

Work in your group to solve the following problems before you leave class today. Check your answers with me before you leave (solutions are available up front).

1. a) Find the vertex, x-intercepts, and y-intercept of $f(x)$, and use those four points to sketch the graph of the parabola $y = f(x)$.

$$f(x) = 3x^2 - 6x - 27$$

1) (easy) y-intercept: $f(0) = -27$, so $(0, -27)$.

2) Complete the square:

$$3(x^2 - 2x) - 27$$

$$= 3(x^2 - 2x + 1) - 27 - 3$$

$$= 3(x-1)^2 - 30$$

Vertex: $(1, -30)$

3) x-ints:

$$0 = 3(x-1)^2 - 30$$

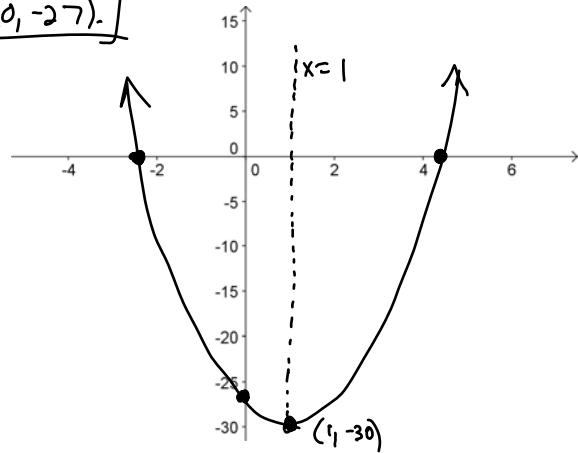
$$30 = 3(x-1)^2$$

$$10 = (x-1)^2$$

$$\pm\sqrt{10} = x-1$$

$$1 \pm \sqrt{10} = x$$

$x \approx 4.2$ or -2.2



- b) Your book mentions that the axis of the parabola $y = ax^2 + bx + c$ can be calculated with the formula $x = -b/(2a)$. Verify that calculation gives the correct vertex for the problem above.

$$x = -(-6)/(2(3)) = 1, \text{ as we found above. } \checkmark$$

2. A charter flight charges \$200 per person, plus \$4 per person for each unsold seat on the plane. The plane has 100 seats.

- a. Which brings in more revenue: having the flight be totally full, having 10 empty seats, or having 80 empty seats? *Having 10 empty seats is the best of those 3 scenarios.*

- b. Write a function for the revenue with x empty seats.

$$f(x) = (200 + 4x)(100 - x)$$

- c. Find the number of seats that will bring in the maximum revenue for the charter flight. What will the revenue be?

Method 1: $f(x) = 20000 + 200x - 4x^2$

Use $x = \frac{-b}{2a} = \frac{-200}{2(-4)} = \frac{-200}{-8} = 25$ empty seats.

$f(25) = 20000 + 200(25) - 4(25^2) = 22,500$ in revenue.

Method 2: (Complete the square to find vertex):

$$f(x) = -4(x^2 - 50x) + 20000$$

$$= -4(x^2 - 50x + (25)^2) + 20000 - ((-4) \cdot (25^2))$$

$$= -4(x - 25)^2 + 20000 + 2500 = -4(x - 25)^2 + 22500$$

max value is the y-coord. of the vertex.
\$22,500!