

Example: Find the equation of the parabola with vertex at  $(2, 1)$  and passing through  $(.75, 4)$ .

Solution: The plan is to start with  $y = x^2$  and re-scale it so that it will pass through  $(.75, 4)$  after translating it to put its vertex at  $(2, 1)$ .

Re-scaling horizontally is achieved by replacing  $x$  by  $\frac{1}{c}x$ . We get  $y = (\frac{1}{c}x)^2$ . Translating right by 2 and up by 1 gives  $y = (\frac{1}{c}(x - 2))^2 + 1$ .

When  $x = .75$  then  $y = 4$  so  $4 = (\frac{1}{c}(.75 - 2))^2 + 1$  must be true.

Then:

$$3 = (\frac{1}{c}(.75 - 2))^2$$

$$\sqrt{3} = \frac{1}{c}(.75 - 2)$$

$$\frac{\sqrt{3}}{1.25} = \frac{1}{c}$$

or

$$\frac{1}{c} = \frac{4\sqrt{3}}{5}$$

The desired equation is:

$$y = (\frac{4\sqrt{3}}{5}(x - 2))^2 + 1$$

or

$$y = \frac{48}{25}(x - 2)^2 + 1$$