterminal. Show detailed steps.

13. Convert $450°$ to radians and find two negative coterminal angles in radians.

Solutions

1. **Definition:** Coterminal angles share the same terminal side when drawn in standard position. Example: $30°$ and $390°$ (degrees); $\frac{\pi}{6}$ and $\frac{13\pi}{6}$ (radians).

2. Positive: $45° + 360° = 405°$, Negative: $45° - 360° = -315°$.

3. Positive: $210° + 360° = 570°$, $210° + 720° = 930°$. Negative: $210° - 360° = -150°$, $210° - 720° = -510°$.

4. Positive: $\frac{\pi}{4} + 2\pi = \frac{9\pi}{4}$, Negative: $\frac{\pi}{4} - 2\pi = -\frac{7\pi}{4}$.

5. $120° \times \frac{\pi}{180} = \frac{2\pi}{3}$ radians.

6. $-\frac{3\pi}{2} \times \frac{180}{\pi} = -270°$.

7. $-330° + 360° = 30°$ (smallest positive coterminal angle).

8. $\frac{7\pi}{6} - 2\pi = -\frac{5\pi}{6}$ (largest negative coterminal angle).

9. Clockwise $150°$ is coterminal to counterclockwise $360° - 150° = 210°$.

10. $\frac{5\pi}{3} - 2\pi = -\frac{\pi}{3}$ (coterminal angle between 0 and 2π: $\frac{5\pi}{3}$).

11. $1080° - 3 \times 360° = 0°$, so they are coterminal.

12. Add 2π: $-\frac{11\pi}{6} + 2\pi = \frac{\pi}{6}$ (coterminal).

13. $450° \times \frac{\pi}{180} = \frac{5\pi}{2}$. Negative coterminal angles: $\frac{5\pi}{2} - 2\pi = \frac{\pi}{2}$, $\frac{\pi}{2} - 2\pi = -\frac{3\pi}{2}$.