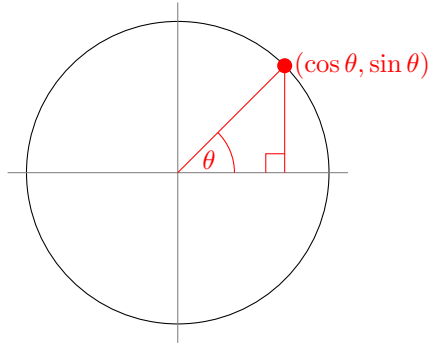
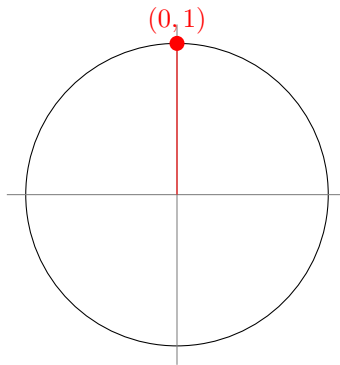


## Sines, cosines, and the unit circle

Every angle has its own sine and cosine. Closely related to sines and cosines from right triangles are sines and cosines from the unit circle. The sine and cosine of an angle are the  $y$  and  $x$  coordinates, respectively, of the point on the unit circle that sits at that angle. See the figure below.



Let's use this to figure out the sine and cosine of  $90^\circ$  (which is  $\pi/2$  radians). A  $90^\circ$  angle corresponds to the point right at the top of the circle, like shown below.



Since this is the unit circle, the coordinates of that point are  $(0, 1)$ . The  $x$ -coordinate is the cosine and the  $y$ -coordinate is the sine. So  $\cos(\pi/2) = 0$  and  $\sin(\pi/2) = 1$ . Similar reasoning can be used to figure out the sine and cosine of  $0$ ,  $\pi$ , and  $3\pi/2$  ( $0$ ,  $90^\circ$  and  $270^\circ$ ).

## Exercises

1. Use the unit circle definition to find cosine and sine of 0.
2. Use the unit circle definition to find cosine and sine of  $\pi$ .
3. Use the unit circle definition to find cosine and sine of  $3\pi/2$ .

## Answers

1. The angle  $0$  corresponds to the point  $(1, 0)$  on the unit circle. The cosine and sine correspond to the  $x$ - and  $y$ -coordinates, respectively, so  $\cos(0) = 1$  and  $\sin(0) = 0$ .
2. The angle  $\pi$  ( $180^\circ$ ) corresponds to the point  $(-1, 0)$  on the unit circle. The cosine and sine correspond to the  $x$ - and  $y$ -coordinates, respectively, so  $\cos(0) = -1$  and  $\sin(0) = 0$ .
3. The angle  $3\pi/2$  ( $270^\circ$ ) corresponds to the point  $(0, -1)$  on the unit circle. The cosine and sine correspond to the  $x$ - and  $y$ -coordinates, respectively, so  $\cos(0) = 0$  and  $\sin(0) = -1$ .