Introduction to Trigonometry: Angles in Standard Position

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Learning Objectives

- Identify angles in standard position on the coordinate plane
- Distinguish between positive and negative angles based on rotation direction
- Sketch angles in standard position given their measure

For each problem, determine the angle measure, sketch the angle in standard position, or identify whether the rotation is positive or negative.

1. Determine whether the following angle is positive or negative based on counterclockwise rotation.

$\theta = 230^\circ$

Answer: _____

2. Determine whether the following angle is positive or negative based on clockwise rotation.

$\theta = -150^\circ$

Answer: _____

3. Identify the quadrant in which the terminal side of the angle lies.

$\theta = 135^\circ$

Answer: _____

4. Find the coterminal positive angle for the given negative angle.

$\theta = -150^\circ$

Answer: _____

5. Find the coterminal negative angle for the given positive angle.

$\theta = 230^\circ$

Answer: _____

6. Identify the quadrant in which the terminal side of the angle lies.

$\theta = -45^\circ$

Answer: _____

7. Determine if the angle is in standard position. The initial side is on the positive y-axis.

$\theta = 90^\circ$

Answer: _____

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8. Find the smallest positive coterminal angle.

$\theta = 450^\circ$

Answer: _____

9. Determine the direction of rotation for the given angle.

$\theta = -270^\circ$

Answer: _____

10. Convert the angle measure to its reference angle.

$\theta = 230^\circ$

Answer: _____

Emphasize that the initial side must always lie on the positive x-axis and that counterclockwise rotation produces positive angles while clockwise rotation produces negative angles.

Solutions

1. Determine whether the following angle is positive or negative based on counterclockwise rotation.

$\theta = 230^\circ$

→ *Recall that counterclockwise rotation produces positive angles*
→ *Since 230 degrees is measured counterclockwise from the positive x-axis, the angle is positive*
→ *The terminal side lies in the third quadrant*

Answer: Positive (counterclockwise)

2. Determine whether the following angle is positive or negative based on clockwise rotation.

$\theta = -150^\circ$

→ *Clockwise rotation produces negative angles*
→ *The terminal side rotates 150 degrees clockwise from the positive x-axis*
→ *This places the terminal side in the third quadrant*

Answer: Negative (clockwise)

3. Identify the quadrant in which the terminal side of the angle lies.

$\theta = 135^\circ$

→ *Angles between 90 and 180 degrees terminate in Quadrant II*
→ *135 degrees is between 90 and 180 degrees*
→ *Therefore the terminal side lies in Quadrant II*

Answer: Quadrant II

4. Find the coterminal positive angle for the given negative angle.

$\theta = -150^\circ$

→ *Add 360 degrees to the negative angle to find its positive coterminal angle*
→ *Calculate negative 150 plus 360 equals 210*
→ *The coterminal positive angle is 210 degrees*

Answer: $\theta = 210^\circ$

5. Find the coterminal negative angle for the given positive angle.

$\theta = 230^\circ$

→ *Subtract 360 degrees from the positive angle*
→ *Calculate 230 minus 360 equals negative 130*
→ *The coterminal negative angle is negative 130 degrees*

Answer: $\theta = -130^\circ$

6. Identify the quadrant in which the terminal side of the angle lies.

$\theta = -45^\circ$

→ *A negative angle rotates clockwise from the positive x-axis*
→ *Rotating 45 degrees clockwise places the terminal side below the x-axis*
→ *This terminal side lies in Quadrant IV*

Answer: Quadrant IV

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7. Determine if the angle is in standard position. The initial side is on the positive y-axis.

$\theta = 90^\circ$

→ *An angle in standard position must have its initial side on the positive x-axis*
→ *If the initial side is on the positive y-axis, the angle is not in standard position*
→ *Therefore this angle is not in standard position*

Answer: Not in standard position

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8. Find the smallest positive coterminal angle.

$\theta = 450^\circ$

→ *Subtract 360 degrees from the angle to find a coterminal angle*
→ *Calculate 450 minus 360 equals 90*
→ *The smallest positive coterminal angle is 90 degrees*

Answer: $\theta = 90^\circ$

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9. Determine the direction of rotation for the given angle.

$\theta = -270^\circ$

→ *Negative angles indicate clockwise rotation*
→ *The terminal side rotates 270 degrees in the clockwise direction*
→ *This places the terminal side on the positive y-axis*

Answer: Clockwise

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10. Convert the angle measure to its reference angle.

$\theta = 230^\circ$

→ *For angles in Quadrant III, subtract 180 degrees from the angle*
→ *Calculate 230 minus 180 equals 50*
→ *The reference angle is 50 degrees*

Answer: $\theta_{ref} = 50^\circ$