Name: _____ Date: _____

THE RECIPROCAL TRIG FUNCTIONS
COMMON CORE ALGEBRA II

We have now seen three primary trigonometric functions, the sine, cosine, and tangent functions. Each of these can be defined in terms of either **ratios of the sides of a right** triangle or **the unit circle**. For each of these functions, though, there exists what is known as a **reciprocal function**. Their definitions are shown below.

THE OTHER FOUR TRIGONOMETRIC FUNCTIONS

1. SECANT: $\sec(\theta) = \dfrac{1}{\cos(\theta)}$ 2. **COSECANT:** $\csc(\theta) = \dfrac{1}{\sin(\theta)}$

3. **COTANGENT:** $\cot(\theta) = \dfrac{1}{\tan(\theta)}$ or equivalently $\cot(\theta) = \dfrac{\cos(\theta)}{\sin(\theta)}$

***Exercise* #1:** Considering your work with sine and cosine, evaluate each of the following. Express your answers in exact and simplest form.

(a) $\sec(60^\circ)$ (b) $\cot(150^\circ)$ (c) $\csc\left(\dfrac{3\pi}{4}\right)$

***Exercise* #2:** Which of the following is closest to the value of $\sec(52^\circ)$?

(1) 0.62 (3) 0.36

(2) 1.62 (4) 2.48

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Because each of these reciprocal trigonometric functions has a variable denominator, there will be angles at which these denominators are zero and hence the function is undefined.

***Exercise* #3:** Which of the following values of x is *not* in the domain of $y = \csc(x)$?

(1) $x = 180^\circ$ (3) $x = 90^\circ$

(2) $x = 60^\circ$ (4) $x = 135^\circ$

_____

Because each of these functions is dependent on sine and/or cosine, it is possible to determine the **sign** (positive or negative nature) of each based on the quadrant of the input angle.

***Exercise* #4:** Determine the sign of each of the following trigonometric functions in the quadrant specified.

(a) $\cot(\beta)$ for β in quad. II (b) $\sec(\beta)$ for β in quad. IV (c) $\csc(\beta)$ for β in quad. III

***Exercise* #5:** If $\cot(\theta) < 0$ and $\sec(\theta) > 0$ then θ could be which of the following angles?

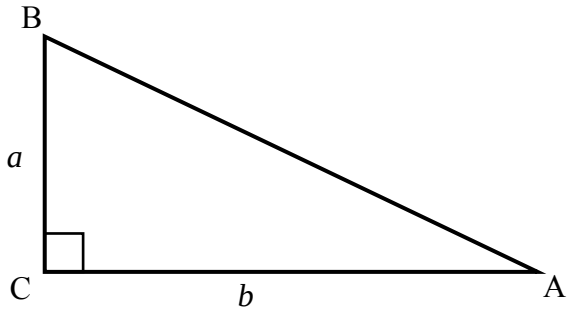
(1) $\theta = 48^\circ$ (3) $\theta = 122^\circ$

(2) $\theta = 310^\circ$ (4) $\theta = 225^\circ$

We should also be able to produce all of the trigonometric ratios (all SIX of them) if we are given a right triangle.

***Exercise* #6:** A right triangle is shown below with sides of length *a* and *b*.

(a) Find the length of the hypotenuse in terms of *a* and *b*. Label on the diagram.



(b) State the value of each of the following trigonometric ratios in terms of the constants *a* and *b*.

$\sin A =$ $\csc A =$

$\cos A =$ $\sec A =$

$\tan A =$ $\cot A =$

***Exercise* #7:** If α is an angle whose terminal ray lies in the fourth quadrant and $\cos\alpha = \frac{1}{3}$, then determine the exact value of $\csc\alpha$. Show how you arrived at your answer.

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THE RECIPROCAL TRIG FUNCTIONS
COMMON CORE ALGEBRA II HOMEWORK

FLUENCY

1. Determine the value of each of the following in exact and simplest form (leave no complex fractions).

(a) $\csc\left(30^\circ\right)$ (b) $\cot\left(90^\circ\right)$ (c) $\sec\left(180^\circ\right)$

(d) $\cot\left(\frac{\pi}{3}\right)$ (e) $\csc\left(\frac{3\pi}{2}\right)$ (f) $\sec\left(\frac{5\pi}{4}\right)$

2. Use your calculator to determine the value of each of the following to the nearest *hundredth*.

(a) $\cot\left(115^\circ\right)$ (b) $\sec\left(312^\circ\right)$ (c) $\csc\left(245^\circ\right)$

3. In simplest radical form, $\sec\left(135^\circ\right)$ is equal to

(1) $-\frac{\sqrt{2}}{3}$ (3) $-\frac{\sqrt{2}}{2}$

(2) $-\sqrt{2}$ (4) $-\frac{\sqrt{3}}{2}$ _____

4. Which of the following is nearest to the value of $\cot\left(220^\circ\right)$?

(1) 1.19 (3) –2.74

(2) 3.17 (4) –0.85 _____

5. For which of the following values of α is $\cot(\alpha)$ undefined? _____

(1) 60° (3) 180°

(2) 90° (4) 135°

6. For which angle, β, below will $\sec(\beta)$ not exist? _____

(1) 30° (3) 180°

(2) 45° (4) 90°

7. Determine whether each function in the tables below is positive, $(+)$, or negative, $(-)$, for angles whose terminal rays lie in the respective quadrants. Use the table in part (a) to help create the table in (b).

(a)

	I	II	III	IV
$\cos(\theta)$				
$\sin(\theta)$				

(b)

	I	II	III	IV
$\tan(\theta)$				
$\cot(\theta)$				
$\sec(\theta)$				
$\csc(\theta)$				

8. For the angle β it is known that $\csc(\beta) > 0$ and $\sec(\beta) < 0$. When drawn in standard position, the terminal ray of β lies in quadrant

(1) I (3) III

(2) II (4) IV _____

9. The angle θ when drawn in standard position has its terminal ray in the second quadrant. If it is known that $\sin\theta = \frac{5}{13}$ then determine the values of all of the remaining trigonometric functions.

(a) $\cos\theta$ (b) $\tan\theta$ (c) $\sec\theta$

(d) $\csc\theta$ (e) $\cot\theta$