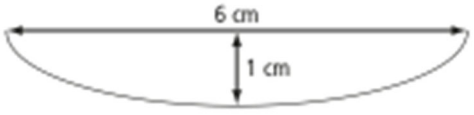
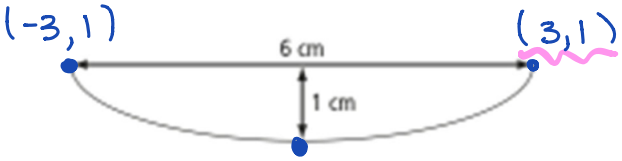
Name: _____ Date: _____

Learning Goal 3.2	Given a quadratic function, identify the characteristics of graphs, including domain, range, intercepts, vertex and the axis of symmetry.

Example Parabolic mirrors are often used in lights because they give a focused beam. Suppose a parabolic mirror is 6 cm wide and 1 cm deep, as shown.



a. Suppose the vertex of the mirror is at the origin. Determine the quadratic function in vertex form that describes the shape of the mirror.



$f(x) = \frac{1}{9}x^2$

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

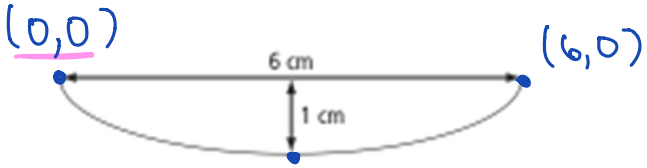
$= a(x-0)^2+0$

$= ax^2$

$1 = a(3)^2$

$\frac{1}{9} = \frac{a\times 9}{9}$ $a = \frac{1}{9}$

b. Now suppose the origin is at the left outer edge of the mirror. Determine the quadratic function in vertex form that describes the mirror.



$g(x) = \frac{1}{9}(x-3)^2+1$

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

$= a(x-3)^2-1$

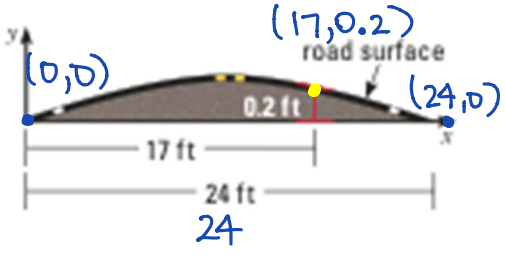
$0 = a(0-3)^2-1$

$+1 \quad +1$

$1 = a(-3)^2$

$1 = a(9) \Rightarrow a = \frac{1}{9}$

Example The surfaces of some roads are shaped like parabolas to allow rain to run off to either side. Write a quadratic model for the surface of the road shown.



$h(x) = ax(x-24)$

$0.2 = a(17)(17-24)$

$0.2 = a(17)(-7)$

$\frac{0.2}{-119} = \frac{a(-119)}{-119}$

$a = 0.002$

$h(x) = 0.002x(x-24)$

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$\frac{0.2}{119} = \frac{2}{1190} = \frac{1}{595}$

Example A student council currently sells memberships for $6 per year and has 700 members. To increase revenue, they decide to increase the membership cost. The results of a survey indicate that 50 fewer students will buy a membership for every $1 increase in the membership cost.

a. Write a quadratic function in standard form to model this situation.

x = the change in cost

R = cost × quantity

$= (6+x)(700-50x)$

b. What are the coordinates of the vertex? What information does it give the student council?

$6+x=0$

$x=-6$

$R=(6+4)(700-50(4))$

$=(10)(700-200)$

$=(10)(500)=5000$

$R=5000$

$(4, 5000)$

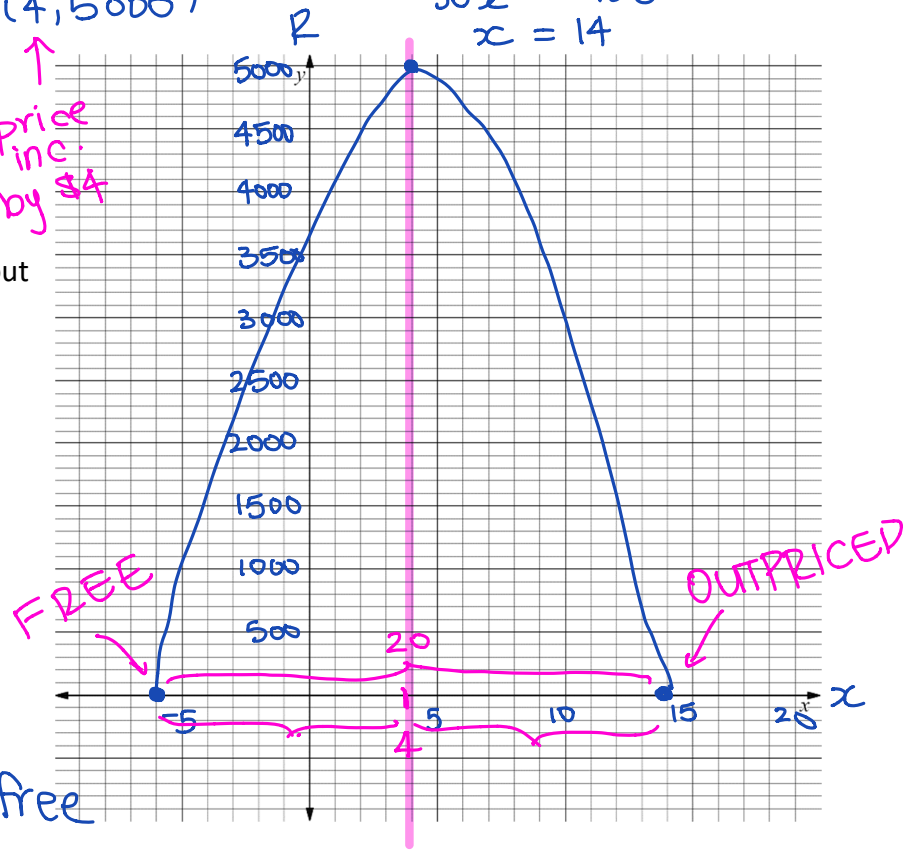
price inc. by $4

$700-50x=0$

$-50x=-700$

$x=14$

c. Graph the quadratic function. What does the shape of the graph communicate about the situation?



d. Determine if there are any x-intercepts that are relevant. What do these intercepts, if they exist, represent in the situation?

$x=-6$ Membership is free

$x=14$ No one wants to be a member ☹

e. What domain and range are logical for this situation? Explain.

$\{x \mid -6 \le x \le 14, x \in \mathbb{R}\}$

$\{y \mid 0 \le y \le 5000, y \in \mathbb{R}\}$