Today's Learning Goal(s):

Date: ____________________

By the end of the class, I will be able to:

a) determine the maximum or minimum values of a quadratic function in two different ways.

Last day's work: READ pp. 140-145

p. 138 #1 – 7

p. 139 A – F

pp. 145-146 #1 – 8, 9ac, 10

Use Google Classroom Link to watch video proof

3.2 Determining Maximum and Minimum Values of a Quadratic Function

Date: Mar. 9/17

Ex. 1: Maximizing Profit

The demand function for a new product is $p(x) = -5x + 44$, where $p(x)$ represents the selling price of the product and x is the number sold in thousands. The cost function is $C(x) = 4x + 30$.
Calculate the quantity of items sold that will produce the maximum profit.

REVENUE = PRICE (NUMBER SOLD) $R(x) = [p(x)](x)$ PROFIT = REVENUE – COST $P(x) = R(x) - C(x)$

WIK: selling price formula is $p(x) = -5x + 44$
cost formula is $C(x) = 4x + 30$
x represents the number of items sold, in thousands

WINTK: I need to find maximum profit using the formula $P(x) = R(x) - C(x)$
But, first I need to find the revenue using the formula $R(x) = [p(x)](x)$

PLAN:
1. find revenue
2. find profit
3. find maximum profit by completing the square
4. concluding sentence

$R(x) = [p(x)](x)$
$R(x) = [-5x + 44](x)$
$= -5x^2 + 44x$

$P(x) = R(x) - C(x)$
$= -5x^2 + 44x - (4x + 30)$
$= -5x^2 + 44x - 4x - 30$
$= -5x^2 + 40x - 30$
$= -5(x^2 - 8x) - 30$
$= -5(\underbrace{x^2 - 8x + 16}) - 16) - 30$
$= -5(x-4)^2 + 80 - 30$
$= -5(x-4)^2 + 50$

$\left(\frac{b}{2}\right)^2$

$\left(\frac{8}{2}\right)^2$

the maximum profit is \$50000 when 4000 items are sold.

Ex. 2: Find the minimum for the function $y = 2x^2 - 8x - 42$.

a) Find the zeros

$0 = 2x^2 - 8x - 42$

$= 2(x^2 - 4x - 21)$

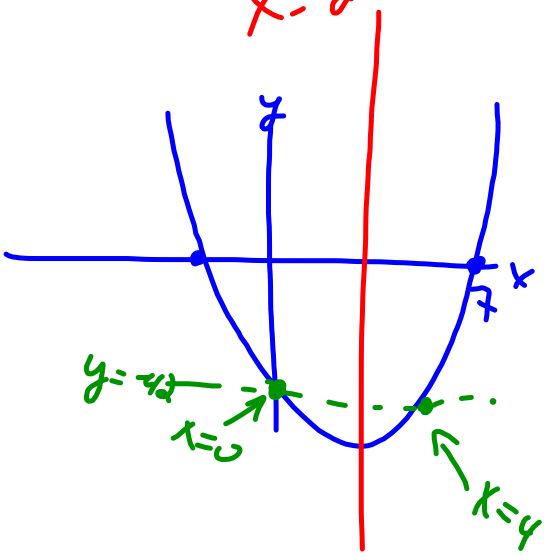
$= 2(x-7)(x+3)$

$\therefore x = 7$ or $x = -3$

A of S: $x = \frac{-3+7}{2}$

$= \frac{4}{2}$

$x = 2$



b) $y = 2x^2 - 8x - 42$

$= 2x(x-4) - 42$

if $x = 0$ $2x(x-4) = 0$

$\hookrightarrow y = -42$

if $x = 4$, $y = -42$

A of S: $x = \frac{0+4}{2}$

$x = 2$

sub $x = 2$

$y = 2(2-7)(2+3)$

$= 2(-5)(5)$

$= -50$

$\therefore v(2, -50)$

$\therefore$ the minimum value of the function is -50.

Are there any Homework Questions you would like to see on the board?

Last day's work: READ pp. 140-145
p. 138 #1 – 7 → 4d, 2c
5b
p. 139 A – F
pp. 145-146 #1 – 8, 9ac, 10
Use Google Classroom Link to watch video proof

Today's Homework Practice includes:

pp. 153-154 #3, 4ace, 5ac, 7ac, 8, 11

Some additional examples follow...

p.138

2c) $f(x) = -3(x+2)^2 + 3$

$= -3(x^2 + 4x + 4) + 3$

$= -3x^2 - 12x - 12 + 3$

$= -3x^2 - 12x - 9$

4d) $y = -3(x+2)(x-5)$

let $y = 0$

$0 = -3(x+2)(x-5)$

$\therefore x = -2$ or $x = 5$

AofS: $x = \frac{-2+5}{2}$

$y = -3(\frac{3}{2}+2)(\frac{3}{2}-5) = \frac{3}{2}$

$\frac{3}{2} - 5$

$= \frac{3}{2} - \frac{10}{2}$

$= -3(\frac{7}{2})(-\frac{7}{2})$

$= \frac{147}{4}$ $\therefore V(\frac{3}{2}, \frac{147}{4})$

opens down

5b) Solve

$x^2 - 6x + 3 = 0$

$x^2 - 6x + 9 - 9 + 3 = 0$

$(x-3)^2 - 6 = 0$

$(x-3)^2 = 6$

$x - 3 = \pm\sqrt{6}$

$x = 3 \pm \sqrt{6}$

$x = 3 + \sqrt{6}$ or $x = 3 - \sqrt{6}$

$\doteq 5.449$ $\doteq 0.550$

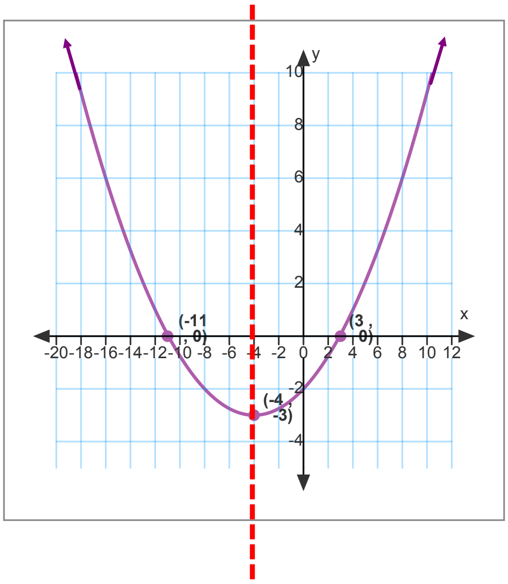
$\doteq 5.45$ $\doteq 0.55$

Recall:

vertex

zeros

axis of symmetry



Ex. 3: For the function $f(x)=3x^2-2x-5$ find:

a) the x-intercepts

let $f(x) = 0$

$0 = 3x^2-2x-5$

$0=(3x-5)(x+1)$

$\therefore x=\frac{5}{3}$ or $x=-1$

Pull

b) the maximum or minimum value
(use 1/2 way method for x-intercepts above)

*for the complete the square method, pull the tab below

AOS: $x=\dfrac{-1+\frac{5}{3}}{2}$

$=\dfrac{\frac{2}{3}}{2}$

$=\frac{2}{6}$

$=\frac{1}{3}$

Pull

b) the max/min value (ie. vertex)

$f(x) = 3x^2-2x-5$

$f(x)=3\left(x^2-\frac{2}{3}x+\frac{1}{9}-\frac{1}{9}\right)-5$

$f(x)=3\left(x-\frac{1}{3}\right)^2-\frac{1}{9}(3)-5$

$f(x)=3\left(x-\frac{1}{3}\right)^2-\frac{16}{3}$

Vertex: $\left(\frac{1}{3},-\frac{16}{3}\right)$

Opens Up → minimum value

Therefore the minimum value is $-\frac{16}{3}$ which occurs when $x=\frac{1}{3}$.

$\frac{1}{2}\left(\frac{2}{3}\right)$

$f(x)=(3x-5)(x+1)$

$=\left(3\left(\frac{1}{3}\right)-5\right)\left(\frac{1}{3}+1\right)$

$=(1-5)\left(\frac{4}{3}\right)$

$=(-4)\left(\frac{4}{3}\right)$

$=-\frac{16}{3}$

Therefore the minimum value is $-\frac{16}{3}$ which occurs when $x=\frac{1}{3}$.

Ex. 4: Find the maximum or minimum value for the function

$h(x) = -2x^2 + 10x + 55$

$\frac{5}{2}$

Yay!! for fractions!

$= -2\left(x - \frac{5}{2}\right)^2 + \frac{135}{2}$

$= -2(x^2 - 5x) + 55$

$= -2\left(x^2 - 5x + \frac{25}{4} - \frac{25}{4}\right) + 55$

$\frac{-2}{1}\left(\frac{-25}{4_2}\right)$

$= -2\left(x - \frac{5}{2}\right)^2 + \frac{25}{2} + \frac{110}{2}$

$= -2\left(x - \frac{5}{2}\right)^2 + \frac{135}{2}$