

**Chapter 5**  
**Section 5.4**

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**Def:** If  $\alpha$  is an angle whose terminal side passes through the unit circle at  $(x, y)$  we define the **tangent**, **cotangent**, **secant**, and **cosecant** functions as:

$$\tan(\alpha) = \frac{y}{x}, \cot(\alpha) = \frac{x}{y}, \sec(\alpha) = \frac{1}{x}, \text{ and } \csc(\alpha) = \frac{1}{y}$$

**Alternate Def:** Recall if  $\alpha$  is an angle whose terminal side passes through the unit circle at  $(x, y)$ , then  $\sin(\alpha) = y$  and  $\cos(\alpha) = x$ . This gives us alternate definitions for the above functions by:

$$\tan(\alpha) = \frac{\sin(\alpha)}{\cos(\alpha)}, \cot(\alpha) = \frac{\cos(\alpha)}{\sin(\alpha)}, \sec(\alpha) = \frac{1}{\cos(\alpha)}, \text{ and } \csc(\alpha) = \frac{1}{\sin(\alpha)}$$

**Ex:** Find the value of all six trigonometric for  $\alpha = \pi/4$  and  $\beta = 150^\circ$

**Q:** What are the domains of these new functions?

**Graph of  $y = \tan(x)$**

**Graph of  $y = \cot(x)$**

**Graph of  $y = \sec(x)$**

**Graph of  $y = \csc(x)$**

**Ex:** Graph  $y = 2 \sec(x - \pi/2)$

**Practice:** 8, 13, 18, 22, 55, 59, 73, 75