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 Class: Math 1301 Date: 3-26-13
 Topic/Section: Quadratic Functions

Examples and Vocabulary	Notes/Comments/Questions
<u>Fundamental Properties of Quadratic Functions or Parabolas</u>	
① Formula can be written as $y = f(x) = ax^2 + bx + c, a \neq 0$ a is called the <u>leading coefficient</u> c is called the <u>constant coefficient</u>	
② domain = all real numbers	
③ $y\text{-int.} = c = f(0) = a \cdot 0^2 + b \cdot 0 + c$	
④ The graph of a quadratic function is a bowl-shaped called <u>parabola</u>.	

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⑤ If $a > 0$, the parabola opens upward $\cup$. If $a < 0$, the parabola opens downward $\cap$.	
⑥ vertex = $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right) \right)$	
⑦ x-ints. = $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
⑧	

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① Which of the following functions are quadratic?	
a. $\checkmark f(x) = 2x^2 - 4x - 1$ $a=2, b=-4, c=-1$	
b. $\checkmark g(x) = (2-x)(3+x) = 6+2x-3x-x^2$ $a=-1, b=-1, c=6 = 6-x-x^2$	
c. $\checkmark h(x) = \frac{x^2}{3} + \frac{2x}{3} + 1 = \frac{1}{3}x^2 + \frac{2}{3}x + 1$ $a=\frac{1}{3}, b=\frac{2}{3}, c=1$	
d. $\times F(x) = 3 - 2^2x = 3 - 4x$	
e. $\times G(x) = \sqrt[3]{x^2} - 7x + 2$ $= x^{2/3} - 7x + 2$	
f. $\checkmark k(x) = -\frac{1}{2}x^2 - x + 2$ $a=-1/2, b=-1, c=2$	

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② A baseball is popped up with an initial velocity of 80 feet per sec. The height h of the ball after t elapsed seconds is given by $h = -16t^2 + 80t + 3$	$a = -16$ $b = 80$ $c = 3$
a. What is the height of the ball after 2 sec?	99 ft $h(2) = -16(2)^2 + 80(2) + 3 = -16(4) + 160 + 3$ $= -64 + 160 + 3 = 99$
b. What is the maximum height of the ball?	103 ft $\text{vertex} = \left(\frac{-80}{2(-16)} = \frac{-80}{-32} = 2.5, \right.$ $h(2.5) = 103 = (2.5, 103)$
c. When does the ball hit the ground?	$0 = -16t^2 + 80t + 3$

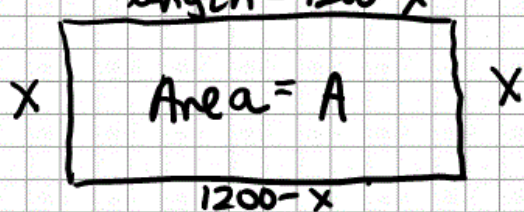
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Examples and Vocabulary	Notes/Comments/Questions
③ Benny sells sandals at a souvenir shop near the beach. The monthly profit P (in hundreds of dollars) from the sale of the sandals is given by the formula $P = 12x - 3x^2 - 9$ where x is the monthly demand (in hundreds of pairs). a. What is Benny's maximum profit? What demand results in the maximum profit? vertex = $\left(\frac{-12}{2(-3)} = \frac{-12}{-6} = 2, p(2) = 12 \cdot 2 - 3 \cdot 2^2 - 9\right.$ $= 24 - 12 - 9$ $= 3) = (2, 3)$ Maximum profit is \$300 when Benny sales 200 pairs of sandals.	$a = -3 < 0$ $b = 12$ $c = -9$

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Examples and Vocabulary	Notes/Comments/Questions
c. What are Benny's break-even points? $0 = 12x - 3x^2 - 9$ $0 = -3x^2 + 12x - 9$ $0 = -3(x^2 - 4x + 3)$ $0 = -3(x-3)(x-1)$ $-3 \neq 0 \text{ or } x-3=0 \text{ or } x-1=0$ $x=3 \quad x=1$	100 pairs, 300 pairs
④ UHD has purchased 2400 ft of fencing to fence in a gator corral (rectangular). a. Find a function that models the area of the corral in terms of the width x.	

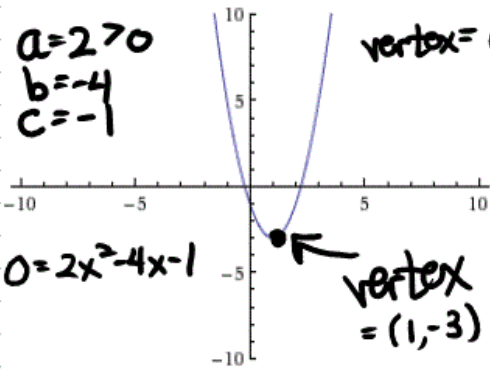
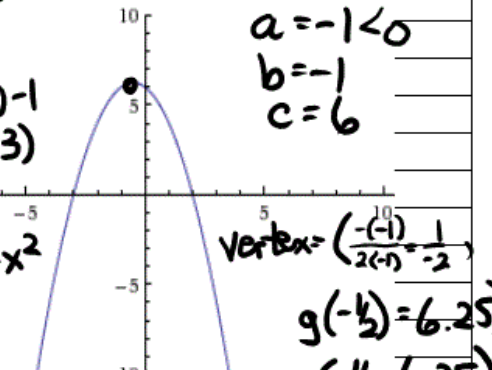
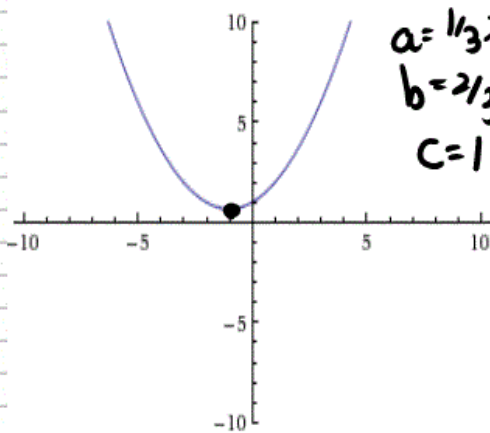
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Examples and Vocabulary	Notes/Comments/Questions
length = $1200 - x$  b. Find the dimensions of the rectangle that maximize the area of the corral. 600×600 $A = 1200x - x^2$ vertex = $\left(\frac{-1200}{2(-1)} = 600, 360000\right)$	$A = f(x) = x \cdot \text{length}$ $A = x(1200 - x) = 1200x - x^2$ $2400 = x + \text{length} + x + \text{length}$ $2400 = 2x + 2 \cdot \text{length}$ $2400 - 2x = 2 \cdot \text{length}$ $\frac{2400 - 2x}{2} = \text{length}$ $1200 - x = \text{length}$ $a = -1$ $b = 1200$ $c = 0$

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Examples and Vocabulary	Notes/Comments/Questions														
⑤ The following table shows the percentage y of adult women working, x years after 1950. Find a quadratic function that fits the scatter plot of this data.															
<table border="1"> <thead> <tr> <th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>12</td><td>38</td></tr> <tr><td>22</td><td>43</td></tr> <tr><td>32</td><td>52</td></tr> <tr><td>42</td><td>57</td></tr> <tr><td>52</td><td>60</td></tr> <tr><td>62</td><td>57</td></tr> </tbody> </table>	x	y	12	38	22	43	32	52	42	57	52	60	62	57	$y = -0.114286x^2 + 1.27714x + 22.8914$
x	y														
12	38														
22	43														
32	52														
42	57														
52	60														
62	57														

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Examples and Vocabulary	Notes/Comments/Questions
a. $f(x) = 2x^2 - 4x - 1$ $a=2 > 0$ $b=-4$ $c=-1$  vertex = $\left(\frac{-(-4)}{2 \cdot 2} = 1, \frac{f(1)}{2 \cdot 2} = -3\right)$ $f(1) = 2(1)^2 - 4(1) - 1 = 2 - 4 - 1 = -3$ $0 = 2x^2 - 4x - 1$ vertex = $(1, -3)$	b. $g(x) = 6 - x - x^2$ $a=-1 < 0$ $b=-1$ $c=6$  vertex = $\left(\frac{-(-1)}{2(-1)} = -\frac{1}{2}, \frac{g(-1/2)}{2(-1)} = 6.25\right)$ $g(-1/2) = 6.25$ $= (-1/2, 6.25)$ $0 = 6 - x - x^2$
c. $h(x) = \frac{x^2}{3} + \frac{2x}{3} + 1$ $a=1/3 > 0$ $b=2/3$ $c=1$ 	f. $k(x) = -\frac{1}{2}x^2 - x + 2$ $a=-1/2 < 0$ $b=-1$ $c=+2$ 