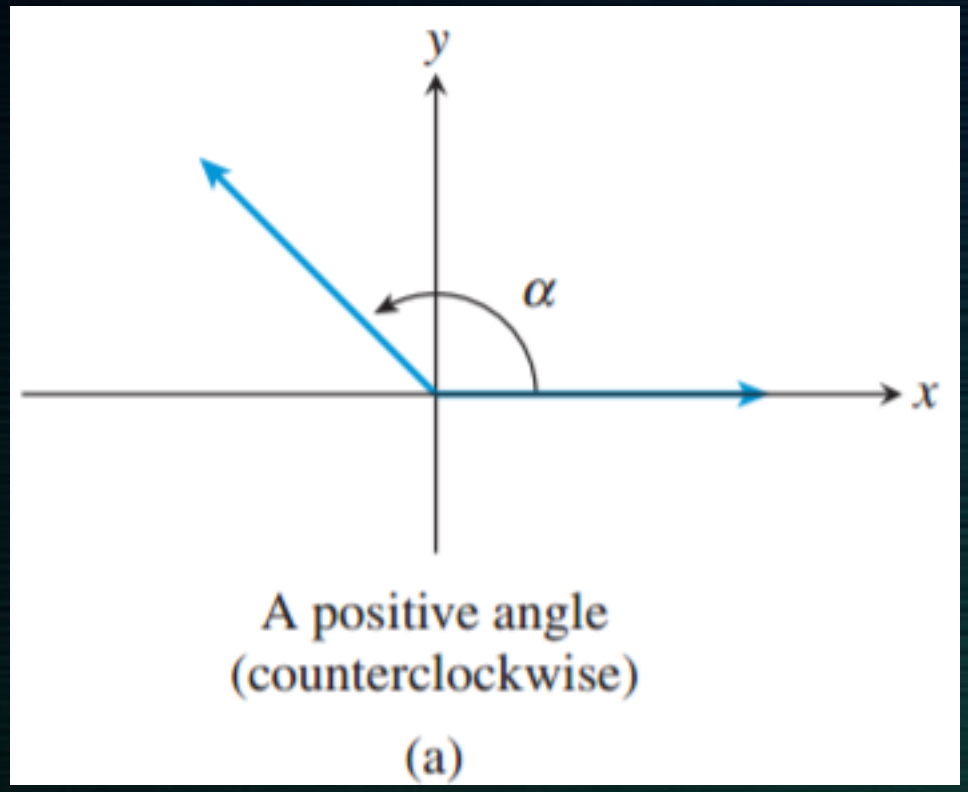
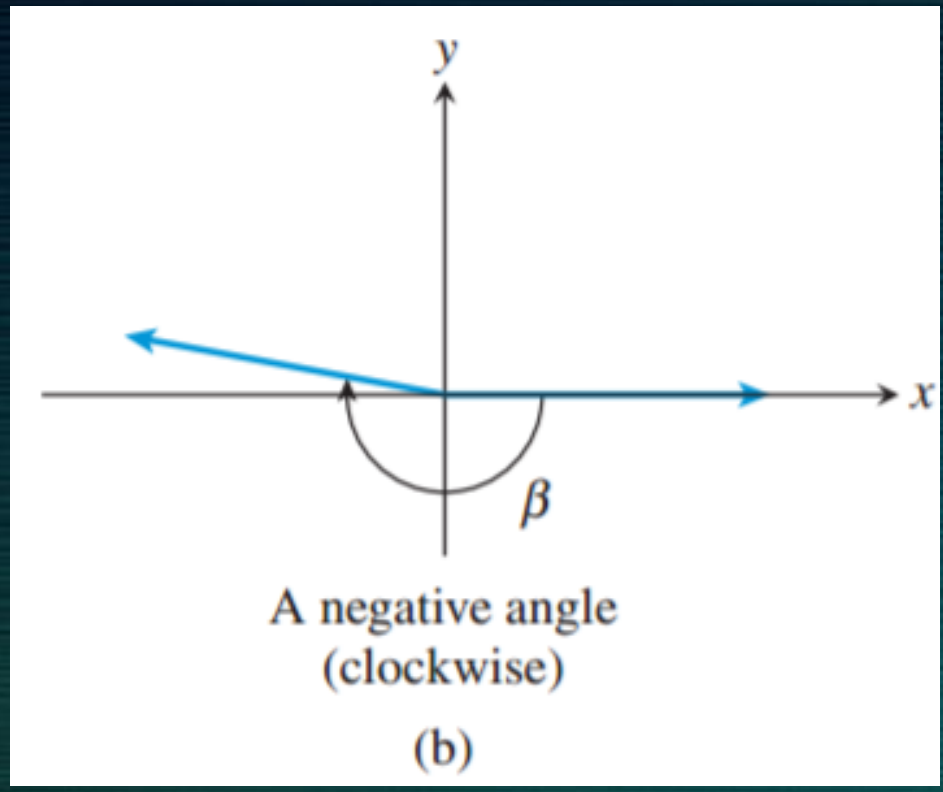


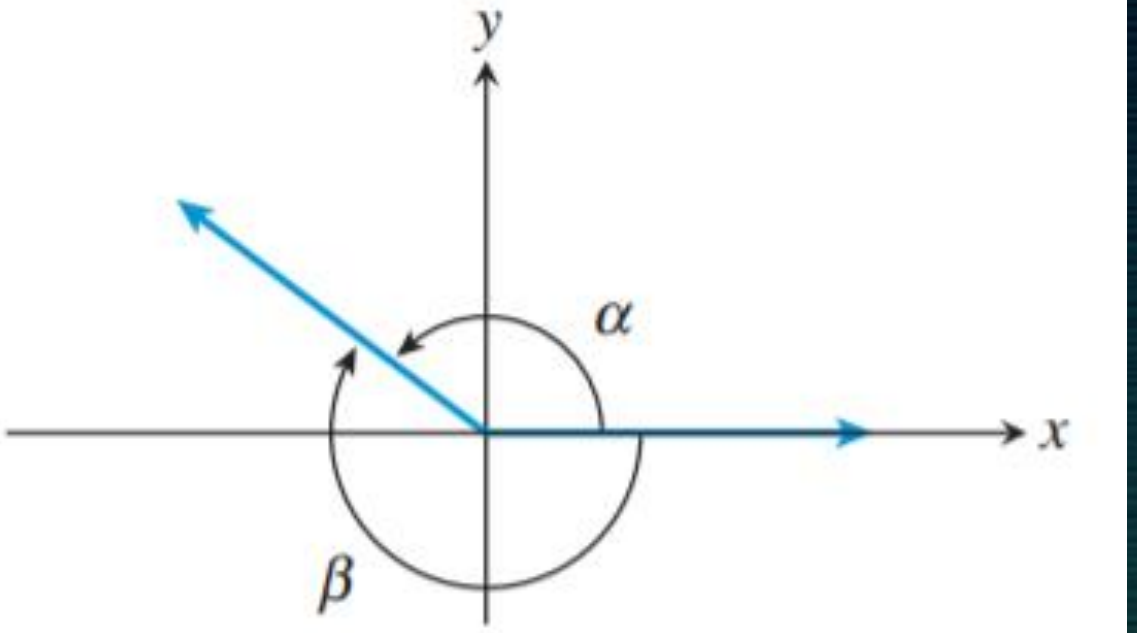
A positive angle
(counterclockwise)

(a)



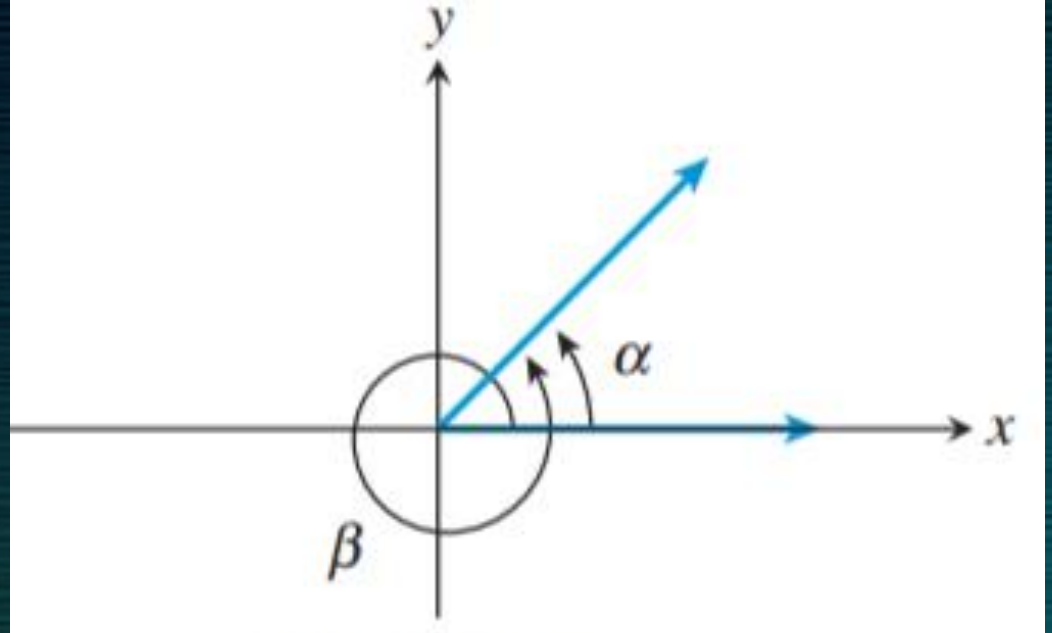
A negative angle
(clockwise)

(b)



Positive and negative coterminal angles

(a)



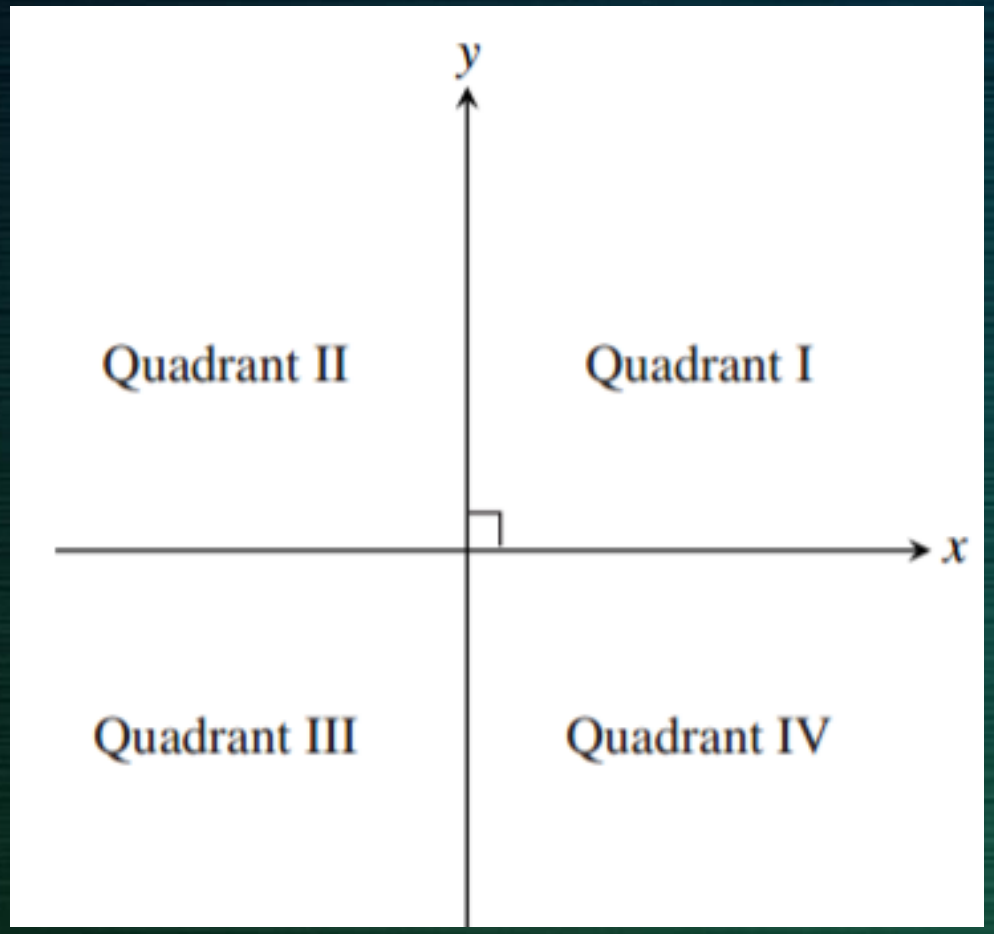
Two positive coterminal angles

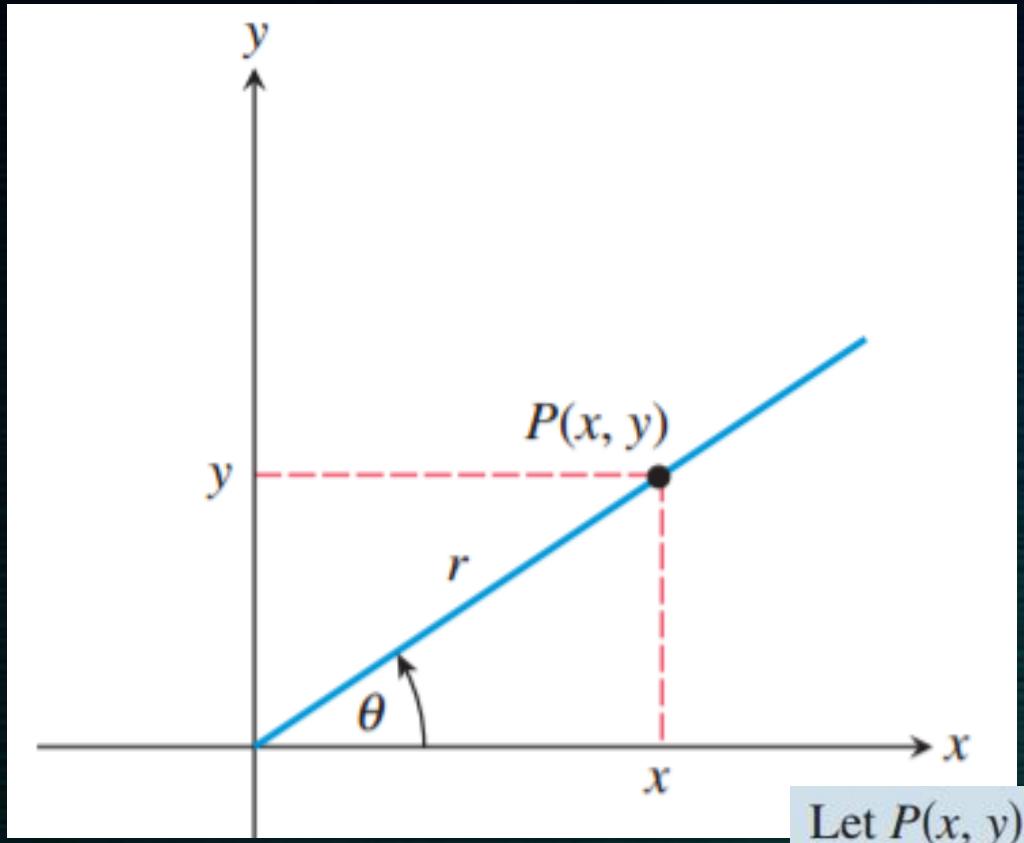
(b)

EXAMPLE 1 Finding Coterminal Angles

Find and draw a positive angle and a negative angle that are coterminal with the given angle.

(a) $30°$ **(b)** $-150°$ **(c)** $\frac{2\pi}{3}$ radians





Let $P(x, y)$ be any point in the first quadrant (QI), and let r be the distance from P to the origin. (See Figure 4.24.)

1. Use the acute angle definition of the sine function (Section 4.2) to prove that $\sin\theta = y/r$.
2. Express $\cos\theta$ in terms of x and r.
3. Express $\tan\theta$ in terms of x and y.
4. Express the remaining three basic trigonometric functions in terms of x, y, and r.

EXAMPLE 2 Evaluating Trig Functions Determined by a Point in QI

Let θ be the acute angle in standard position whose terminal side contains the point $(5, 3)$. Find the six trigonometric functions of θ.

EXAMPLE 3 Evaluating Trig Functions Determined by a Point Not in QI

Let θ be any angle in standard position whose terminal side contains the point $(-5, 3)$. Find the six trigonometric functions of θ.

EXAMPLE 4 Evaluating the Trig Functions of 315°

Find the six trigonometric functions of 315°.

EXAMPLE 5 Evaluating More Trig Functions

Find the following without a calculator:

(a) $\sin(-210^\circ)$

(b) $\tan(5\pi/3)$

(c) $\sec(-3\pi/4)$

EXAMPLE 6 Evaluating Trig Functions of Quadrantal Angles

Find each of the following, if it exists. If the value is undefined, write "undefined."

(a) $\sin(-270^\circ)$

(b) $\tan 3\pi$

(c) $\sec \dfrac{11\pi}{2}$

EXAMPLE 7 Using One Trig Ratio to Find the Others

Find $\cos\theta$ and $\tan\theta$ by using the given information to construct a reference triangle.

(a) $\sin\theta = \frac{3}{7}$ and $\tan\theta < 0$

(b) $\sec\theta = 3$ and $\sin\theta > 0$

(c) $\cot\theta$ is undefined and $\sec\theta$ is negative