$f(x) = x^2 + 2x + 1$ & $g(x) = 2x - 3$

ⓐ $f \circ g$

$$(f \circ g)(x) = f(g(x)) = f(2x-3)$$
$$= (2x-3)^2 + 2(2x-3) + 1$$
$$= 4x^2 - 12x + 9 + 4x - 6 + 1$$
$$= 4x^2 - 8x + 4$$

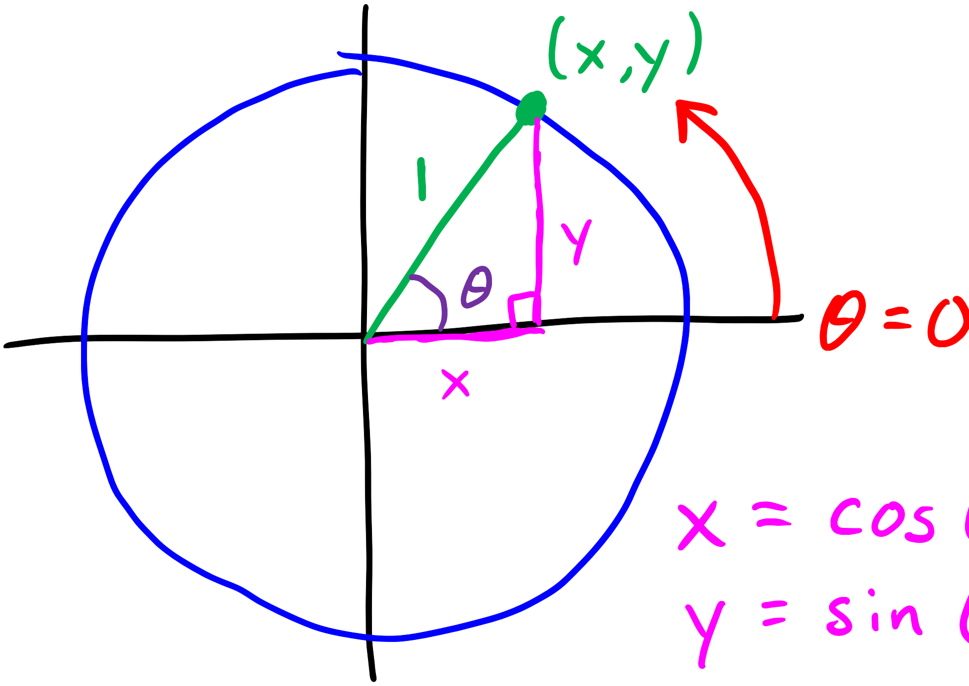
ⓑ $g \circ f$

$$(g \circ f)(x) = g(x^2+2x+1) = 2(x^2+2x+1) - 3$$
$$= 2x^2 + 4x - 1$$

ⓒ $g \circ g \circ g$

$$(g \circ g \circ g)(x) = g(g(g(x))) = g(g(2x-3))$$
$$= g(\underbrace{2(2x-3) - 3}_{(g \circ g)(x)}) = g(4x-9)$$
$$= 2(4x-9) - 3 = 6x - 21$$

$$\cos(e^{x^2}) = f(g(h(x)))$$



measure θ in radians

$(2\pi = 360^\circ)$

$x = \cos\theta$

$y = \sin\theta$

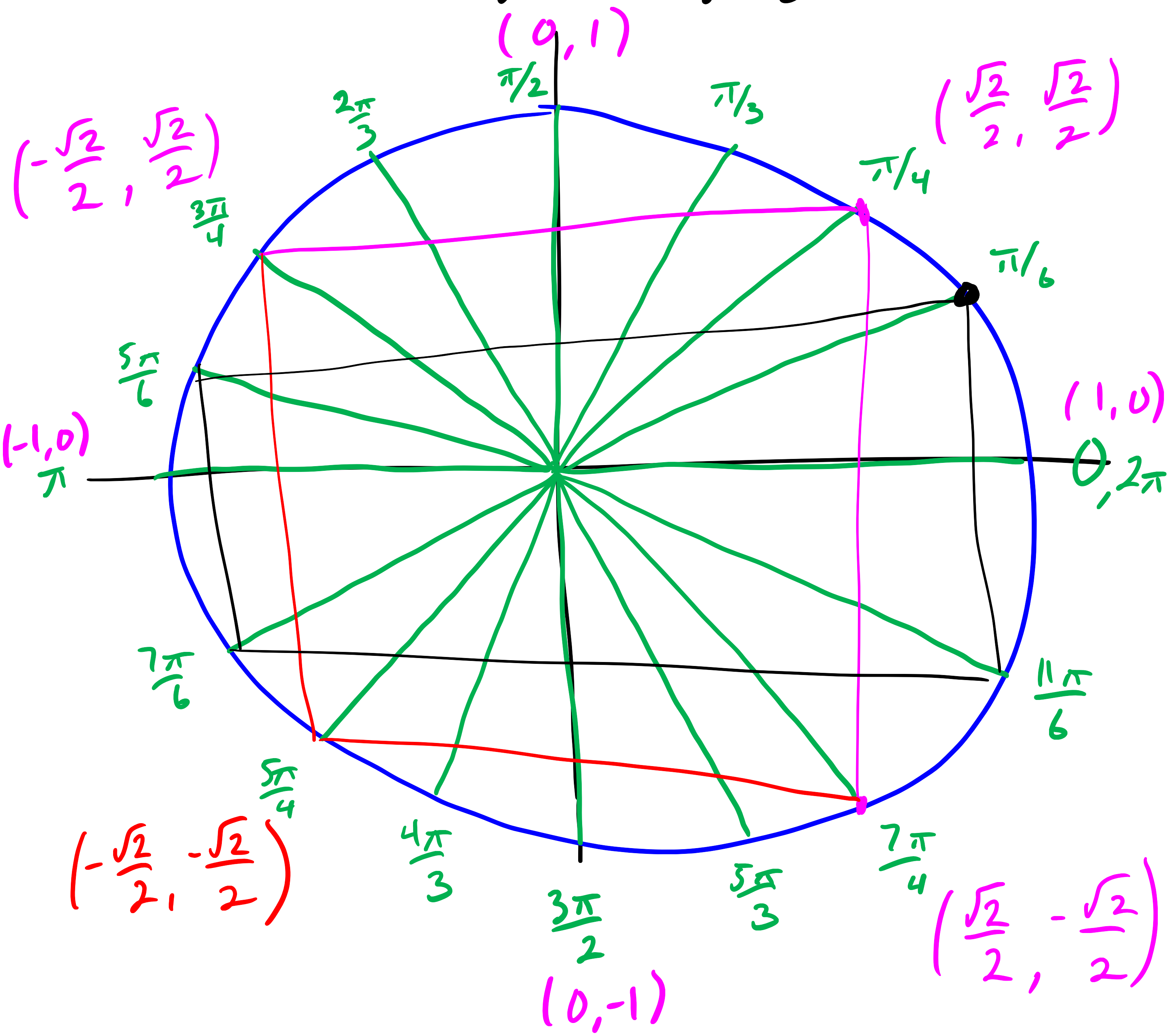
	0°	30°	45°	60°	90°
θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
$\sin\theta$	0	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0

simplify

	0°	30°	45°	60°	90°
θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
$\sin\theta$	$\sqrt{0}/2$	$\sqrt{1}/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	$\sqrt{4}/2$
$\cos\theta$	$\sqrt{4}/2$	$\sqrt{3}/2$	$\sqrt{2}/2$	$\sqrt{1}/2$	$\sqrt{0}/2$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}, \quad \sec\theta = \frac{1}{\cos\theta}, \quad \csc\theta = \frac{1}{\sin\theta}$$

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

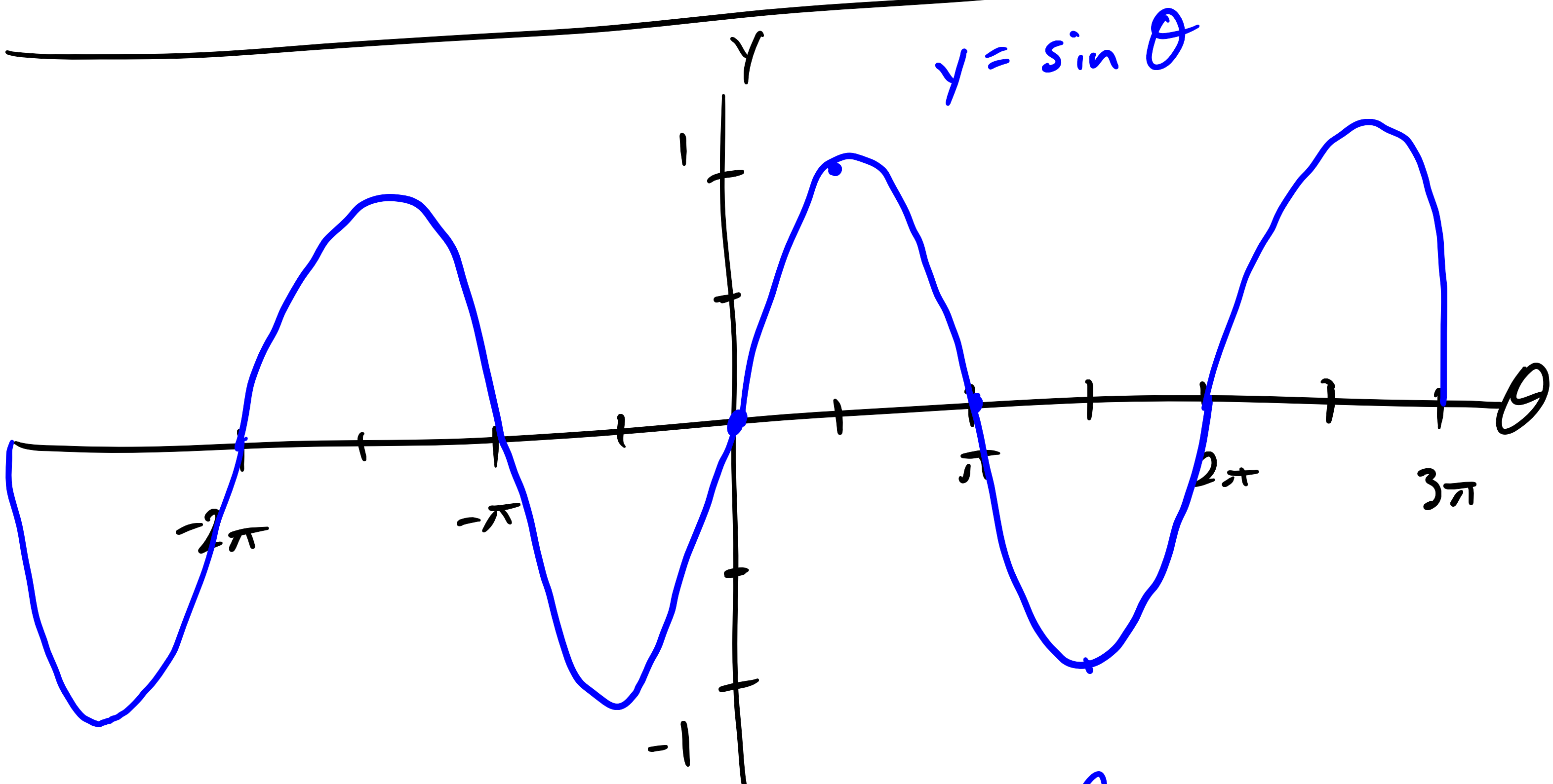


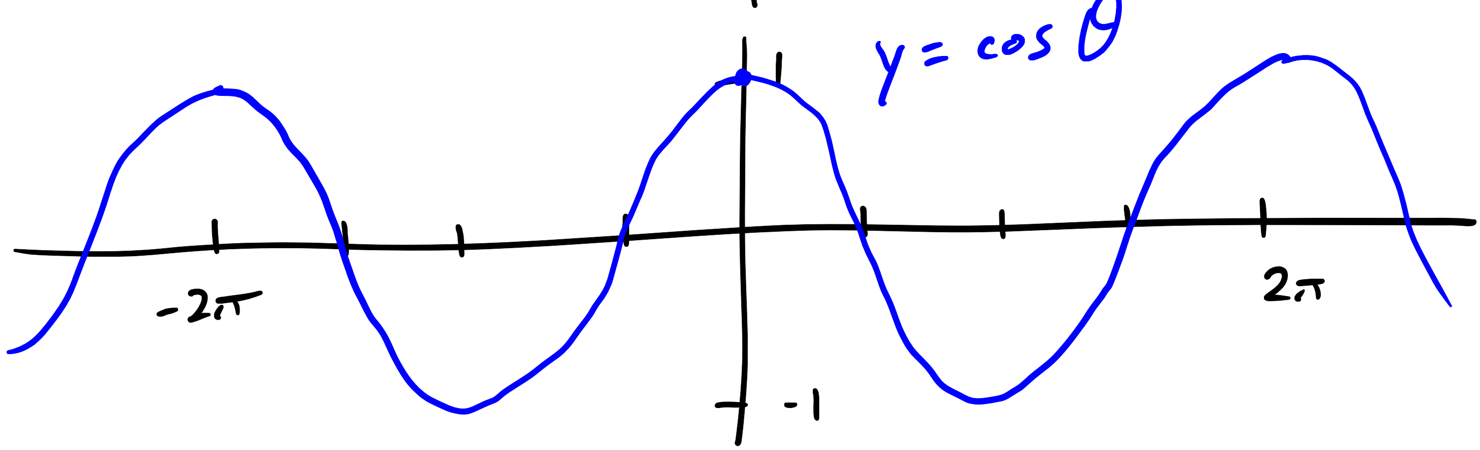
$$x^2 + y^2 = 1$$

Ex:

$$\left.\begin{aligned} \sin\frac{\pi}{6} &= \frac{1}{2} \\ \cos\frac{\pi}{6} &= \frac{\sqrt{3}}{2} \end{aligned}\right\} \rightarrow \begin{aligned} \sin\frac{5\pi}{6} &= \frac{1}{2} \\ \cos\frac{5\pi}{6} &= \frac{-\sqrt{3}}{2} \end{aligned}$$

$$\frac{7\pi}{6} \qquad \frac{11\pi}{6}$$





$$\sin(\theta + 2\pi) = \sin\theta$$
$$\cos(\theta + 2\pi) = \cos\theta$$

$$\begin{cases} \sin(\theta + 2n\pi) = \sin\theta \\ \cos(\theta + 2n\pi) = \cos\theta \end{cases}$$

$n = \cdots, -2, -1, 0, 1, 2, \cdots$

$$\sin\left(\frac{17\pi}{3}\right) = \sin\left(\frac{11\pi}{3} + \frac{6\pi}{3}\right) = \sin\left(\frac{5\pi}{3} + \cancelto{4\pi}{\frac{12\pi}{3}}\right)$$

$2\pi = \frac{6\pi}{3}$

$$= \sin\left(\frac{5\pi}{3}\right) = \frac{-\sqrt{3}}{2}$$

$f(x) = x^2 + 2x + 1 \qquad g(x) = 2x - 3$

ⓐ $f \circ g$ composition

$(f \circ g)(x) = f(g(x)) = f(2x-3)$

$= (2x-3)^2 + 2(2x-3) + 1$

$= 4x^2 - 12x + 9 + 4x - 6 + 1$

$= \boxed{4x^2 - 8x + 4}$

ⓑ $g \circ f$

$(g \circ f)(x) = g(f(x)) = 2(x^2 + 2x + 1) - 3 = 2x^2 + 4x - 1$

ⓒ $g \circ g \circ g$

$(g \circ g \circ g)(x) = g(g(g(x)))$

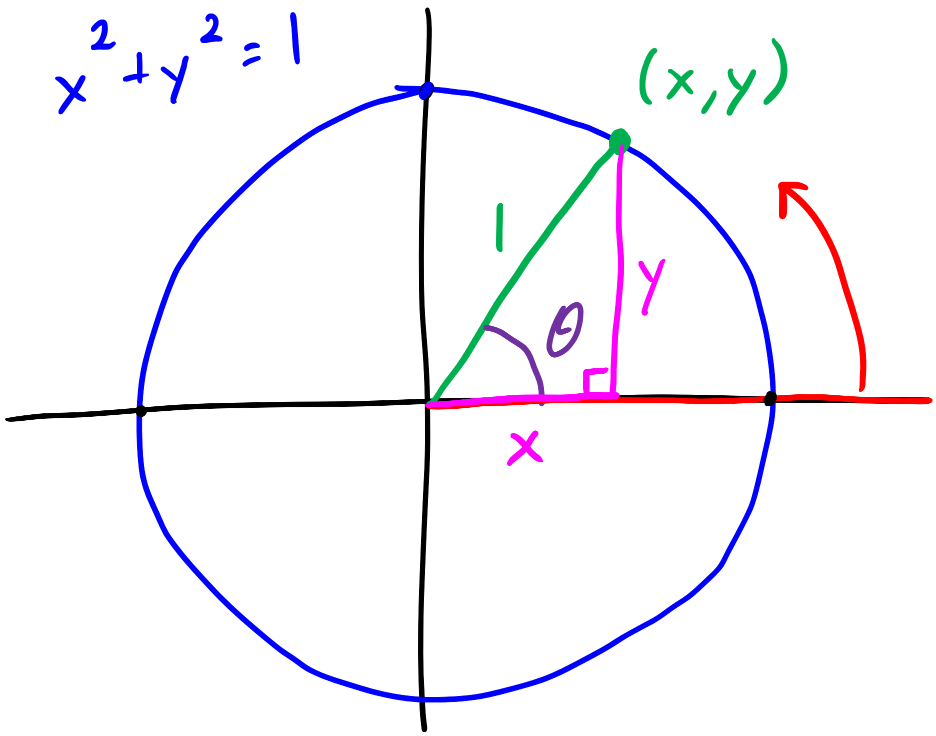
$= g(g(2x-3))$

$= g(2(2x-3) - 3) = g(4x-9)$

$= 2(4x-9) - 3 = 8x - 21$

$\cos\left(e^{x^2}\right)$ $\qquad f(g(h(x)))$

$\cos x \qquad e^x \qquad x^2$



$\theta = 0$

$2\pi = 360°$

$x = \cos\theta$

$y = \sin\theta$

θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
$\sin\theta$	0	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0

simplifying

θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
$\sin\theta$	$\sqrt{0}/2$	$\sqrt{1}/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	$\sqrt{4}/2$
$\cos\theta$	$\sqrt{4}/2$	$\sqrt{3}/2$	$\sqrt{2}/2$	$\sqrt{1}/2$	$\sqrt{0}/2$

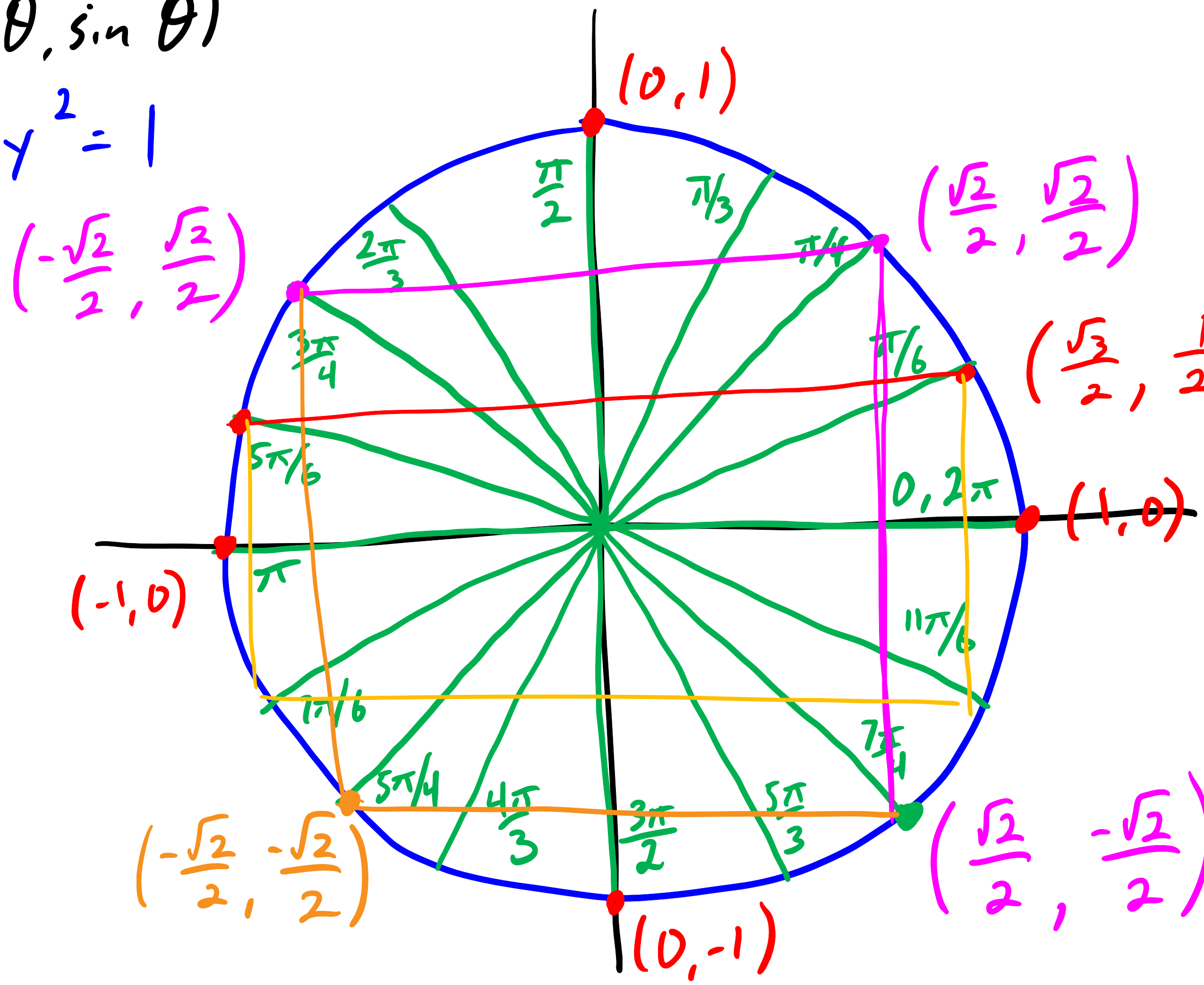
Other trig functions

$$\tan\theta = \frac{\sin\theta}{\cos\theta}, \quad \sec\theta = \frac{1}{\cos\theta}, \quad \csc\theta = \frac{1}{\sin\theta}$$

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

$(\cos\theta, \sin\theta)$

$x^2 + y^2 = 1$

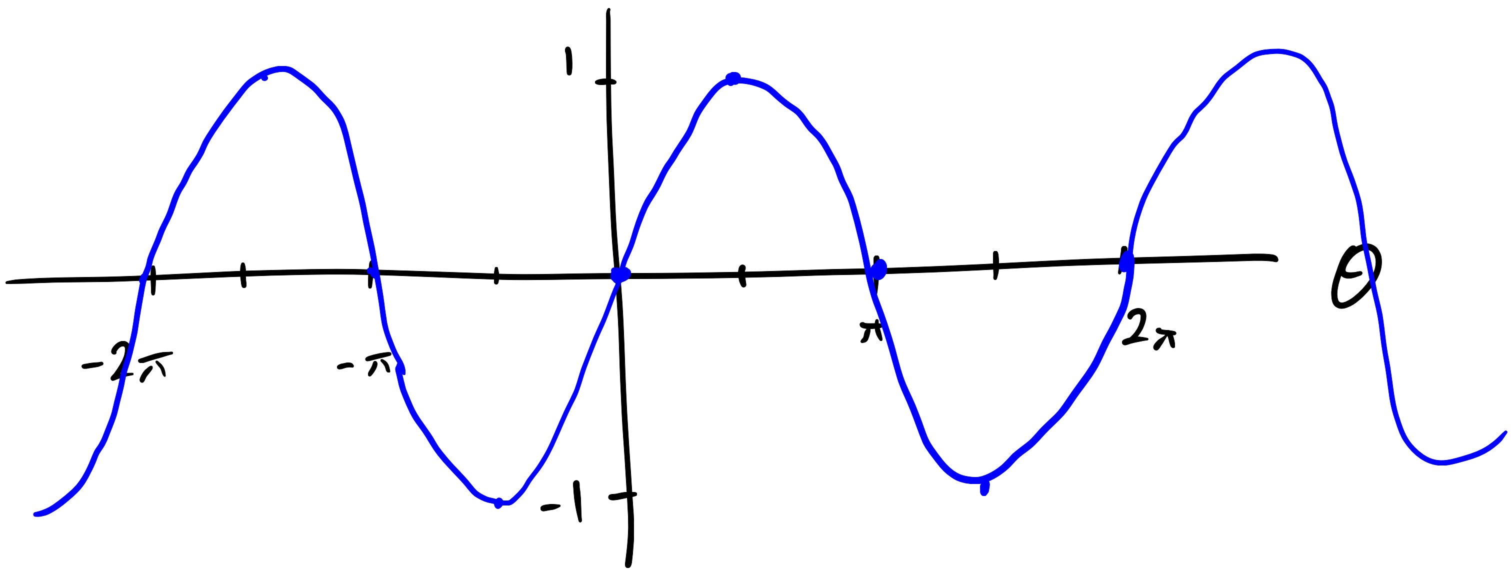


<u>Ex:</u> $\cos\frac{5\pi}{6} = -\frac{\sqrt{3}}{2}$

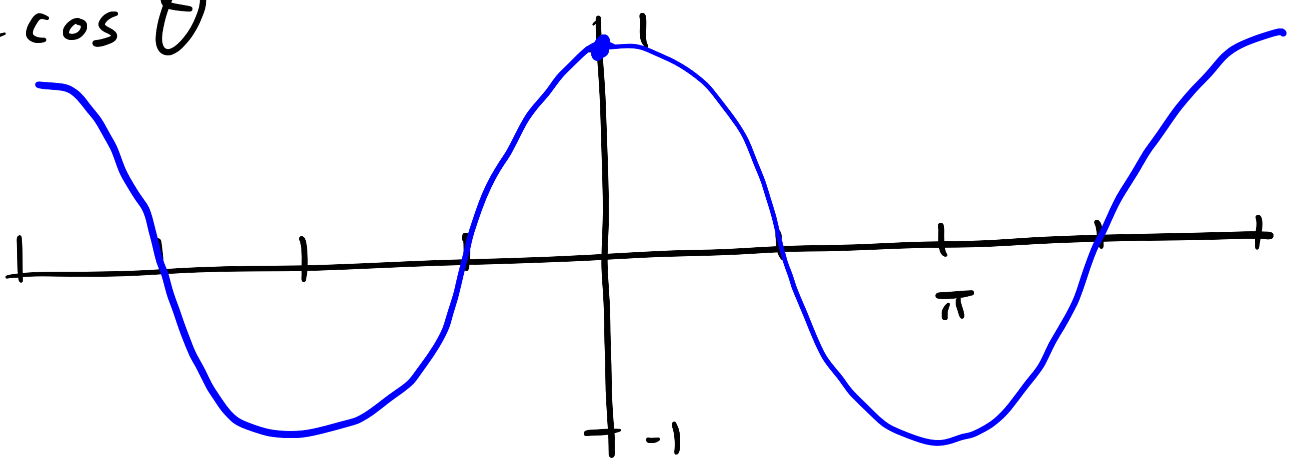
$\sin\frac{5\pi}{6} = \frac{1}{2}$

$\frac{\pi}{6} \to \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

$y = \sin \theta$



$y = \cos \theta$



$$\cos\left(\frac{11\pi}{3}\right) = \cos\left(\frac{5\pi}{3} + \frac{6\pi}{3}\right)$$

$$= \cos\left(\frac{5\pi}{3} \cancel{+ 2\pi}\right)$$

$$= \cos\left(\frac{5\pi}{3}\right) = \frac{\sqrt{3}}{2}$$

$$\sin(\theta + 2n\pi) = \sin(\theta)$$

$$\cos(\theta + 2n\pi) = \cos(\theta)$$