Honors Unit 4: Quadratics Study Guide
Spring 2016

Name: Key

I. Multiplying Binomials and Trinomials: Hint- Box method or FOIL.

1. $(2x+1)(x-5)$

$2x^2-10x+x-5$

$2x^2-9x-5$

2. $(-x-1)(x+2)$

$-x^2-2x-x-2$

$-x^2-3x-2$

3. $(x+4y)(2x-7y)$

$2x^2-7xy+8xy-28y^2$

$2x^2+xy-28y^2$

4. $(x+2)^2$ =

$(x+2)(x+2)$

$x^2+2x+2x+4$

x^2+4x+4

5. $(x^2+3x-4)(-2x+6)$

	x^2	$3x$	-4
$-2x$	$-2x^3$	$-6x^2$	$8x$
6	$6x^2$	$18x$	-24

$-2x^3+26x-24$

6. $(3x-4)(3x^2-x-7)$

	$3x^2$	$-x$	-7
$3x$	$9x^3$	$-3x^2$	$-21x$
-4	$-12x^2$	$4x$	28

$9x^3-15x^2-17x+28$

II. Factoring

1. $3x^2+10x-25$

Slip a ① $x^2+10x-75$

Factor ② $(x+15)(x-5)$

Divide ③ $(x+\frac{15}{3})(x-\frac{5}{3})$

Simplify ④ $(x+5)(x-\frac{5}{3})$

Slide Den ⑤ $(x+5)(3x-5)$

2. $14z^8+24z^7-30z^3$

$2z^3(7z^5+12z^4-15)$

Cannot factor any more

3. $18p^3-63p^2-9p$

$9p(2p^2-7p-1)$

try Slip + Slide: p^2-7p-2 is not factorable

4. $5x^2+75x+250$

$5(x^2+15x+50)$

$5(x+5)(x+10)$

5. $\underbrace{x^3-5x^2}\underbrace{-25x+125}$

$x^2(x-5)-25(x-5)$

$(x^2-25)(x-5)$

Keep factoring

$(x-5)(x+5)(x-5)$

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

6. $81b^2-16c^2$ Diff. of Sq.

$(9b-4c)(9b+4c)$

III. Solving by factoring or quadratic formula

1. Factor the trinomial $x^2-2x=35$ to find the zeros

$x^2-2x-35=0$ $\quad x-7=0 \quad x+5=0$

$(x-7)(x+5)=0 \quad x=7 \quad x=-5$

2. Find the zeros of the quadratic function $4x^2+8x+7=4$. Write the quadratic formula used to solve and then write the solutions.

$4x^2+8x+3=0$

$a=4 \quad b=8 \quad c=3$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-8\pm\sqrt{64-4(4)(3)}}{2(4)}=\frac{-8\pm\sqrt{16}}{8}$

$x=\frac{-8+4}{8}=\frac{1}{2}$

$x=\frac{-8-4}{8}=-\frac{3}{2}$

3. Using the quadratic formula, find the solutions to the equation $5n^2+9n=-4$

$5n^2+9n+4=0$

$a=5, b=9, c=4$

$x=\frac{-9\pm\sqrt{81-4(4)(5)}}{2(5)}=\frac{-9\pm\sqrt{1}}{10}$

$x=\frac{-9+1}{10}=\frac{-8}{10}=-\frac{4}{5}$

$x=\frac{-9-1}{10}=\frac{-10}{10}=-1$

4. Find the zeros of the quadratic function $3x^2=-10x+25$

$3x^2+10x-25=0$ $\quad x+5=0 \quad 3x-5=0$

Look for factors $(x+5)(3x-5)=0 \quad x=-5 \quad 3x=5$

$x=\frac{5}{3}$

IV. Discriminant

1. Using the quadratic function $x^2 + 2x - 1 = 2$, identify the discriminant and the number of solutions the function will have. $x^2 + 2x - 3 = 0$

   $a = 1 \quad b = 2 \quad c = -3$

   Discriminant: $b^2 - 4ac$

   $(2)^2 - 4(1)(-3)$

   $4 + 12 = 16$

   $b^2 - 4ac > 0$ so 2 real solutions

2. Determine the value of the discriminant and number of solutions for the quadratic function $3x^2 - 5x + 32 = 0$.

   $a = 3 \quad b = -5 \quad c = 32$

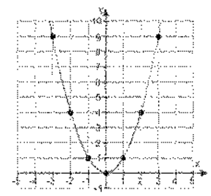
   $b^2 - 4ac = (-5)^2 - 4(3)(32)$

   $= 25 - 384$

   $= -359$

   $b^2 - 4ac < 0 \rightarrow$ No real Solutions

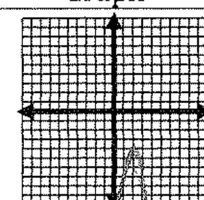
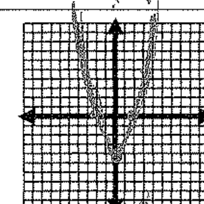
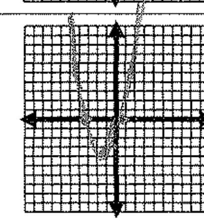
3. Looking at the graph to the right, what do you know about the discriminant?

   One solution so discriminant $= 0$

   (x-intercept)

V. Standard form of a Quadratic ($y=ax^2+bx+c$): Be able to identify axis of symmetry, vertex, minimum or maximum, zeros and y-intercept of a quadratic function in standard form. Then graph the quadratic.

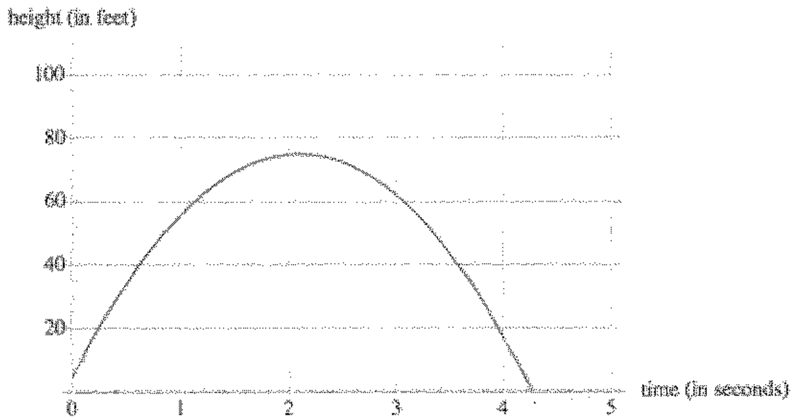
Equation	A.O.S	Vertex	Zeros	Y-Intercept	Graph
#1 $y = -2x^2 + 8x - 12$	$x = \frac{-b}{2a}$ $= \frac{-8}{2(-2)} = \frac{-8}{-4}$ $x = 2$	Plug in 2 $-2(2)^2 + 8(2) - 12$ $-8 + 16 - 12 = -4$ Vertex: $(2, -4)$	None Can check using discriminant	$(0, -12)$	
#2 $y = x^2 - 4$	$x = \frac{0}{2} = 0$ $x = 0$	Plug in 0 $(0)^2 - 4 = -4$ Vertex: $(0, -4)$	$x^2 - 4 = 0$ $(x-2)(x+2) = 0$ $x = 2, x = -2$ $(2, 0) + (-2, 0)$	$(0, -4)$	
#3 $y = x^2 + 2x - 3$	$x = \frac{-2}{2(1)} = -1$ $x = -1$	Plug in (-1) $(-1)^2 + 2(-1) - 3$ $1 - 2 - 3 = -4$ Vertex: $(-1, -4)$	$x^2 + 2x - 3 = 0$ $(x+3)(x-1) = 0$ $x = -3 \quad x = 1$ $(-3, 0) + (1, 0)$	$(0, -3)$	

VI. Maximum/Minimum Comparison: Use your knowledge of quadratics to compare minimum and maximum values in application problems.

1. Suppose Brett and Andre each throw a baseball into the air. The height of Brett's baseball is given by

$$h(t) = -16t^2 + 79t + 6$$

where h is in feet and t is in seconds. The height of Andre's baseball is given by the graph below:



Brett claims that his baseball went higher than Andre's, and Andre says that his baseball went higher.

a. Who is right? Why?

Find Brett's max height.
① $Y_1 = -16x^2 + 79x + 6$
② Graph
③ 2nd - Trace Max.
$x = 2.5$, $y = 103.5$ ft

Andre's max is less than 80 ft from graph

$\boxed{103.5 > 80 \text{ Brett is right}}$

b. How long is each baseball airborne?

Brett. 2nd - Trace, zeros
$\boxed{x = 5\text{ s}}$

$\boxed{\text{Andre from graph about } 4.2\text{ s}}$

2. Three teams are participating in an egg launch contest. Their results from the egg launch can be found below.

Team A

Use QuadReg

Time	Height
2	-5.2
3	9.8
6	45.2
9	66.2
12	72.8
15	65
18	42.8
21	6.2
22	-9.2

$h = -0.6x^2 + 19x - 40$

$(2.3, 0)$ $(21.4, 0)$

$21.4 - 2.3 = 19.1$ ft

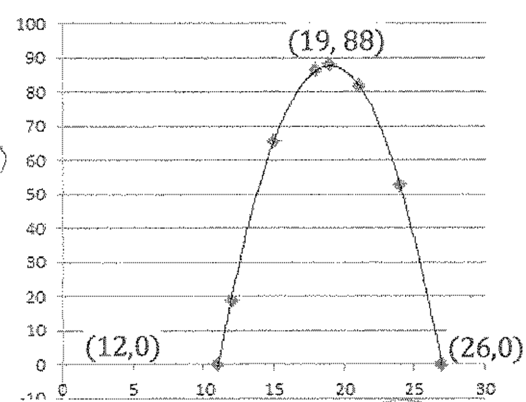
Team B

$F(x) = -1.3x^2 + 39.6x - 195.1$

$(6.2, 0)$ $(24.3, 0)$

$24.3 - 6.2 = 18.1$ ft

Team C



$26 - 12 = 14$ ft

a. Which team's egg was launched the highest? Explain how you know this.

Team A max = 72.8
B max = 106.5
C max = 88

Team B highest

b. Which team's egg was launched the furthest? Explain how you know this.

A Dist between zeros = 19.1
B " = 18.1
C " = 14

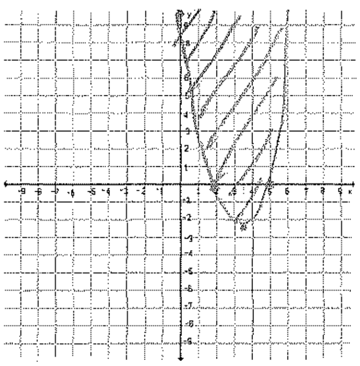
Team A

c. Which team should win the contest and why?

Depends on if by height or distance

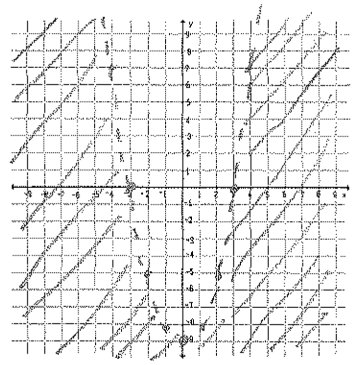
VII. Graphing Quadratic Inequalities

1. Graph $y \geq x^2 - 7x + 10$



Zeros (5,0)(2,0)
V: (3.5, -2.25)
Y-int: (0, 10)
Solid line ≥
Test 0,0 which is on outside
$0 \geq 0^2 - 7(0) + 10$
$0 \geq 10$ False
Shade inside

2. Graph the quadratic in equality $y < x^2 - 9$.



Z: (3,0) (-3,0)
V: (0,-9)
Y int: (0,-9

x	y
-2	-5
-1	-8
0	-9
1	-8
2	-5

Dashed <
Test 0,0 on inside
$0 < 0 - 9$
$0 < 9$ False
Shade outside

VIII. Linear and Quadratic Systems

1. Solve the following linear-quadratic system

$$y + x = 1 \quad — \quad y = -x + 1$$
$$y + 2 = x^2 + x \quad\quad y = x^2 + x - 2$$

$-x + 1 = x^2 + x - 2$
$0 = x^2 + 2x - 3$
$(x+3)(x-1) = 0$
$x = -3 \quad x = 1$

$x = -3 \rightarrow y = 4$
$x = 1 \rightarrow y = 0$

$\boxed{(-3, 4) \quad (1, 0)}$

2. How many solutions does each system have?

a. $y = x^2$
$y = 2x + 3$
$x^2 = 2x + 3$
$x^2 - 2x - 3 = 0$
$a = 1 \quad b = -2 \quad c = -3$

$b^2 - 4ac$
$4 - 4(1)(-3)$
$4 + 12 = 16$
$> 0 \rightarrow$ 2 sol.

b. $y = x^2 + 3$
$x - 2y = 2$
$-2y = -x + 2$
$y = \frac{1}{2}x - 1$

$x^2 + 3 = \frac{1}{2}x - 1$
$x^2 - \frac{1}{2}x + 4 = 0$
$2x^2 - x + 8 = 0$
$a = 2 \quad b = -1 \quad c = 8$
$b^2 - 4ac = 1 - 4(2)(8)$
$= -63$
$< 0 \rightarrow$ No Solutions

3. A daredevil jumps off the CN Tower and falls freely for several seconds before releasing his parachute. His height, h, in meters, t seconds after jumping can be modeled by: $h = -4.9t^2 + t + 360$ before he releases his parachute; and $h = -4t + 142$ after he releases his parachute. How long after jumping did the daredevil release his parachute?

① $Y_1 = -4.9x^2 + x + 360$
$Y_2 = -4x + 142$

② Graph
③ 2^{nd}-Trace intersect

look at positive x
$\boxed{x = 7.2 \text{ seconds}}$

height is 113.2 m

4. A punter kicks a football. Its height, *h*, in meters, *t* seconds after the kick is given by the equation $h = -4.9t^2 + 18.24t + 0.8$. The height of an approaching blocker's hands is modeled by the equation $h = -1.43t + 4.26$ using the same time. Can the blocker knock down the punt? If so, at what point will it happen?

① $Y_1 = -4.9x^2 + 18.24x + .8$
$Y_2 = -1.43x + 4.26$

② Graph
③ 2^{nd}-Trace intersect

Yes at 0.18 s