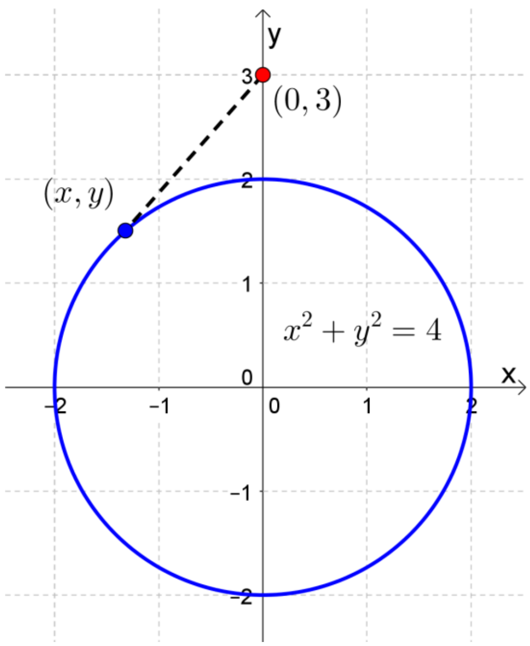
1. Find the distance from the point $(0, 3)$ to the circle $x^2 + y^2 = 4$ as a function of y only. Be sure to simplify your function.

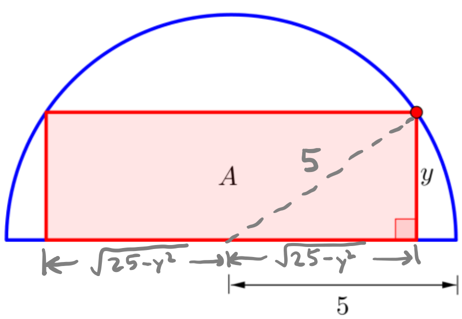


$$d(x,y) = \sqrt{(x-0)^2 + (y-3)^2}$$
$$= \sqrt{x^2 + (y-3)^2}$$

$x^2 + y^2 = 4$
$x^2 = 4 - y^2$

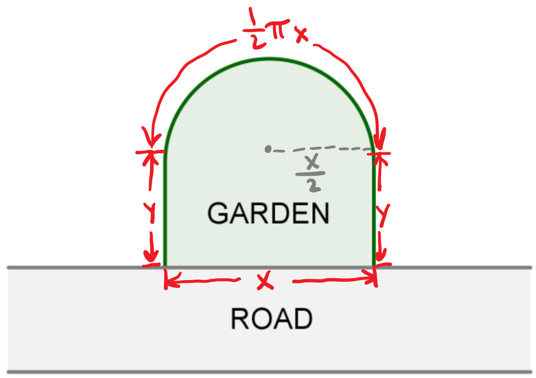
$$d(y) = \sqrt{4 - \cancel{y^2} + \cancel{y^2} - 6y + 9}$$
$$= \boxed{\sqrt{13 - 6y}}$$

2. A rectangle is inscribed in a semicircle of radius 5. Find a function that models the area A of the rectangle in terms of its height y.



$$A(y) = y \cdot \left(2\sqrt{25-y^2}\right)$$
$$= \boxed{2y\sqrt{25-y^2}}$$

4. You want to fence a garden with one side against a straight road. The garden consists of a rectangular region and a semicircular region as shown below. Most of the fencing costs \$3 per foot, but the fencing next to the road must be sturdier and costs \$4 per foot. You want to have an area of 400 ft^2. Find a function in one variable that models the cost of fencing the garden.



The length of the semicircle is:

$$\frac{1}{2}(2\pi r) = \pi r = \pi\left(\frac{x}{2}\right) = \frac{1}{2}\pi x$$

Area of semicircle is $\frac{1}{2}\pi r^2 = \frac{1}{2}\pi\left(\frac{x}{2}\right)^2$

$$C(x,y) = 3\cdot\left(\frac{1}{2}\pi x + y + y\right) + 4\cdot x$$

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

$A = 400$

$$xy + \frac{1}{2}\pi\left(\frac{x}{2}\right)^2 = 400$$

$$xy = 400 - \frac{1}{8}\pi x^2$$

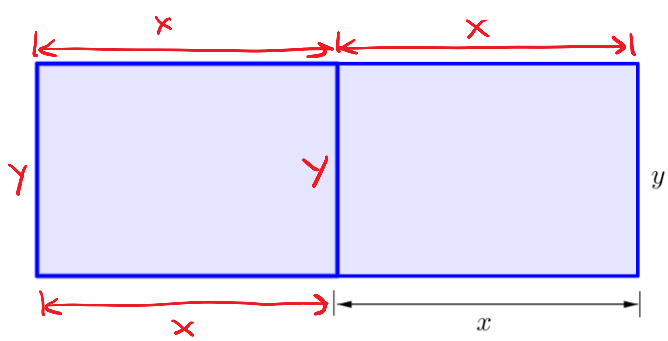
$$y = \frac{400}{x} - \frac{1}{8}\pi x$$

$$C(x) = \frac{3}{2}\pi x + 6\left(\frac{400}{x} - \frac{1}{8}\pi x\right) + 4x$$

$$= \frac{3}{2}\pi x + \frac{2400}{x} - \frac{3}{4}\pi x + 4x$$

$$= \boxed{\frac{3}{4}\pi x + \frac{2400}{x} + 4x}$$

6. A 10000-square-foot rectangular plot of land is going to be divided into two equal-sized, adjacent playgrounds (see diagram). Find the number of feet of fencing required as a function of x. (Note: here is only one fence between the playgrounds, not two.)



$$F(x,y) = 4x + 3y$$

$A = 2x\cdot y$

$$10000 = 2xy$$

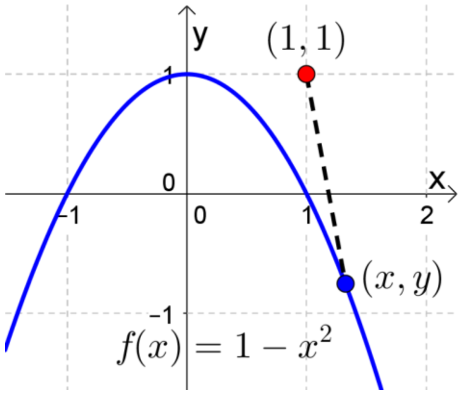
$$5000 = xy$$

$$y = \frac{5000}{x}$$

$$F(x) = 4x + 3\left(\frac{5000}{x}\right)$$

$$= \boxed{4x + \frac{15000}{x}}$$

8. Find the distance from the point $(1,1)$ to the parabola $f(x) = 1 - x^2$ as a function of x only. Be sure to simplify your function.



$$d(x,y) = \sqrt{(x-1)^2 + (y-1)^2} \qquad y = 1 - x^2$$

$$d(x) = \sqrt{x^2 - 2x + 1 + (\cancel{1} - x^2 - \cancel{1})^2}$$

$$= \sqrt{x^2 - 2x + 1 + (-x^2)^2}$$

$$= \boxed{\sqrt{x^4 + x^2 - 2x + 1}}$$