ID:_____ Name:_____

1. Convert from degree to radian.

a) 180°   b) 90°   c) 360°   d) 240°   e) −135°   f) −120°

$180° \cdot \frac{\pi}{180°} = \pi$

$90° \cdot \frac{\pi}{180°} = \frac{\pi}{2}$

$360° \cdot \frac{\pi}{180°} = 2\pi$

$240° \cdot \frac{\pi}{180°} = \frac{4\pi}{3}$

$-135° \cdot \frac{\pi}{180°} = -\frac{3\pi}{4}$

$-120° \cdot \frac{\pi}{180°} = -\frac{2\pi}{3}$

2. Convert from radian to degree.

a) $\frac{\pi}{3}$ b) $\frac{3\pi}{2}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$ e) $-\frac{4\pi}{3}$ f) $-\frac{5\pi}{4}$

$\frac{\pi}{3} \cdot \frac{180°}{\pi} = 60°$
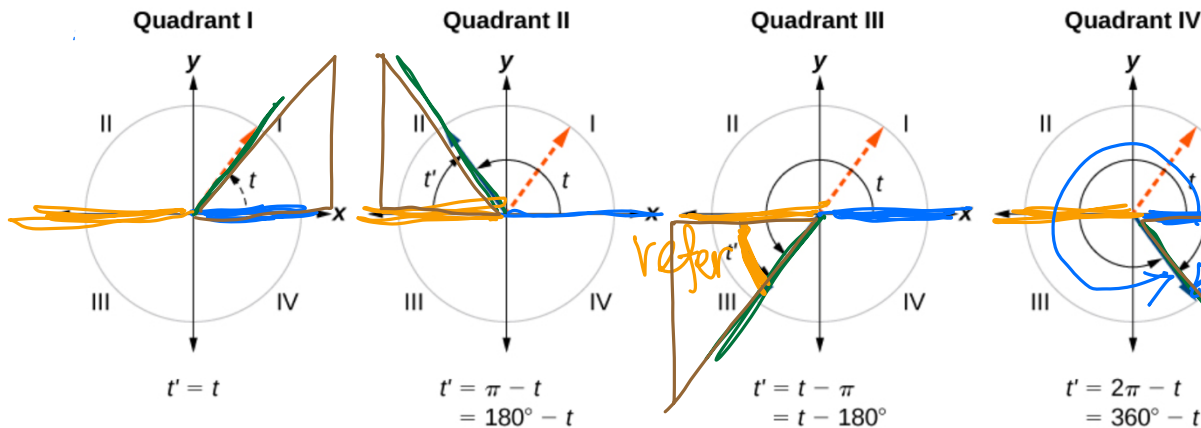
$\frac{3\pi}{2} \cdot \frac{180°}{\pi} = \frac{3}{2} \cdot 180° = 270°$

$\frac{\pi}{4} \cdot \frac{180°}{\pi} = 45°$

$\frac{\pi}{6} \cdot \frac{180°}{\pi} = 30°$

$-\frac{4\pi}{3} \cdot \frac{180°}{\pi} = -240°$

$-\frac{5\pi}{4} \cdot \frac{180°}{\pi} = -5 \cdot 45° = -225°$

3. Reference Angle:

Quadrant I	Quadrant II	Quadrant III	Quadrant IV
$t' = t$	$t' = \pi - t$ $= 180° - t$	$t' = t - \pi$ $= t - 180°$	$t' = 2\pi - t$ $= 360° - t$

How to find the reference angle of the given angle ?

$II(-,+)$ $I(+,+)$

$III(-,-)$ $IV(+,-)$
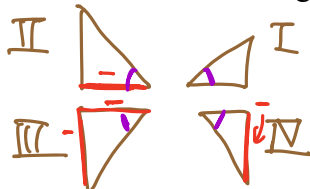
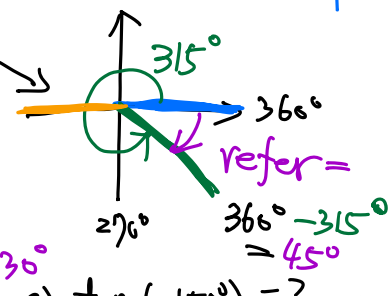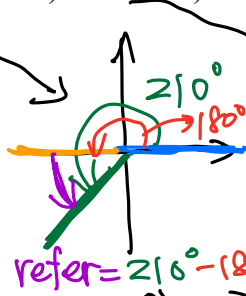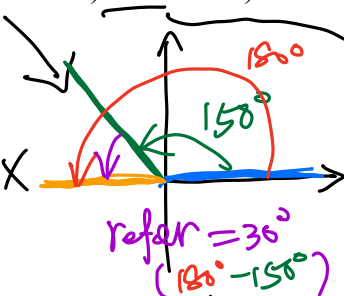4. Find the reference angle of the given angle.

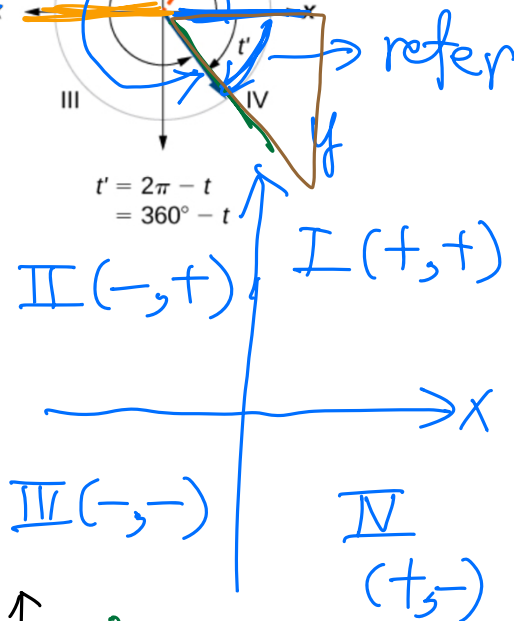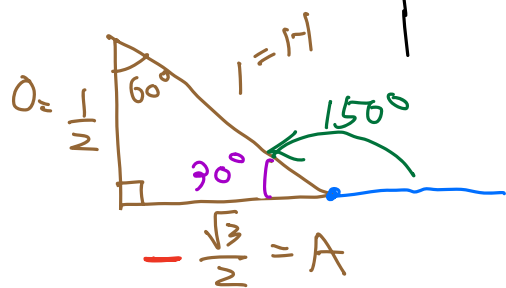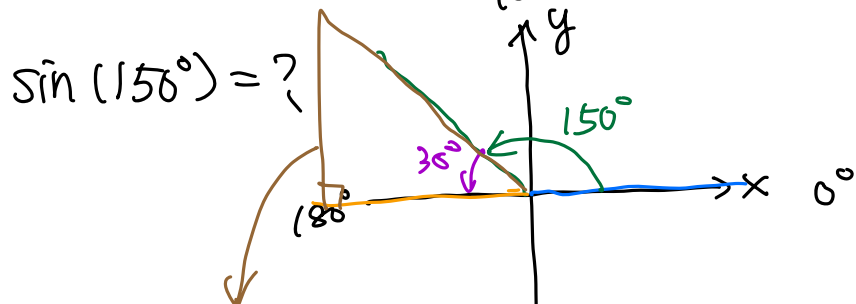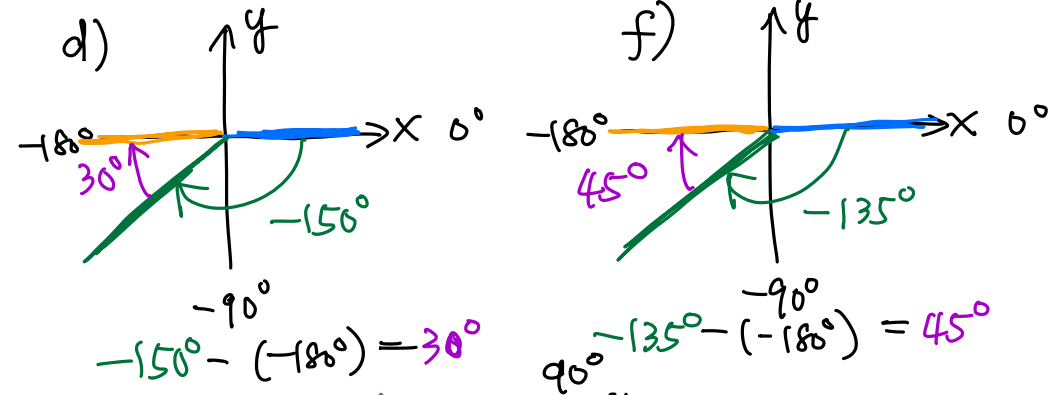a) 60°   b) 150°   c) 210°   d) −150°   e) 315°   f) −135°

refer = 60°

refer = 30° (180° − 150°)

refer = 210° − 180° = 30°

refer = 360° − 315° = 45°

extra question: a) sin(150°) =?   b) cos(210°) =?   c) tan(−150°) =? ...

d)

$-180°$ $30°$ $\xrightarrow{}X \; 0°$
$-150°$

$-90°$

$-150° - (-180°) = 30°$

f)

$-180°$ $45°$ $\xrightarrow{}X \; 0°$
$-135°$

$-90°$

$-135° - (-180°) = 45°$

$\sin(150°) = ?$

$90°$
$150°$
$30°$
$\xrightarrow{}X \; 0°$
$180°$

$1 = H$
$60°$
$O = \frac{1}{2}$
$150°$
$30°$
$-\frac{\sqrt{3}}{2} = A$

$\sin(150°) = \dfrac{O}{H} = \dfrac{\frac{1}{2}}{1} = \dfrac{1}{2}$

$\cos(150°)$
$\qquad = \dfrac{A}{H} = \dfrac{-\frac{\sqrt{3}}{2}}{1} = -\dfrac{\sqrt{3}}{2}$

$\tan(150°) = \dfrac{\sin(150°)}{\cos(150°)} = \dfrac{\frac{1}{2}}{-\frac{\sqrt{3}}{2}}$
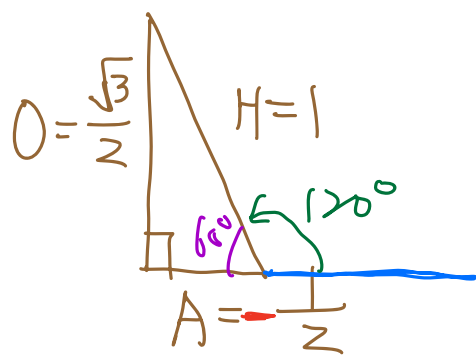
$\qquad = \dfrac{1}{2} \cdot \left(-\dfrac{2}{\sqrt{3}}\right) = -\dfrac{1}{\sqrt{3}}$

$\sin(210°) = ?$

$90°$
$210°$
$180°$
$210° - 180° = 30°$
$\xrightarrow{}X \; 0°$
$270°$

$A = -\frac{\sqrt{3}}{2}$
$210°$
$30°$
$H = 1$
$-\frac{1}{2} = O$

$\sin(210°) = \dfrac{-\frac{1}{2}}{1} = -\dfrac{1}{2}$

$\cos(210°) = \dfrac{-\frac{\sqrt{3}}{2}}{1} = -\dfrac{\sqrt{3}}{2}$

$\sin(120°) = ?$

$90°$
$60°$ $120°$
$180°$ $\xrightarrow{}\; 0°$

$O = \frac{\sqrt{3}}{2}$ $H = 1$
$60°$ $120°$
$A = -\frac{1}{2}$

$\sin(120°) = \dfrac{O}{H} = \dfrac{\frac{\sqrt{3}}{2}}{1} = \dfrac{\sqrt{3}}{2}$

$\cos(120°) = \dfrac{A}{H} = \dfrac{-\frac{1}{2}}{1} = -\dfrac{1}{2}$

$\tan(120°) = \dfrac{\frac{\sqrt{3}}{2}}{-\frac{1}{2}}$
$\qquad = \dfrac{\sqrt{3}}{2} \cdot (-2)$
$\qquad = -\sqrt{3}$

5. Unit Circle:

II $(-,+)$
Positive: sin, csc
Negative: cos, tan, sec, cot

I $(+,+)$
Positive: sin, cos, tan, sec, csc, cot
Negative: none

$\left(\frac{-1}{2}, \frac{\sqrt{3}}{2}\right)$ $(0,1)$ 90° $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

$\left(\frac{-\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$ $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

120° 60°

$\left(\frac{-\sqrt{3}}{2}, \frac{1}{2}\right)$ 135° 45° $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ $\cos(30°) = \frac{\sqrt{3}}{2}$

150° 30° $\sin(30°) = \frac{1}{2}$

$\frac{\sqrt{3}}{2}$ H=7 $0 = \frac{1}{2}$

120° 60° 300°

$(-1,0)$ 180° $-\frac{1}{2}$ 1330° A 0° 0 (1,0) 360° 2π

$\frac{\sqrt{3}}{2}$

210° 330°

225° 315°

$\left(\frac{-\sqrt{3}}{2}, \frac{-1}{2}\right)$ 240° 300° $\left(\frac{\sqrt{3}}{2}, \frac{-1}{2}\right)$

$\left(\frac{-\sqrt{2}}{2}, \frac{-\sqrt{2}}{2}\right)$ $\left(\frac{\sqrt{2}}{2}, \frac{-\sqrt{2}}{2}\right)$

$\left(\frac{-1}{2}, \frac{-\sqrt{3}}{2}\right)$ 270° $\left(\frac{1}{2}, \frac{-\sqrt{3}}{2}\right)$

$(0,-1)$

Positive: tan, cot
Negative: sin, cos, sec, csc

III $(-,-)$

Positive: cos, sec
Negative: sin, tan, csc, cot

IV $(+,-)$
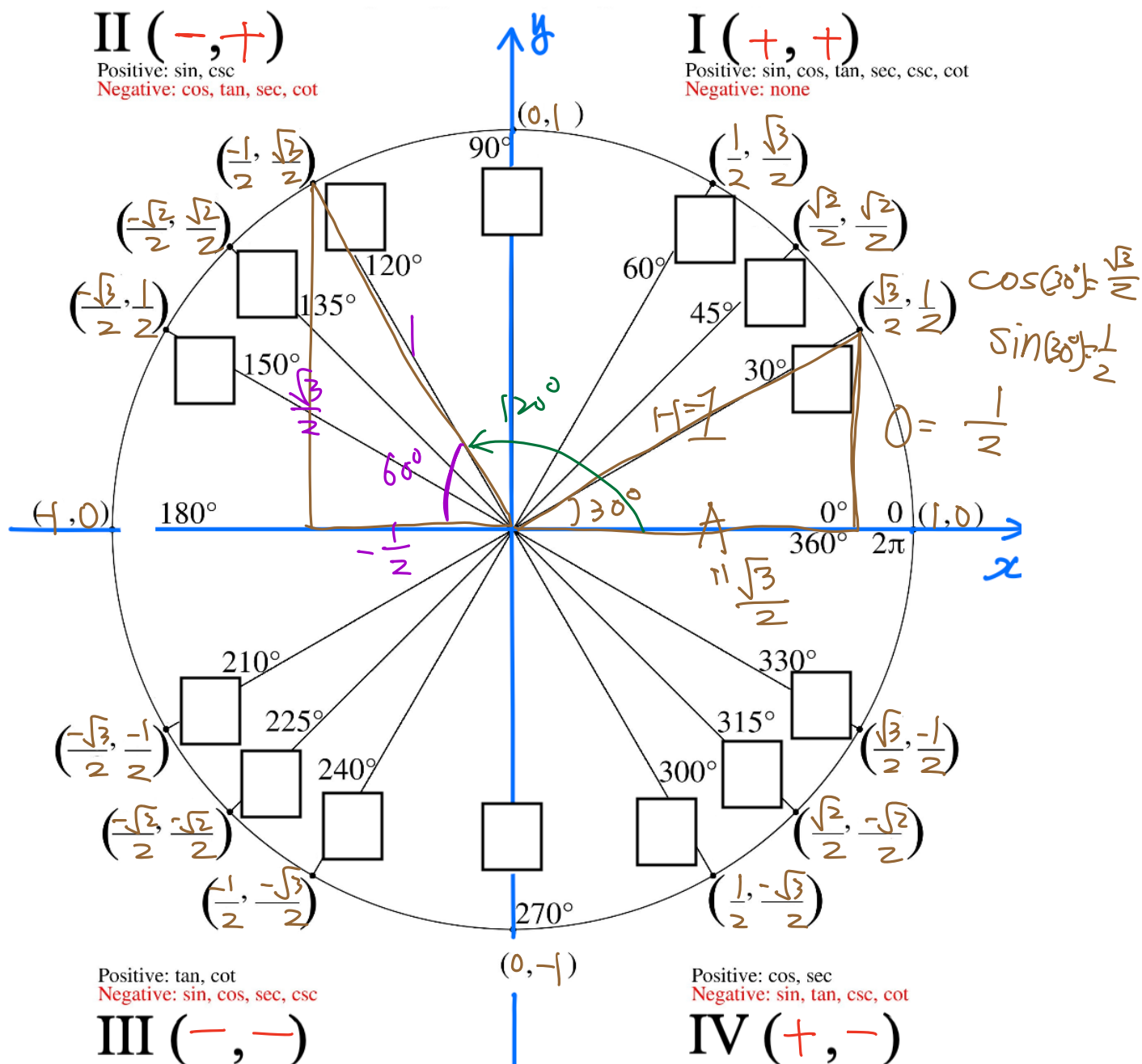
6. Find the exact solutions to the trigonometric equation for $0 \le x < 2\pi$. $(x \in [0,2\pi))$. 360°

$$4\sin(x) + 2 = 0.$$

$\frac{4 \cdot \sin(x)}{4} = \frac{-2}{4} \Rightarrow \sin(x) = -\frac{1}{2} = \frac{O}{H}$

$-\frac{1}{2}$ 30° 1 180° + 30° = 210°

30° $O = -\frac{1}{2}$

360° − 30° = 330°

27. A 10-foot ladder is leaning up against a wall. If the base of the ladder is situated 4 feet away from the base of the wall, what is the angle of elevation of the ladder? Draw a picture that depicts the situation and label the relevant information. Round your answer to the nearest tenth of a degree.

Wall

← 10 feet

base   4 feet

10 feet = H

x

4 feet = A

$$\cos(X) = \frac{A}{H} = \frac{4}{10}$$

$$\cos^{-1}\left(\frac{4}{10}\right) = \bigcirc$$