Intermediate Algebra

§8.6 Further Graphing of Quadratic Equations

Writing Quadratic Functions in the Form $y=a(x-h)^2+k$

Please refer to lecture notes.

Deriving a Formula for the Vertex

Please refer to lecture notes.

The graph of

$$f(x) = ax^2 + bx + c, \text{ when } a \neq 0,$$

is a parabola with vertex

Vertex $\left(\frac{-b}{2a}, c - \frac{b^2}{4a}\right)$

(Some books write it as $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$ which means you use $-\frac{b}{2a}$ to find the x-coord. of the vertex, then "plug it in" to find the corresponding y-coord of the vertex.)

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AAC MML Sp 27

Find the vertex of the graph of the quadratic function. Determine whether the graph opens upward or downward, find any intercepts, and sketch the graph.

$$f(x) = -2x^2 + 12x$$

$$= \underbrace{(-2)}_{a}x^2 \underbrace{(+12)}_{b}x \underbrace{+0}_{c}$$

Vertex

$$\left(\frac{-b}{2a}, c - \frac{b^2}{4a}\right)$$

$$\left(\frac{-12}{2(-2)}, 0 - \frac{12^2}{4(-2)}\right)$$

$$\boxed{(3, 18)}$$

$\boxed{\text{opens downward}}$ $a<0$

y-int $(x=0)$

$y = -2x^2 + 12x$

$y = -2(0)^2 + 12(0)$

$y = 0$

$(0, 0)$

$\boxed{a = -2}$

(1 L/R)	$-2 \cdot 1^2 = -2$	(2 down
(2 L/R)	$-2 \cdot 2^2 = -8$	(8 down)
3 L/R	$-2 \cdot 3^2 = -18$	(18 down)

Intercepts

x-int $(y=0)$

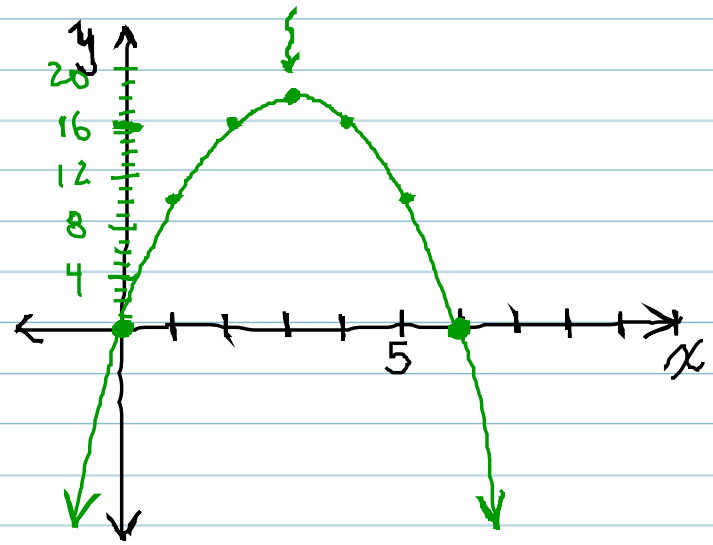
$y = -2x^2 + 12x$

$0 = -2x^2 + 12x$

$0 = -2x(x - 6)$ ✓

$\frac{-2x}{-2} = \frac{0}{-2}$ or $x - 6 = 0$

$x = 0$ $\quad x = 6$



Finding Maximum and Minimum Values

Please refer to lecture notes.

AAC MMLSP 48

The number of locations of a certain chain restaurant worldwide can be modeled by the quadratic equation

$$f(x) = -91x^2 + 1310x + 42273$$

where $f(x)$ is the number of restaurants and x is the number of years after 2000.

(a) Will this function have a maximum or minimum? How can you tell?

(b) According to this model, in what year will the number of restaurants be at its maximum or minimum?

(c) What is the maximum/minimum number of restaurants predicted?

*

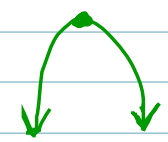
Year	x	# of restaurants
2000	0	42273
2001	1	43492

$$f(x) = -91x^2 + 1310x + 42273$$

If $x = 1$, what does that represent?

$$f(1) = -91 \cdot 1^2 + 1310 \cdot 1 + 42273$$
$$= -91 + 1310 + 42273$$
$$= 43492$$

(a) maximum or minimum? $a = -91$



$a = -91$ $b = 1310$ $c = 42273$

b) (c)

Vertex $\left(\frac{-b}{2a}, c - \frac{b^2}{4a}\right)$

$$\left(\frac{-1310}{2(-91)}, 42273 - \frac{1310^2}{4(-91)}\right)$$

$$(7.1978\ldots, 46987.56044\ldots)$$

x: number of years after 2000

y "$f(x)$": number of restaurants

(b) $\boxed{2007}$ (c) $\boxed{46988}$