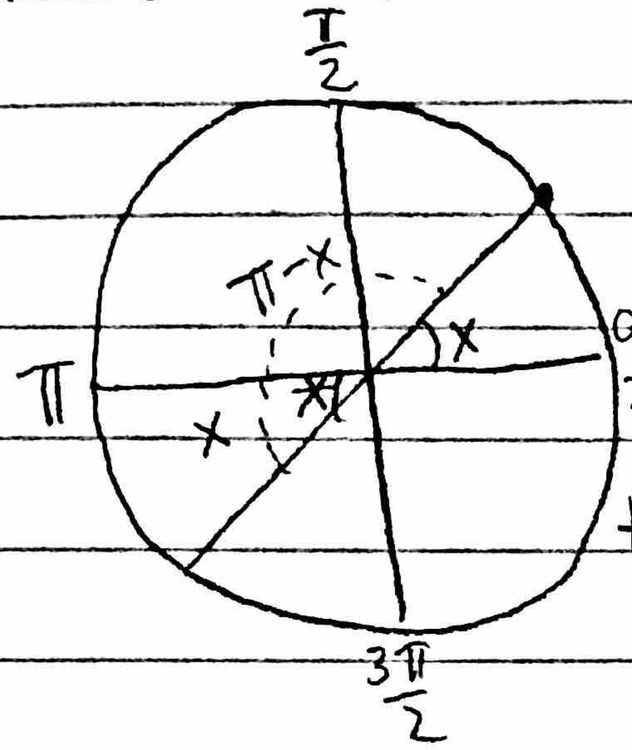
7.8/9.1 Supplementary Material

$\tan(x) = 4$ $[-\pi, \pi]$

$x = \tan^{-1}(4) \approx 1.326$

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



In the past, I've told you to think of $\tan(x)$ as the slope of the line from the origin of the unit circle to the point.

If we extend this line, we can see that this "extension" is π radians away

The dashed line represents the amount of radians from our original line to the "extension". This "extension" has the same slope of our original line.

This means the extension is another solution!

However, you don't need to do this! You can just add or subtract π from this first solution and then do the same with the other solutions

Solutions:

$\tan^{-1}(4) - \pi \approx -1.816$, $\tan^{-1}(4) \approx 1.326$

Graphically find solutions to trigonometric equations

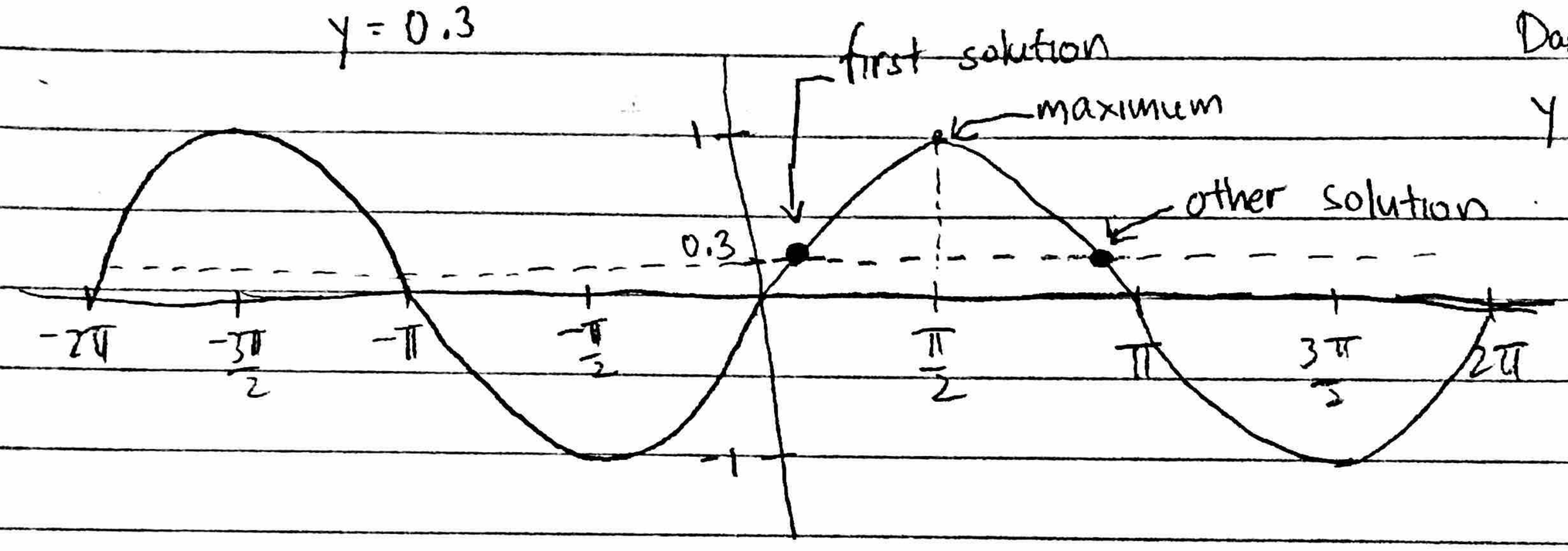
Let's do something easy

$$\sin(x) = 0.3 \qquad [0, \pi]$$

I recommend that you have desmos open and plot the following functions:

$y = \sin(x)$

$y = 0.3$



It may be hard to tell, but our first solution and other solution are symmetric around the maximum!

Let's find out where our first solution is on this graph:

Let x_1 be our first solution

$$x_1 = \sin^{-1}(0.3) \approx 0.305$$

Now, we need to know where our max is. We know that the maximum is at $\pi/2$. Let's find the distance between our first solution and the max

$$d = \frac{\pi}{2} - 0.305$$

Since the solutions are symmetric around the max, we know the other solution is d units to the right of our max. Therefore, our second solution is:

$$x_2 = \frac{\pi}{2} + d = \frac{\pi}{2} + \left(\frac{\pi}{2} - 0.305\right) = \pi - 0.305$$