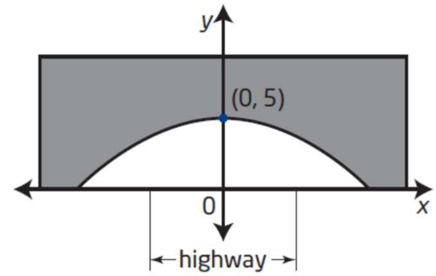
Name: ______________________________ Date: __________________________

Learning Goal 9.2	Solving quadratic inequalities.

1. A highway goes under a bridge formed by a parabolic arch, as shown. The highest point of the arch is 5 m high. The road is 10 m wide, and the minimum height of the bridge over the road is 4 m. Determine the quadratic function that models the parabolic arch of the bridge.



If the minimum height is 4 m, then the points $(-5, 4)$ and $(5, 4)$ must both lie on the curve.

Find vertex form of the equation:

$$y = a(x-p)^2 + q$$

$$y = a(x-0)^2 + 5$$
$$y = ax^2 + 5$$

Then find the expansion/compression factor by using one of the points you found:

$$4 = a(5)^2 + 5$$
$$4 = 25a + 5$$
$$-1 = 25a$$
$$a = -\frac{1}{25}$$
$$y = -\frac{1}{25}x^2 + 5$$

Now the bridge goes above the highway, so I want the point $(0, 0)$ to be false:

$$0 \blacksquare -\frac{1}{25}(0)^2 + 5$$
$$0 \blacksquare 0 + 5$$
$$0 \geq 5$$

$$y \geq -\frac{1}{25}x^2 + 5$$

$$\{y | y > 0, y \in \mathbb{R}\}$$

2. To raise money, the student council sells candy – grams each year. From past experience, they expect to sell 400 candy – grams at a price of \$4 each. They have also learned from experience that each \$0.50 increase in the price causes a drop in sales of 20 candy – grams. Write an equation that models this situation. Suppose the student council needs revenue of at least \$1 800. Solve an inequality to find all the possible prices that will achieve the fundraising goal.

Let R be the revenue in dollars, and x be the number of \$0.50 price changes

Revenue = cost x price

$$R = (4 + 0.5x)(400 - 20x)$$

$$1\,800 < (4 + 0.5x)(400 - 20x)$$

$$1\,800 < 1600 - 80x + 200x - 10x^2$$

$$1\,800 < 1600 + 120x - 10x^2$$

$$0 < -200 + 120x - 10x^2$$

$$0 < -10x^2 + 120x - 200$$

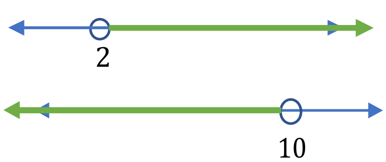
$$0 < -10(x^2 - 12x + 20)$$

$$0 < -10(x - 2)(x - 10)$$

So one factor needs to be positive and the other negative.

$x - 2 > 0$ $\quad$ $x - 10 < 0$

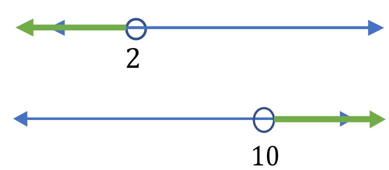
$x > 2$ $\quad$ $x < 10$



$2 < x < 10$

$x - 2 < 0$ $\quad$ $x - 10 > 0$

$x < 2$ $\quad$ $x > 10$



No solutions

$$\{x \,|2 < x < 10, x \in \mathbb{R}\}$$

T1he cost needs to be raised somewhere in between \$1.00 and \$5.00 for them to meet their revenue goals.

Assignment p. 496 # 9 – 12, 14, 17 Quiz Next Day!