Date:_____

# Unit 2B: Standard Position Trigonometry

Name: _____

Date: _____

| Date | √ | Assignment |
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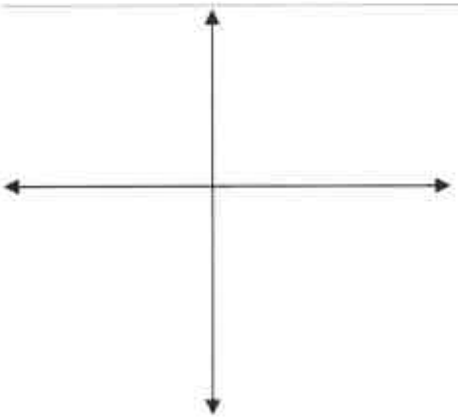
# *Unit 2B: Standard Position Trigonometry*
## *2B.1 Angles in Standard Position*



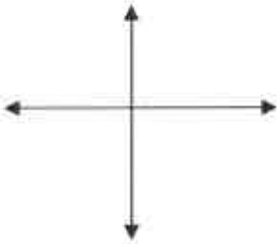
**Initial Arm:**

**Terminal Arm:**

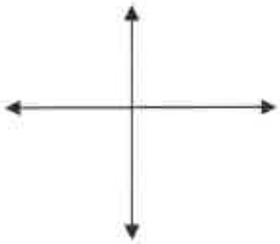
**Standard Position:**

**ex.** Sketch each angle in standard position. State the quadrant in which the terminal arm lies.

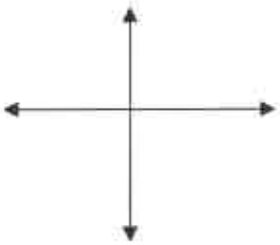
a) 36°



b) 210°



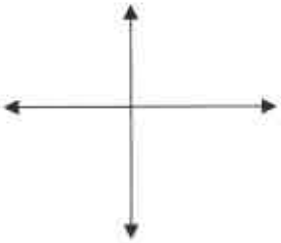
c) 315°



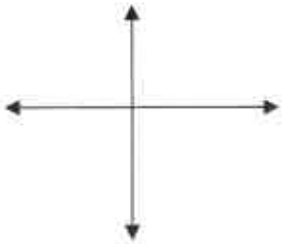
**Reference Angle:**

**ex.** Determine the reference angle $\theta_R$ for each angle $\theta$. Sketch $\theta$ in standard position and label the reference angle $\theta_R$.

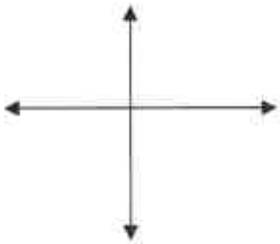
a) 130°



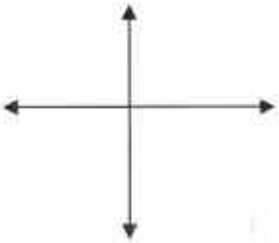
b) 300°



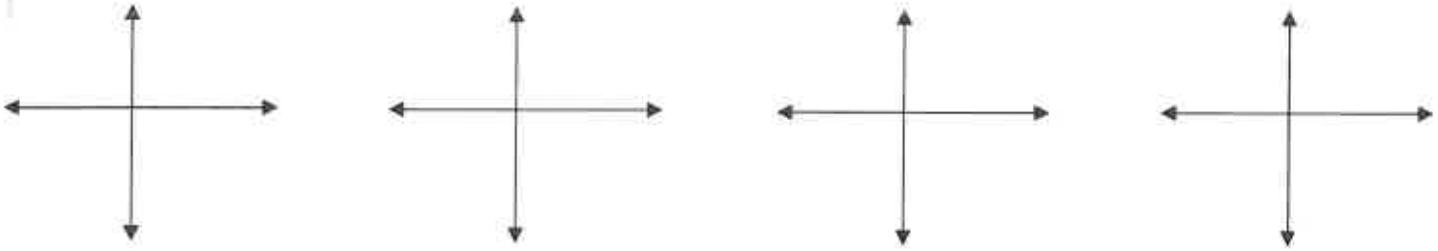
c) 75°



d) 40°



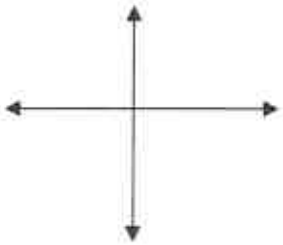
**ex.** Sketch four angles in standard position with a reference angle of 20°.



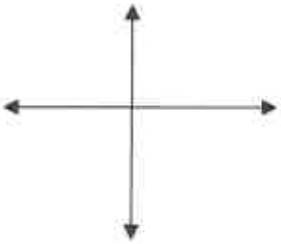
Angles in Standard Position and Reflections

**ex.** Sketch and determine the angle in standard position when an angle of $\theta = 50°$ is reflected:

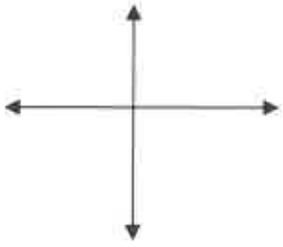
a) in the $y$-axis.



b) in the $x$-axis.



c) in the $y$-axis and then in the x axis.



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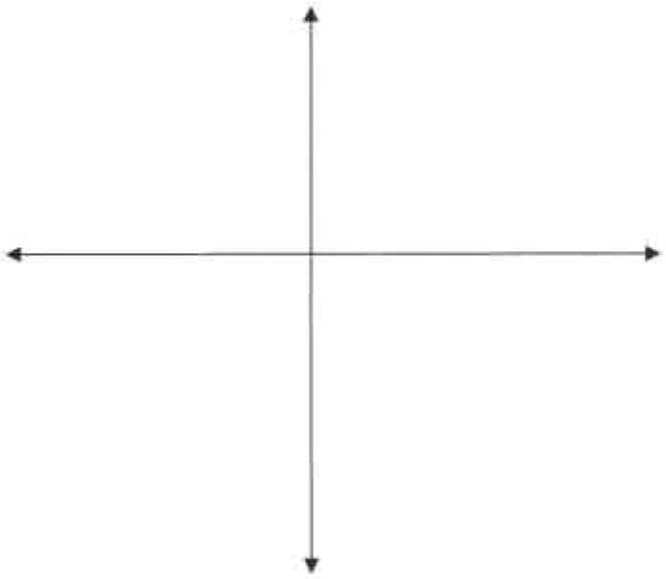
# *Unit 2B: Standard Position Trigonometry*
# *2B.2 Trigonometric Ratios of Any Angle*

**Key questions yet to be answered about trigonometry:**

- **How can an angle greater than 90° have primary trigonometric ratios? ex. $\tan 200° = 0.3640$**
- **How can an angle have a negative primary trigonometric ratio? ex. $\cos 100° = -0.1736$**

**Use your calculator to determine the following ratios to 4 decimal places:**

| | | |
|---|---|---|
| $\sin 30° =$ | $\cos 40° =$ | $\tan 50° =$ |
| $\sin 150° =$ | $\cos 140° =$ | $\tan 130° =$ |
| $\sin 210° =$ | $\cos 220° =$ | $\tan 230° =$ |
| $\sin 330° =$ | $\cos 320° =$ | $\tan 310° =$ |

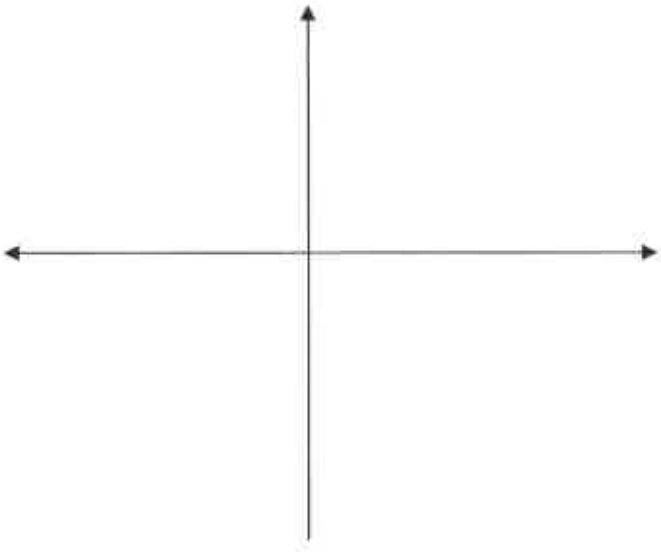


$\sin\theta =$

$\cos\theta =$

$\tan\theta =$

**Determine which trig ratios are positive for each quadrant.**



**ex.** Without using a calculator state if each ratio is positive or negative:

$\sin 260°$ $\cos 315°$ $\tan 91°$

**ex.** The point P(-3, 6) lies on the terminal arm of an angle θ in standard position. Draw $\theta$ and determine the rations for $\sin\theta$, $\cos\theta$ and $\tan\theta$ both as exact values and approximations to 4 decimal places.

**ex.** Suppose $\theta$ is an angle in standard position with terminal arm in quadrant III and $\sin\theta = -\frac{3}{5}$, find:

a) possible coordinates of A, a point on the terminal arm.

b) exact values of $\cos\theta$ and $\tan\theta$

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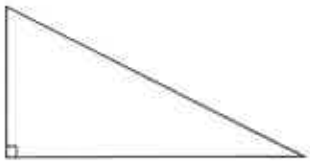
# *Unit 2B: Standard Position Trigonometry*

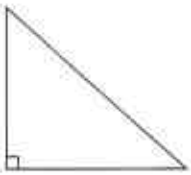
## *2B.3 Special Triangles, Exact Values, & Quadrantal Angles*

**Special Triangles:**

$30° - 60° - 90°$



$45° - 45° - 90°$



These triangles allow us to produce exact values for all the trig ratios (without use of a calculator) involving $30°, 45°$ & $60°$:

| | $30°$ | $45°$ | $60°$ |
|---|---|---|---|
| $\sin\theta = \frac{\text{—}}{\text{—}}$ | $\sin 30° =$ | $\sin 45° =$ | $\sin 60° =$ |
| $\cos\theta = \frac{\text{—}}{\text{—}}$ | $\cos 30° =$ | $\cos 45° =$ | $\cos 60° =$ |
| $\tan\theta = \frac{\text{—}}{\text{—}}$ | $\tan 30° =$ | $\tan 45° =$ | $\tan 60° =$ |

Can also be used to produce exact values for all the trig ratios (without use of a calculator) for standard position angles whose reference angles are $30°, 45°$ or $60°$:

**ex.** Find the exact value of:

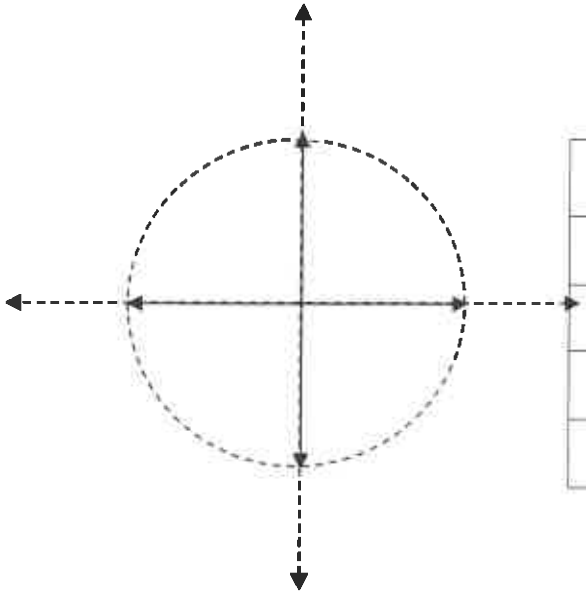
$\sin 150°$ $\cos 150°$

$\sin 225°$ $\tan 225°$

**ex.** A tree casts a shadow 8 m long when the angle of elevation of the sun is $60°$. Calculate the exact height of the tree.

**Quadrantal Angles:**

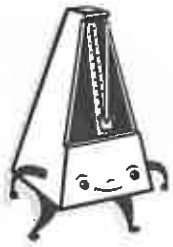
We can also determine exact trigonometric ratio values for quadrantal angles by using a *unit circle* (terminal arm length constant $r = 1$).



| | $\sin\theta =$ — | $\cos\theta =$ — | $\tan\theta =$ — |
|---|---|---|---|
| 0° | $\sin 0° =$ | $\cos 0° =$ | $\tan 0° =$ |
| 90° | $\sin 90° =$ | $\cos 90° =$ | $\tan 90° =$ |
| 180° | $\sin 180° =$ | $\cos 180° =$ | $\tan 180° =$ |
| 270° | $\sin 270° =$ | $\cos 270° =$ | $\tan 270°$ |

Note: $\infty$ = undefined

**ex.** Allie is learning to play the piano. Her teacher uses a metronome to help her keep time. The pendulum arm of the metronome is 10 cm long. For one particular tempo, the setting results in the arm moving back and forth from a start position of 60° to 120°. What horizontal distance does the tip of the arm move in one beat? Give an exact value.



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# *Unit 2B: Standard Position Trigonometry*

## *2B.4 Solving Trigonometric Equations I*

**Trigonometric Equation:**

**ex.** Solve to the nearest tenth of a degree. $0 \leq \theta < 360°$

a) $\sin\theta = 0.7562$

**Solution Steps (show your work!)**

1. Identify your quadrants & sketch
2. Determine your reference angle
3. Determine the solutions

b) $\cos\theta = -0.2491$

c) $\tan\theta = -\frac{5}{3}$

Watch the given restriction on the angle!

**ex.** Solve to the nearest degree. $90° < \theta < 270°$

a) $\sin\theta = -\frac{2}{7}$

b) $\cos\theta = 0.5667$

Sometimes we need to isolate the trigonometric ratio before we can solve.

**ex.** Solve to the nearest degree. $0 \leq \theta < 360°$

a) $5\tan\theta + 1 = 4$

b) $10\sin\theta + 5 = 4\sin\theta$

c) $3(2\cos\theta - 1) + 5 = 3\cos\theta + 7$

Practice:

# *Unit 2B: Standard Position Trigonometry*

## *2B.5 Solving Trigonometric Equations II*

**Solving specific angles:**

**ex.** Solve to the nearest degree, $0 \leq \theta < 360°$, if $\theta$ is an angle in standard position with a terminal arm point:

a) $(-2, 5)$

b) $(-4, -7)$

**Trig equations involving squares:**

**ex.** Solve to the nearest degree, $0 \leq \theta < 360°$:

a) $\tan^2 \theta = \frac{1}{9}$

b) $5\sin^2 \theta - 1 = 3$

**Solving equations with special or quadrantal angles:**

**ex.** Solve without a calculator, $0 \leq \theta < 360°$:

a) $\sin \theta = \frac{1}{2}$

b) $\cos \theta = -\frac{1}{\sqrt{2}}$

c) $\cos \theta = 0$

d) $\sin \theta = -1$

Practice: