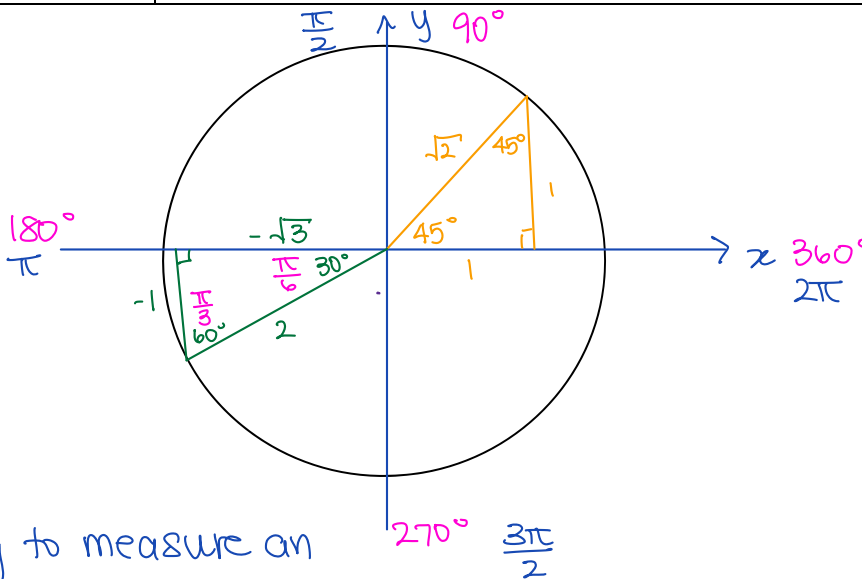Name: _____   Date: _____

Learning Goal 4.1	Examining angles in standard position in both radians and degrees. Exploring the unit circle, reference and coterminal angles and special angles.

$90 + 30 + 60 = 180$

$\frac{\pi}{2} + \quad + \frac{\pi}{3} = \pi$

$\frac{3\pi}{6} + \frac{\pi}{6} + \frac{2\pi}{6} = \frac{6\pi}{6}$

Radian Measure

↳ another way to measure an angle.

Example Convert to radians, leave your answer as an exact value.

a. $60° \times \frac{2\pi}{360°} = 60° \times \frac{\pi}{180°}$ 3
    $\frac{180}{}$
    $= \frac{\pi}{3}$

b. $225° \times \frac{\pi}{180°} = \frac{45 \times \pi}{36}$
    $= \frac{5 \times \pi}{4}$
    $= \frac{5\pi}{4}$

Example Convert to radians, round your answer to the nearest hundredth.

a. $18° \times \frac{\pi}{180°} = 0.31$ *CALCULATOR*

b. $312° \times \frac{\pi}{180} = 5.45$

Example Convert to degrees, round your answer to the nearest degree.

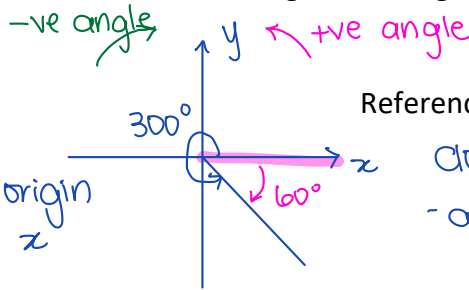a. $\frac{2\pi}{3} \times \frac{180°}{\pi}$ 60°
    $= 2 \times 60$
    $= 120°$

b. $\frac{7\pi}{6} \times \frac{180°}{\pi}$ 30
    $= 7 \times 30$
    $= 210°$

c. $2.3 \times \frac{180}{\pi}$
    $= 132°$

Converting Radians to Degrees	Converting Degrees to Radians
$R \times \frac{D}{R} = D \qquad \times \frac{180}{\pi}$	$D \times \frac{R}{D} = R \qquad \times \frac{\pi}{180}$

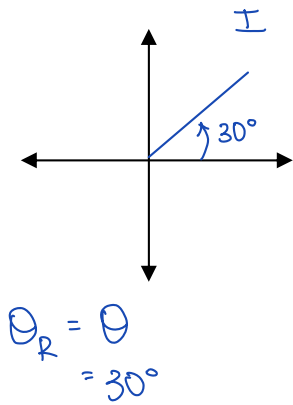Assignment   p. 175 # 1 – 13, 15, 17 – 20, C3, C5   Quiz Next Day!

Angles in Standard Position   −ve angle   y ↖ +ve angle   Reference Angle - measured off the
- the terminal arm   closest x-axis.
  passes through the origin   300°   - always +ve.
- measuring from +ve x   ↘60°   x

Example Draw each angle in standard position.   Find the reference angle. Determine one positive and one
negative co-terminal.

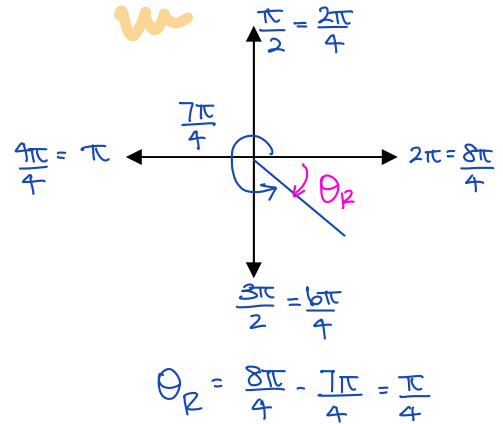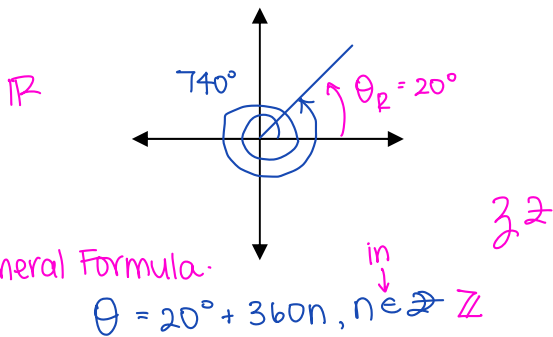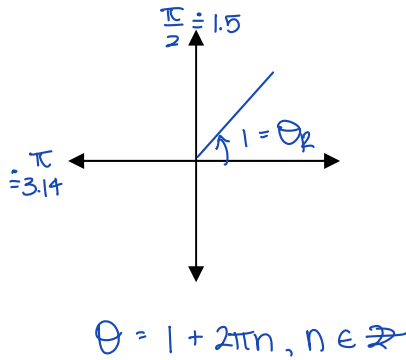   a. 30°   b.   315°   c. $\dfrac{7\pi}{4}$

$\theta_R = \theta$
$= 30°$

$\theta_R = 360 - 315$
$= 45°$
IV

$\dfrac{\pi}{2} = \dfrac{2\pi}{4}$
$\dfrac{7\pi}{4}$
$\dfrac{4\pi}{4} = \pi$ $2\pi = \dfrac{8\pi}{4}$
$\dfrac{3\pi}{2} = \dfrac{6\pi}{4}$

$\theta_R = \dfrac{8\pi}{4} - \dfrac{7\pi}{4} = \dfrac{\pi}{4}$

Example Determine one positive and one negative co-terminal angle of the following angles. Illustrate each
angle with a diagram. Write a general formula for coterminal angles in each case.
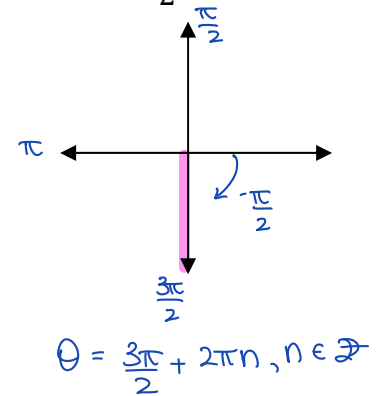
   a. $\theta = 740° = \underbrace{360 + 360° + 20°}_{\text{2 full rotations}}$ b. $\theta = 1$ c. $\theta = -\dfrac{\pi}{2}$

R   740°   ↗ $\theta_R = 20°$

$\dfrac{\pi}{2} \doteq 1.5$
$\dfrac{\pi}{}$
$=3.14$ ↗ $1 = \theta_R$

General Formula: in
   $\theta = 20° + 360n , n \in \mathbb{Z}$

$\dfrac{\pi}{2}$
π
↙ $\dfrac{-\pi}{2}$
$\dfrac{3\pi}{2}$

$\theta = 1 + 2\pi n , n \in \mathbb{Z}$ $\theta = \dfrac{3\pi}{2} + 2\pi n , n \in \mathbb{Z}$

Example A circle has radius 8.2 cm. Calculate the length of an arc of this circle subtended by 3.5 radians.
Express the length to the nearest tenth of a centimetre.

Assignment   p. 175 # 1 – 13, 15, 17 – 20, C3, C5   Quiz Next Day!