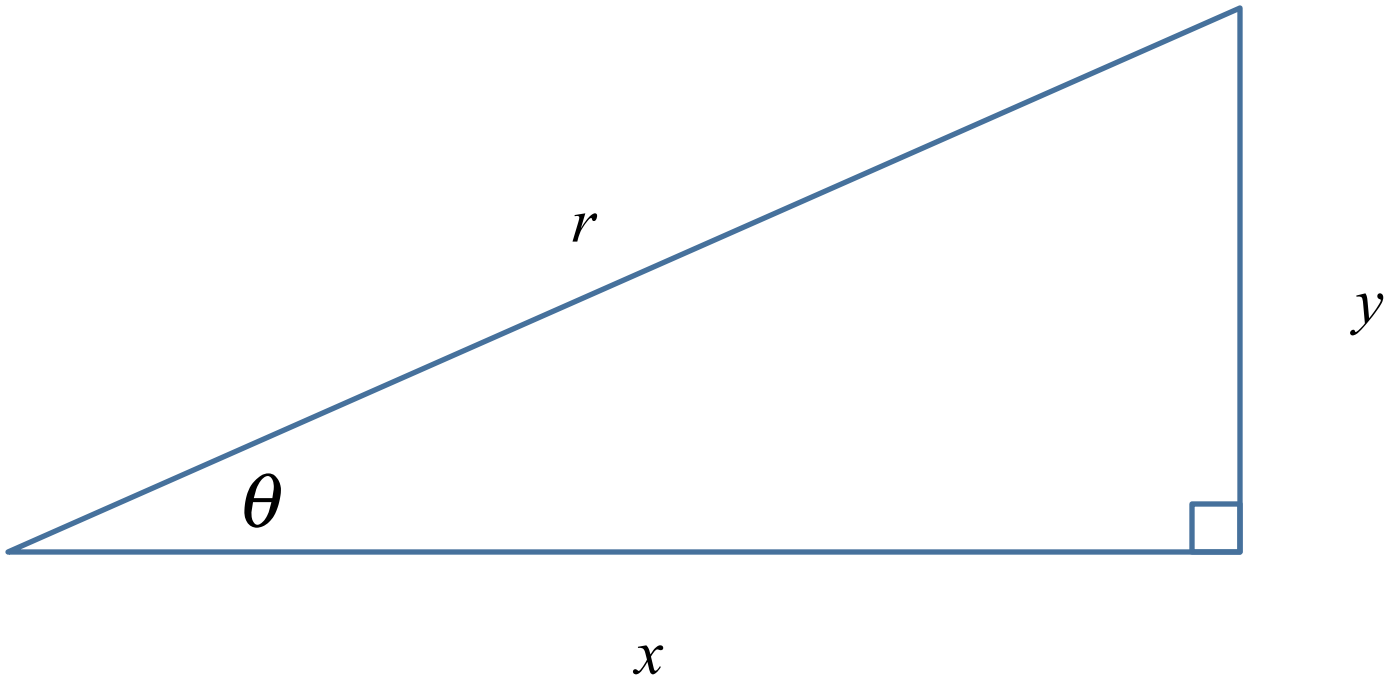


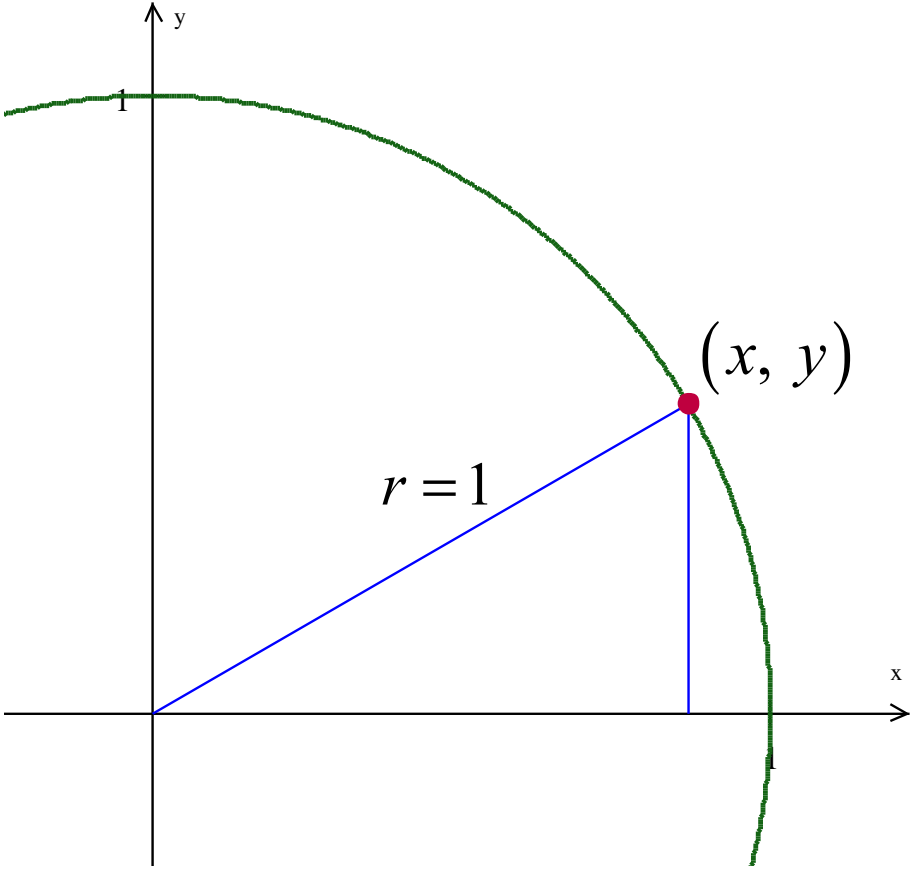

$\frac{y}{r}$ $\frac{x}{r}$ $\frac{y}{x}$

$$x^2 + y^2 = r^2$$

$$\frac{x^2}{r^2} + \frac{y^2}{r^2} = \frac{r^2}{r^2}$$

$$\left(\frac{x}{r}\right)^2 + \left(\frac{y}{r}\right)^2 = 1$$

$$\sin^2 x + \cos^2 x = 1$$




This is the first of three **Pythagorean Identities**

# Reciprocal Trig Functions

$$\csc\theta = \frac{1}{\sin\theta}$$

How did we get this, you wonder?

$$\sin\theta = \frac{y}{r} \qquad \frac{1}{\sin\theta} = \frac{1}{\left(\frac{y}{r}\right)} \qquad \frac{1}{\sin\theta} = \frac{r}{y}$$

Which according to page 74 is $\csc\theta$

$$\csc\theta = \frac{1}{\sin\theta}$$

# Reciprocal Trig Functions

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

# And don’t forget…

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\cot\theta = \frac{\cos\theta}{\sin\theta}$$

$$\sin^2 x + \cos^2 x = 1$$

$$\frac{\sin^2 x}{\sin^2 x} + \frac{\cos^2 x}{\sin^2 x} = \frac{1}{\sin^2 x}$$

$$1 + \cot^2 x = \csc^2 x$$

$$\tan^2 x + 1 = \sec^2 x$$

These are the three
**Pythagorean Identities**

Show that

$$\sin\theta\cot\theta = \cos\theta$$

Rewrite in terms of sine and cosine

$$\sin\theta\frac{\cos\theta}{\sin\theta} = \cos\theta$$

$$\cos\theta = \cos\theta$$

Show that

$$\frac{\csc\theta}{\sec\theta} = \cot\theta$$

$$\frac{\frac{1}{\sin\theta}}{\frac{1}{\cos\theta}} = \cot\theta$$

$$\frac{\cos\theta}{\sin\theta} = \cot\theta$$

Show that

$$\sin\theta(1+\cot^2\theta)=\csc\theta$$

Notice the identity first

$$\sin\theta(\csc^2\theta)=\csc\theta$$

$$\cancel{\sin\theta}\,\frac{1}{\cancel{\sin^2}\,\theta}=\csc\theta$$

$$\frac{1}{\sin\theta}=\csc\theta$$