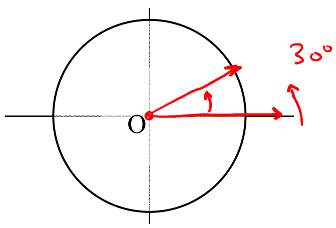
ANGLES IN STANDARD POSITION:

- On a Cartesian plane, you generate an angle by rotating a ray around the origin.
- Vertex of angle is at the origin, and the initial arm is on the positive x-axis.
  - → **Initial Arm**: starting position of ray, along the positive x-axis. Start → OA
  - → **Terminal Arm**: final position of ray, after rotation about origin. Finish → OP
  - → **Direction:** $+\vartheta$ goes counter clockwise and $-\vartheta$ goes clockwise

- Draw 30° in standard position

Include point P and the direction of rotation



- **QUADRANTS**: The x-axis and y-axis divide the plane into four quadrants

y

Quadrants **II**: $90° < \theta < 180°$ | Quadrants **I**: $0° < \theta < 90°$

x

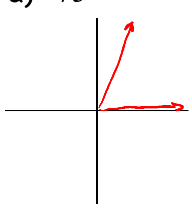
Quadrants **III**: $180° < \theta < 270°$ | Quadrants **IV**: $270° < \theta < 360°$

SKETCH AN ANGLE IN STANDARD POSITION $0° \le \theta \le 360°$

EX. 1 Sketch each angle in standard position. State the quadrant the terminal arm lies.

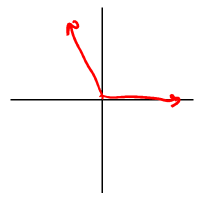
Without a protractor

a) 75°



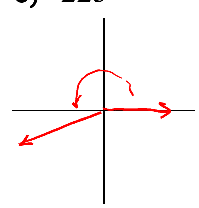
Quadrant: I

b) 105°



Quadrant: II

c) 225°



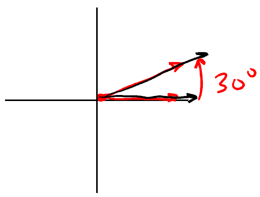
Quadrant: III

See Example 1 & Your Turn **p. 79-80**

REFERENCE ANGLES: θ_R

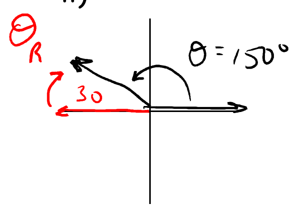
- The positive acute angle formed between the terminal arm and the x-axis
- Each angle in standard position has a corresponding reference angle.
  - → Sketch and determine the measure of the three other angles in standard position that have a reference angle of $30°$

i) $30°$



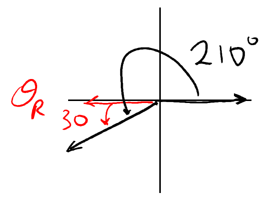
Quadrant: I

ii)



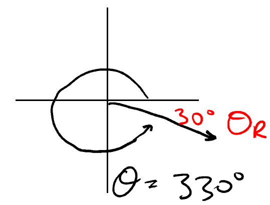
Quadrant: ___

iii)



Quadrant: ___

iv)



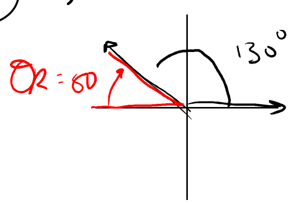
Quadrant: ___

DETERMINE A REFERENCE ANGLE

EX. 2 Determine the reference angle θ_R for each angle θ. Sketch θ in standard position and label the reference angle θ_R.

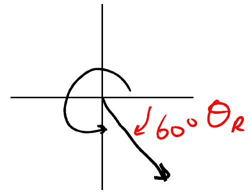
Identify θ_R in **red**

a) $130°$



Quadrant: ___

b) $300°$



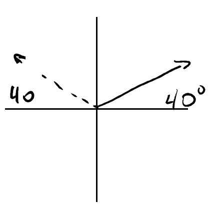
Quadrant: ___

See Example 2 & Your Turn — **p. 80**

DETERMINE THE ANGLE IN STANDARD POSITION

EX. 3 Determine the angle in standard position when an angle of $40°$ is reflected

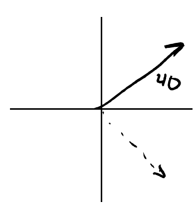
a) in the y-axis



Quadrant: ___

Angle Measure: ______

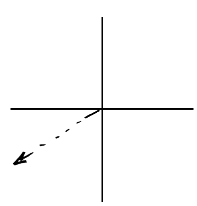
b) in the x-axis



Quadrant: ___

Angle Measure: ______

c) in the y-axis then in the x-axis



Quadrant: ___

Angle Measure: ______

See Example 3 & Your Turn — **p. 81**

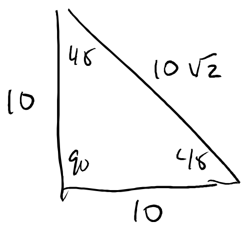
SPECIAL RIGHT TRIANGLES

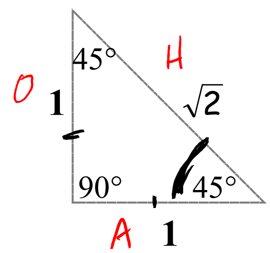
- Some angles have values that we can only find approximate values of their trig ratios (by using a calculator). → sin 35°= 0.5735764364
- Special angles have values that we can find the exact value of their trig ratios (without using a calculator).

A. SPECIAL TRIANGLE: $45°-45°-90°$

MEMORIZE 3.14 π

- Draw the diagonal of a square with side length of 1 unit
- Use the $45°-45°-90°$ to find the exact value of:





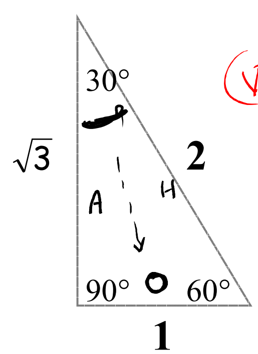
cos 45° = $\frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{\sqrt{2}}$ = $\frac{\sqrt{2}}{2}$

sin 45° = $\frac{1}{\sqrt{2}}$ = $\frac{\sqrt{2}}{2}$

tan 45° = 1

B. SPECIAL TRIANGLE: $30°-60°-90°$

- Drawing the altitude of an equilateral triangle with a side length of 2 units
- Use the $30°-60°-90°$ triangle to find the exact values of:



$a^2 + b^2 = c^2$

$(\sqrt{3})^2 + 1^2 = 2^2$

$3 + 1 = 4$

$4 = 4$ ✓

cos 30° = $\frac{\sqrt{3}}{2}$

sin 30° = $\frac{1}{2}$

tan 30° = $\frac{1}{\sqrt{3}}$ $\frac{\sqrt{3}}{\sqrt{3}}$ → $\frac{\sqrt{3}}{3}$

cos 60° = $\frac{1}{2}$

sin 60° = $\frac{\sqrt{3}}{2}$

tan 60° = $\frac{\sqrt{3}}{1}$