We will start on how I originally thought about the problem.

It was an attempt to measure the arc length of the parabola segment of π *that fit an segment that connected the apex of the parabola to a point on the parabola. The length of this sement was* 3 *the first Prime number.*

This is probably incorrect, but it demostates the point that the x and y lengths of the parabola determine the shape, slope, and length of the parabola. (*Note that if this did work it would be its own new trigonometric ratio which is highly unlikely though it could be a combination of ratios. And if it did work it would be equal to the way we will find the sine and cosine of the angle.*)

$$(\frac{1}{x})^2 \cdot (\frac{1}{y})^2 = 1$$

in or *example*: $Prime = 3$; *at* π *radians along the curve of the parabola*

$$[(\frac{1}{x})^2 \cdot 3] \cdot [(\frac{1}{y})^2 \cdot 3] = 3 + .14 = \pi$$

This will become clear soon.

Given:

$$(\cos x)^2 + (\sin y)^2 = 1$$

$$\sin\theta = \frac{Opposite}{Hypotenuse} \text{ on a right triangle}$$

$$\cos\theta = \frac{Adjacent}{Hypotenuse} \text{ on a right triangle}$$

$$tangent\theta = \frac{Opposite}{Adjacent} \text{ on a right triangle}$$

The Pythagorean Theorem $a^2 + b^2 = c^2$

and the ability to substitute variables in an equation *in* or *example*: $Prime = 3$; *at* π *radians along the curve of the parabola*

where x *and* y *are the length of the sides of a right triangle from apex to point on the parabola*

$$\cos\theta = \frac{Adjacent}{Hypotenuse}$$

$$\cos\theta = \frac{x}{3}$$

$$\sin\theta = \frac{y}{3}$$

$$placed\ into\ (\cos\ x)^2 + (\sin\ y)^2 = 1$$

$$(\frac{x}{3})^2 + (\frac{y}{3})^2 = 1$$

and since we know are radius (*apex segment*) *equals the Prime number* 3

$$(\frac{x}{3})^2 \cdot 3 + (\frac{y}{3})^2 \cdot 3 = 3.14 = \pi$$

We set it equal to π *because that is the length of arc along the parabola. We could set it equal to* 3 *but that would not lead to an answer. We are using* π *because we are using the right triangle to estimate the length of arc. It is an estimate that may however break rules of trigonometry.*

Now it is a matter of substituting the equations we already know.

$$(\frac{x}{3})^2 \cdot 3 + (\frac{y}{3})^2 \cdot 3 = 3.14 = \pi$$

$$\frac{x^2}{9} \cdot 3 + \frac{y^2}{9} \cdot 3 = \pi$$

$$\frac{x^2}{3} + \frac{y^2}{3} = \pi$$

$$\frac{y^2}{3} = \pi - \frac{x^2}{3}$$

$$y = \sqrt{3\pi^2 - x^2}$$

$$y = \sqrt{(3\pi - x)(3+x)}$$

This previous equation is the equivalent of using the Pythagorean Theorem $x^2 + y^2 = c^2$*. It is the Pythagorean Identity of the trigonometric identities.*

Plug into the Pythagorean Theorem $x^2 + y^2 = c^2$

$$x^2 + y^2 = 3^2$$

where 3 *is the hypotenuse*

$$y^2 = 3^2 - x^2$$

$$y = \sqrt{3^2 - x^2}$$

$$y = \sqrt{(3 - x)(3+x)}$$

Since we basically just used the same equation (modified slightly) we get

$$y = y$$

$$y = \sqrt{(3 - x)(3+x)} = \sqrt{(3\pi - x)(3+x)}$$

square both sides

$$(3 - x)(3+x) = (3\pi - x)(3+x)$$

$$3 = 3\pi$$

This proves to be not useful because we modified the Pythagorean equation and set it equal to itself. We need a trigonometric identity that uses our same given in a different calculation.

Now we need to find a relationship of the given. The problem is most of the *trigonometric identities rely on the Pythagorean Theorem. But if the above equations are true we could use*

$$[(\frac{1}{x})^2 \cdot 3] \cdot [(\frac{1}{y})^2 \cdot 3] = 3 + .14 = \pi$$

But we're not. We will use the Scosine equation.

$$L = Scosine = \frac{|\cos[\theta_1] - \cos\theta_2]|}{\cos[\theta_2]} \cdot r$$

$$\cos[\theta_1] = 1$$

3 *our given Prime number which is also the hypotenuse becomes*

$$3 = \frac{1}{L} + x$$

The cosine of the right triangle is $\frac{x}{3}$

$$3 = \frac{1}{\frac{1-\frac{x}{3}}{\frac{x}{3}}} + y$$

$$\frac{\frac{x}{3}}{1-\frac{x}{3}} + y = 3$$

$$\frac{\frac{x}{3}}{1-\frac{x}{3}} = 3 - y$$

$$\frac{x}{3} = (1 - \frac{x}{3})(3 - y)$$

$$x = \frac{1}{3}(3 - y - x + \frac{x \cdot y}{3})$$

$$x = 1 - \frac{y}{3} - \frac{x}{3} + \frac{xy}{9}$$

$$3 \cdot (\frac{4}{3} \cdot x - 1) = -y + \frac{xy}{3}$$

$$4x - 1 = -y + \frac{xy}{3}$$

$$\frac{3 \cdot (4x - 1)}{x \cdot y} = -y$$

$$\frac{3 \cdot (4x - 1)}{x} = -y^2$$

$$y^2 = -1 \cdot [\frac{3 \cdot (4x - 1)}{x}]$$

as previously derived

$$y = \sqrt{(3 - x)(3 + x)}$$

$$y = \sqrt{3^2 - x^2}$$

substitute

$$[\sqrt{3^2 - x^2}]^2 = -1 \cdot [\frac{3 \cdot (4x - 1)}{x}]$$

$$x^2 - 3^2 = \frac{3 \cdot (4x - 1)}{x}$$

$$x^3 - 9x = 3 \cdot (4x - 1)$$

$$3x^3 - 27x = 4x - 1$$

$$3x^3 - 27x + 1 = 4x$$

$$3x^2 + \frac{1}{x} - 27 = 4$$

$$3x^2 + \frac{1}{x} - 23 = 0$$

Plug into the quadratic equation:

$$\frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2a}$$

$$\frac{-1 \pm \sqrt{-1^2 - 4 \cdot 3 \;\; \cdot -23}}{2*3}$$

$$\frac{-1 \pm \sqrt{1+276}}{6}$$

$$\frac{-1 + \sqrt{277}}{6} \text{ or } \frac{-1 - \sqrt{277}}{6}$$

$$x = 2.6072 \text{ or } x = -2.9405$$

Plug into right triangle trigonometric ratios:

$$\cos\theta = \frac{Adjacent}{Hypotenuse} \text{ on a right triangle}$$

$$\cos\theta = \frac{2.6072}{3}$$

$$\theta = \cos^{-1}[\frac{2.6072}{3}]$$

$$\theta = 29.6496 \text{ degrees}$$

So we basically have a 30---60 *triangle and can use this info to find where an arc of* π *radians intersects are parabola with the distance from the apex equal to our Prime number* 3!