MA110. 10/26.

Sin, cos, tan.

- Ramanujan -

5pm R Hunt Morgan 107.

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- Math Excel for MA113.

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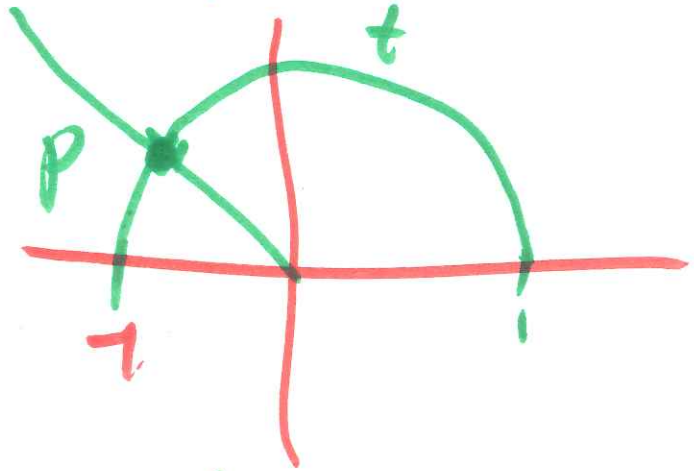
Def. of sin, cos, tan. Draw an angle of $t$ radians in standard position. The terminal side crosses the unit circle at a point P.




$P = (\cos(t), \sin(t))$.

$\tan(t) = \frac{\sin(t)}{\cos(t)}$.

$\cot(t) = \frac{1}{\tan(t)} = \frac{\cos(t)}{\sin(t)}$.

$\sec(t) = \frac{1}{\cos(t)}$, $\csc(t) = \frac{1}{\sin(t)}$

Domain & range

sin(t). Domain is all real numbers

Range is $[-1, 1]$

cos(t). Domain is $(-\infty, \infty)$.

Range is $[-1, 1]$.

$\tan(t) = \frac{\sin(t)}{\cos(t)}$

is undefined if $\cos(t) = 0$

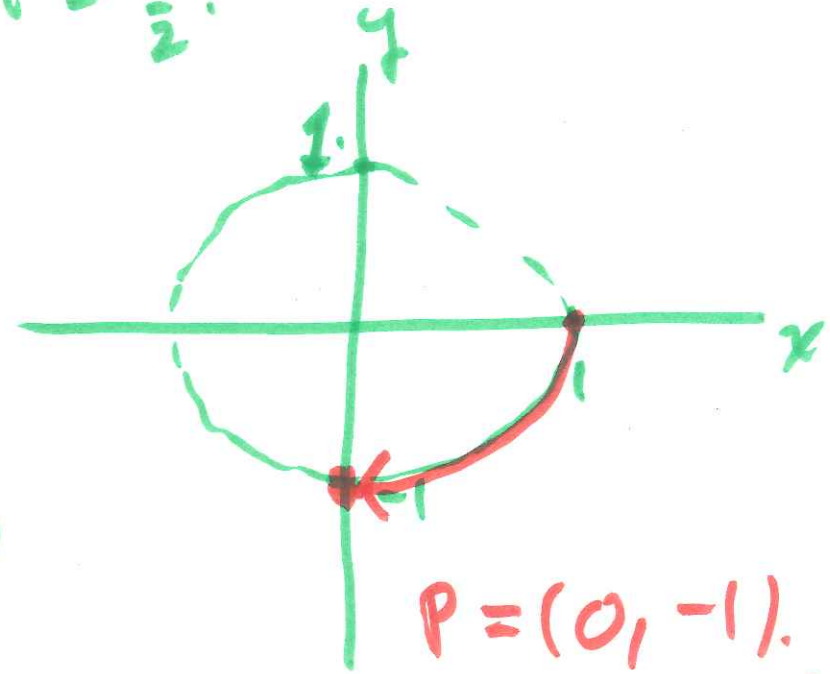
$t = \pm \pi/2, \pm \frac{3\pi}{2}, \ldots$

Domain is all real numbers except

$\pm \pi/2, \pm 3/2\pi \ldots$

Range is $(-\infty, \infty)$

Example Find cos, sin, tan at $t = \frac{\pi}{2}$.



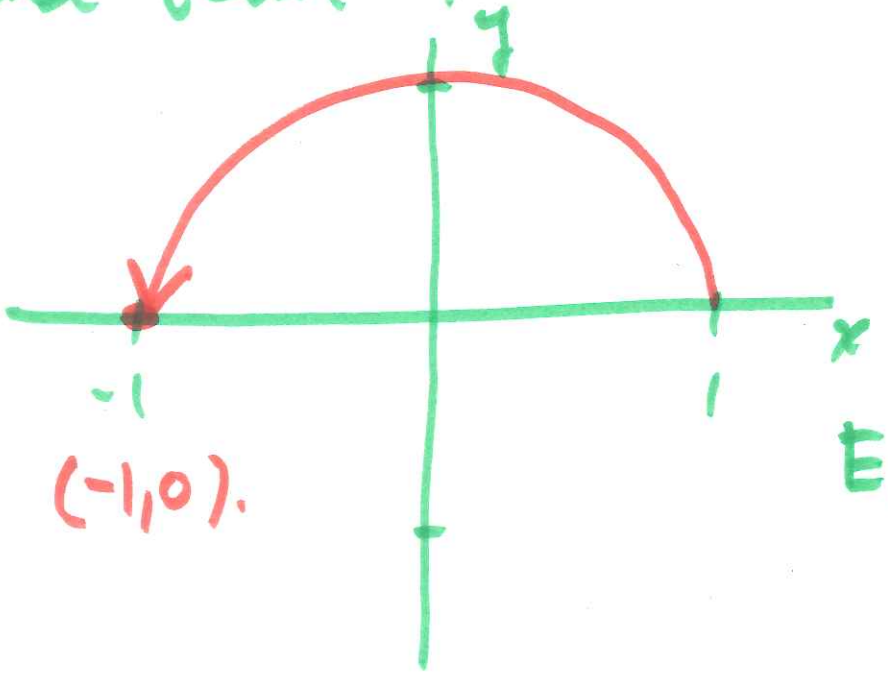

$P = (0, -1)$.

$= (\cos(-\pi/2), \sin(-\pi/2))$

$\cos(-\frac{\pi}{2}) = 0$, $\sin(-\pi/2) = -1$, $\tan(-\frac{\pi}{2}) =$ undef.

# REF #2.

Find $\cos(\pi)$, $\sin(\pi)$ and $\tan(\pi)$.

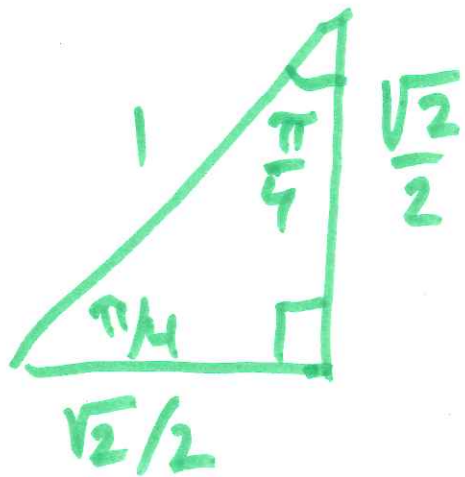


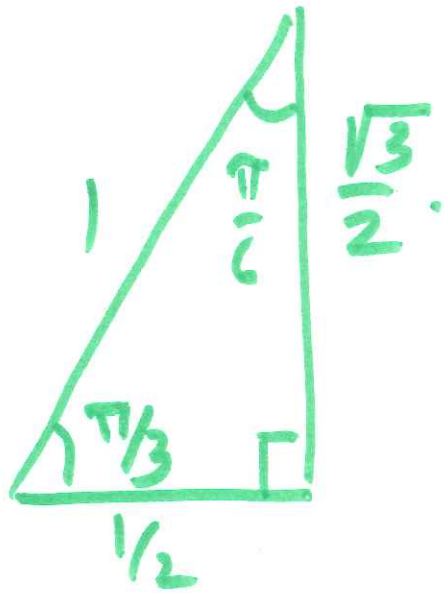

$\cos(\pi) = -1$

$\sin(\pi) = 0$

$\tan(\pi) = \frac{0}{-1} = 0.$

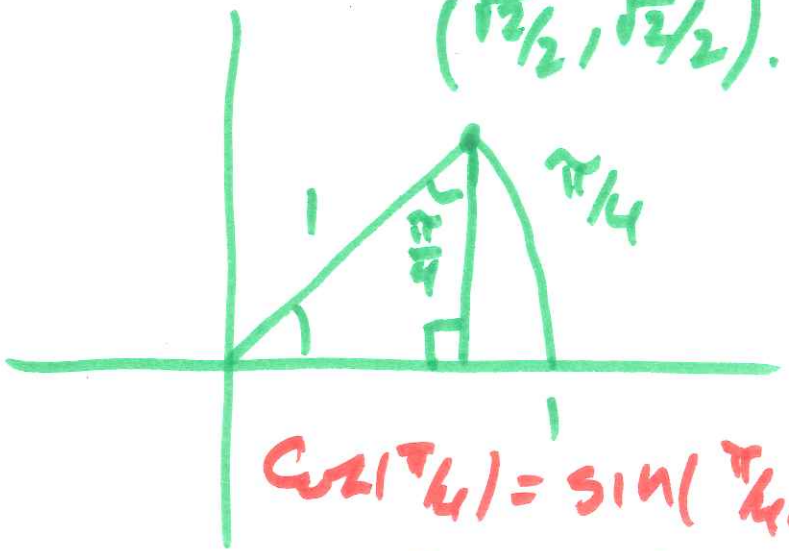
## Special triangles




Ex. Find $\cos(\pi/4)$.

$(\sqrt{2}/2, \sqrt{2}/2)$.




$\cos(\pi/4) = \sin(\pi/4) = \frac{\sqrt{2}}{2}.$

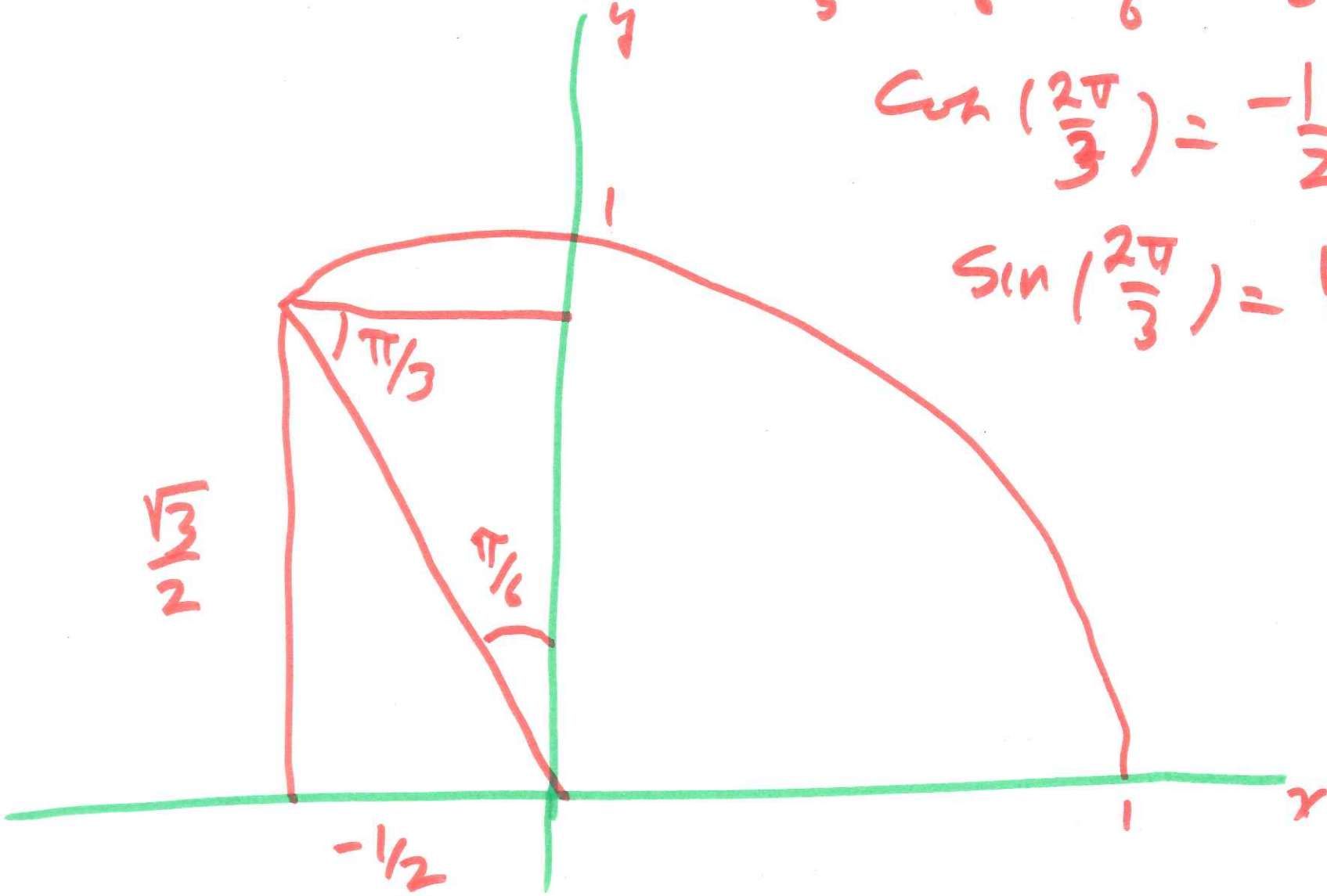
$\tan(\pi/4) = 1$

$\cos(2\pi/3), \sin(2\pi/3)$

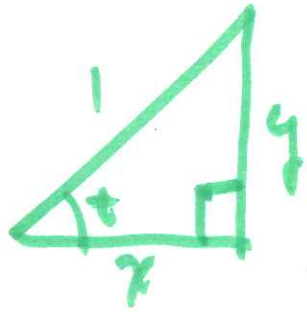
$\frac{2\pi}{3} = \frac{4\pi}{6} = \frac{3\pi}{6} + \pi/6$

$\cos\left(\frac{2\pi}{3}\right) = -\frac{1}{2}.$

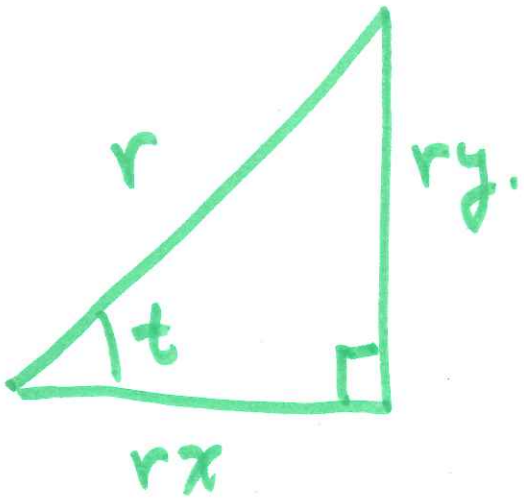
$\sin\left(\frac{2\pi}{3}\right) = \frac{\sqrt{3}}{2}.$



Similar triangles

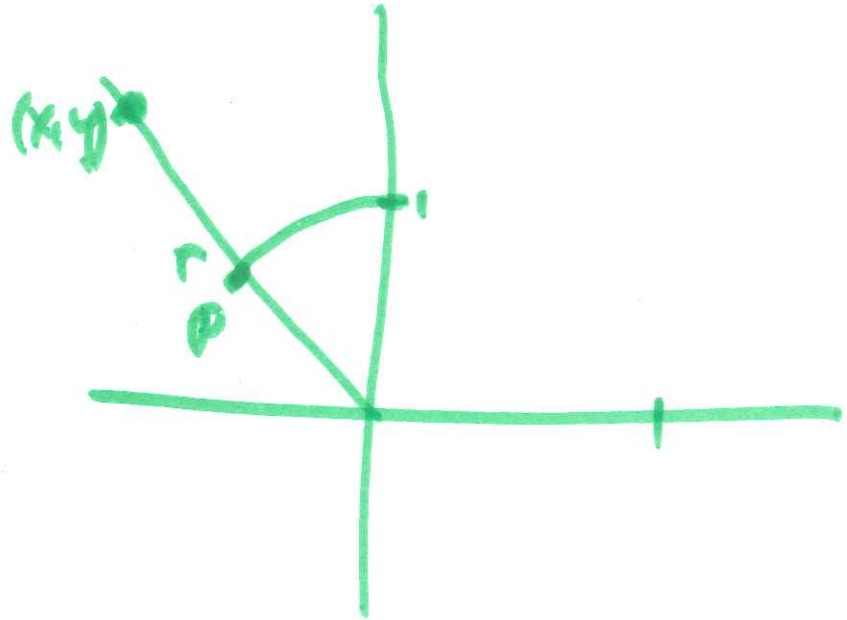



$\sin(t) = y$




$\sin(t) = \frac{ry}{r} = y$

Compute $r = \sqrt{x^2+y^2}$ this the distance from the origin.

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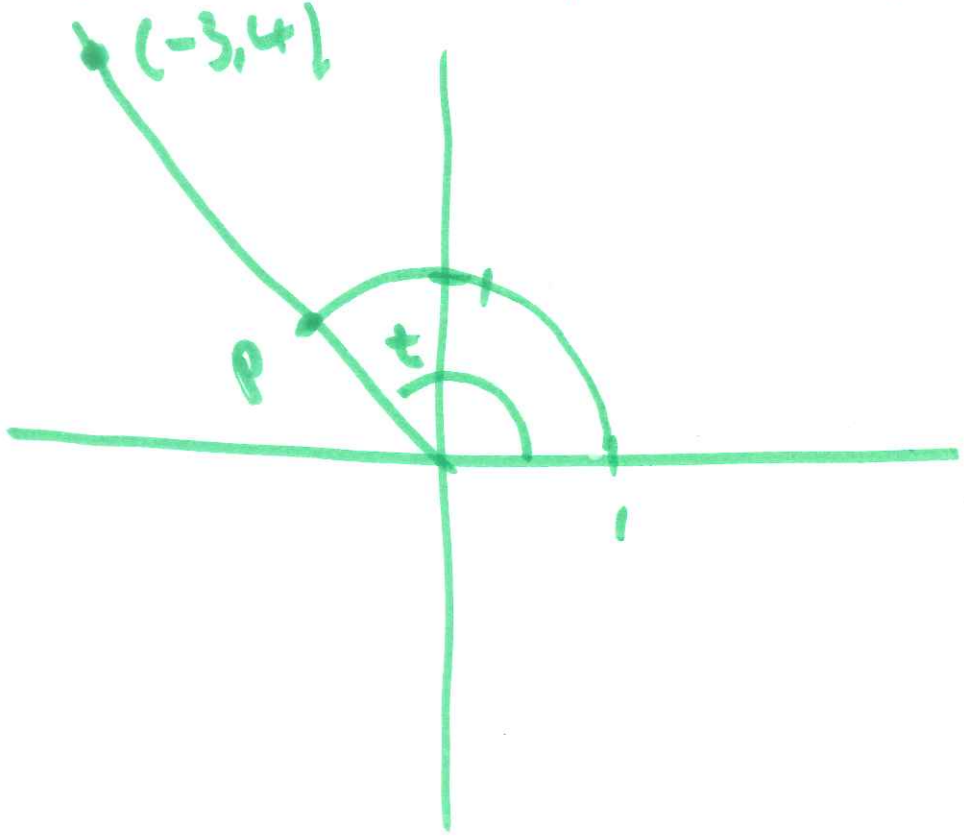
Given a point $(x,y)$ on the terminal sided an angle $t$.

$P = \left(\frac{x}{r}, \frac{y}{r}\right)$.

$= \cos(t), \sin(t)$.

The point $(-3, 4)$ lies on the terminal side of an angle $t$.

Find $(\cos(t), \sin(t))$




$r = \sqrt{(-3)^2 + 4^2}$

$= \sqrt{9 + 16}$

$= \sqrt{25} = \underline{5}$

$P = \left(\frac{-3}{5}, \frac{4}{5}\right)$.

$= (\cos(t), \sin(t))$

$\cos(t) = -3/5$

$\sin(t) = 4/5$.