CONVERTING QUADRATICS NOTES

INTERCEPT FORM TO STANDARD FORM

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

$y = 2(x^2 + 4x - 3x - 12)$ multiply ( )

$y = 2(x^2 + x - 12)$ distribute

- $y = 2x^2 + 2x - 24$

VERTEX FORM TO STANDARD FORM

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

$y = -2[(x-1)(x-1)] + 3$

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

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

$y = -2x^2 + 4x - 2 + 3$

- $y = -2x^2 + 4x + 1$

STANDARD FORM TO INTERCEPT FORM

- $y = x^2 + 7x + 12$

- $y = (x+4)(x+3)$

STANDARD FORM TO VERTEX FORM

- $y = 3x^2 + 2x - 1$

$a = 3$

vertex

$x = \frac{-b}{2a} = \frac{-2}{2(3)} = \frac{-2}{6} = -\frac{1}{3}$

- $y = 3\left(x + \frac{1}{3}\right)^2 - 4/3$

$y = 3(-1/3)^2 + 2(-1/3) - 1$

$y = \frac{3}{9} + \frac{2 \cdot 3}{3 \cdot 3} - 1 \cdot 9/9$

$y = 3/9 + -6/9 - 9/9$

$y = -12/9 = -4/3$

VERTEX FORM TO INTERCEPT FORM

- $y = (x+2)^2$
- $y = (x+2)(x+2)$

INTERCEPT FORM TO VERTEX FORM

- $y = (x-3)(x+5)$

$a = 1$

vertex $(-1, -16)$

$x = \frac{3-5}{2} = -1$

$y = (-1-3)(-1+5)$

$y = (-4)(4)$

$y = -16$

- $y = (x+1)^2 - 16$

AC Math 1
Converting Quadratic Equations WS

Name Answer Key
Period_____

Write in intercept form

1. $y = x^2 - 3x + 2$

$y = (x-2)(x-1)$

2. $y = x^2 - 100$

$y = (x+10)(x-10)$

3. $y = x^2 + 3x - 18$

$y = (x+6)(x-3)$

4. $y = x^2 - 2x - 8$

$y = (x-4)(x+2)$

5. $y = x^2 - x - 132$

$y = (x-12)(x+11)$

6. $y = 4x^2 + 4x + 1$

$y = (2x+1)(2x+1)$

$y = (2x+1)^2$

7. $y = 4x^2 + 5x - 6$

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

8. $y = 12x^2 + 17x + 6$

$y = (4x+3)(3x+2)$

9. $y = 25x^2 - 9$

$y = (5x+3)(5x-3)$

10. $y = 15x^2 + 8x - 16$

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

Write in Standard form

11. $y = (x-5)(x+2)$

$y = x^2 - 3x - 10$

12 $y = -\frac{1}{4}(4x-5)(x+3)$

$y = -\frac{1}{4}(4x^2 + 7x - 15)$

$y = -x^2 - \frac{7}{4}x + \frac{15}{4}$

13. $y = 3(2x-3)(x-1)$

$y = 3(2x^2 - 5x + 3)$

$y = 6x^2 - 15x + 9$

14. $y = (3x-2)^2 + 5$

$y = 9x^2 - 12x + 4 + 5$

$y = 9x^2 - 12x + 9$

15. $y = (x-8)^2 + 13$

$y = x^2 - 16x + 64 + 13$

$y = x^2 - 16x + 77$

16. $y = 2(x+5)^2 - 23$

$y = 2(x^2 + 10x + 25) - 23$

$y = 2x^2 + 20x + 50 - 23$

$y = 2x^2 + 20x + 27$

17. $y = -2(x-11)^2 + 17$

$y = -2(x^2 - 22x + 121) + 17$

$y = -2x^2 + 44x - 242 + 17$

$y = -2x^2 + 44x - 225$

18. $y = \left(\frac{1}{3}x + 4\right)(2x-5)$

$y = \frac{2}{3}x^2 + \frac{19}{3} - 20$

Write in Vertex Form

21. $y = x^2 - 8x + 2$

$y = (x^2 - 8x + 16) + 2 - 16$

$y = (x-4)^2 - 14$

22. $y = x^2 + 12x + 2$

$y = (x^2 + 12x + 36) + 2 - 36$

$y = (x+6)^2 - 34$

23. $y = -2x^2 + 6x - 3$

$y = -2(x^2 - 3x \quad) - 3$

$y = -2(x^2 - 3x + \frac{9}{4}) - 3 + \frac{9}{2}$

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

24. $y = 4x^2 - 4x + 15$

$y = 4(x^2 - x + \frac{1}{4}) + 15 - 1$

$y = 4(x - \frac{1}{2})^2 + 14$

25. $y = (x+3)(x-9)$

$y = x^2 - 6x - 27$

$y = (x^2 - 6x + 9) - 27 - 9$

$y = (x-3)^2 - 36$

26. $y = 2(x+5)(x+7)$

$y = 2(x^2 + 12x + 35)$

$y = 2x^2 + 24x + 70$

$y = 2(x^2 + 12x + 36) + 70 - 72$

$y = 2(x+6)^2 - 2$

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CCGPS Geometry Graphing Quadratics

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Converting Forms of a Quadratic

Convert from vertex form to standard form.

1. $y=2(x-1)^2+1$

$y=2(x-1)(x-1)+1$

$y=2(x^2-2x+1)+1$

$y=2x^2-4x+2+1$ $\boxed{y=2x^2-4x+3}$

2. $y=-(x+3)^2+5$

$y=-(x+3)(x+3)+5$

$y=-(x^2+6x+9)+5$

$y=-x^2-6x-9+5$ $\boxed{y=-x^2-6x-3}$

3. $y=3(x-2)^2-7$

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

$y=3(x^2-4x+4)-7$

$y=3x^2-12x+12-7$

$\boxed{y=3x^2-12x+5}$

4. $y=(x-3)^2+1$

$y=(x-3)(x-3)+1$

$y=x^2-6x+9+1$

$\boxed{y=x^2-6x+10}$

5. $y=-2(x+1)^2+5$

$y=-2(x+1)(x+1)+5$

$y=-2(x^2+2x+1)+5$

$y=-2x^2-4x-2+5$ $\boxed{y=-2x^2-4x+3}$

6. $y=4(x-2)^2-7$ $\boxed{y=4x^2-16x+9}$

$y=4(x-2)^2-7$

$y=4(x-2)(x-2)-7$

$y=4(x^2-4x+4)-7$

$y=4x^2-16x+16-7$

7. $y=4(x-3)^2-10$ $\boxed{y=4x^2-24x+26}$

$y=4(x-3)(x-3)-10$

$y=4(x^2-6x+9)-10$

$y=4x^2-24x+36-10$

8. $y=-3(x-7)^2+6$ $\boxed{y=-3x^2+42x+153}$

$y=-3(x-7)(x-7)+6$

$y=-3(x^2-14x+49)+6$

$y=-3x^2+42x+147+6$

Convert from standard form to vertex form. Then, give the axis of symmetry and vertex.

9. $f(x)=x^2+4x+3$

$y=(x+2)^2-1$

10. $f(x)=x^2-2x+5$ $x=\frac{2}{2}=1$

$y=(x-1)^2+4$

11. $f(x)=2x^2-8x+17$ $x=\frac{8}{2(2)}=2$

$y=2(x-2)^2+9$

12. $f(x)=x^2-8x+15$ $x=\frac{8}{2(1)}=4$

$y=(x-4)^2-1$

13. $f(x)=x^2-4x$

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

14. $f(x)=2x^2+12x+7$ $x=-\frac{12}{2(2)}=-3$

$y=2(x+3)^2-11$

Find the axis of symmetry & vertex for the functions representing the trajectory of a ball.

15. $f(t)=-16t^2+64t+10$ and $f(t)=-16t^2+64t+30$

$x=\frac{-64}{2(-16)}=2$ $y=74$ (2, 74)

$x=\frac{-64}{2(-16)}=2$ $y=94$ (2, 94)

16. Which function will be higher at its peak? $f(t)$

17. How can you determine that by looking at the equation in standard form?

30 is larger than 10

AC Math 1
Converting, Graphing, and Characterizing Quadratics

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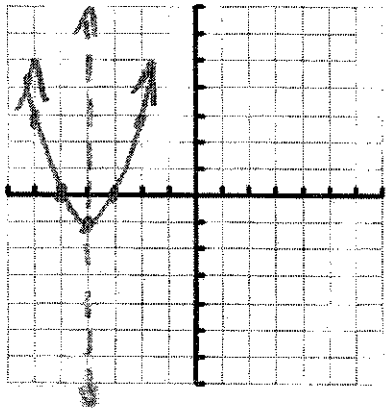
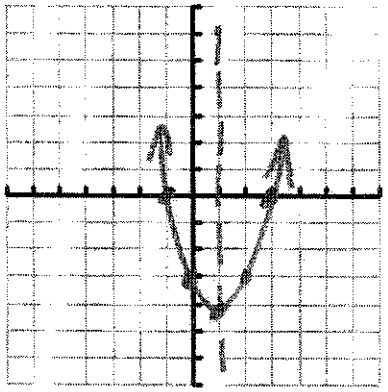
Graph the following quadratic equations neatly on graph paper.

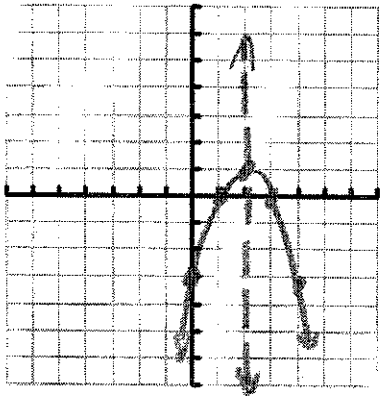
1. $y = x^2 + 8x + 15$



2. $y = (x - 3)(x + 1)$



3. $y = -(x - 2)^2 + 1$



Complete the table. Show all algebraic work neatly on the bottom of the page.

	Standard Form	Intercept Form	Vertex Form	Axis of Symmetry	Vertex	x-Int(s)	y-Int.	Range	Interval of Increase	Interval of Decrease
1	$y = x^2 + 8x + 15$	$y = (x + 5)(x + 3)$	$y = (x + 4)^2 - 1$	$x = -4$	$(-4, -1)$	$(-5, 0)$ $(-3, 0)$	$(0, 15)$	$[-1, \infty)$	$(-4, \infty)$	$(-\infty, -4)$
2	$y = x^2 - 2x - 3$	$y = (x - 3)(x + 1)$	$y = (x - 1)^2 - 4$	$x = 1$	$(1, -4)$	$(3, 0)$ $(-1, 0)$	$(0, -3)$	$[-4, \infty)$	$(1, \infty)$	$(-\infty, 1)$
3	$y = -x^2 + 4x - 3$	$y = -(x - 3)(x - 1)$	$y = -(x - 2)^2 + 1$	$x = 2$	$(2, 1)$	$(3, 0)$ $(1, 0)$	$(0, -3)$	$(-\infty, 1]$	$(-\infty, 2)$	$(2, \infty)$
★	$y = x^2 - 6x + 8$	$y = (x - 2)(x - 4)$	$y = (x - 3)^2 - 1$	$x = 3$	$(3, -1)$	$(2, 0)$ & $(4, 0)$	$(0, 8)$	$[-1, \infty)$	$(3, \infty)$	$(-\infty, 3)$

① $y = x^2 + 8x + 15$
$y = (x + 5)(x + 3)$

① $y = x^2 + 8x + 15$
$y = (x^2 + 8x + 16) + 15 - 16$
$y = (x + 4)^2 - 1$

② $y = (x - 3)(x + 1)$
$y = x^2 - 2x - 3$
then
$y = (x^2 - 2x + 1) - 3 - 1$

③ $y = -(x - 2)^2 + 1$
$y = -(x^2 - 4x + 4) + 1$
$y = -x^2 + 4x - 3$
then
$y = -(x^2 - 4x + 3) = -(x - 3)(x - 1)$

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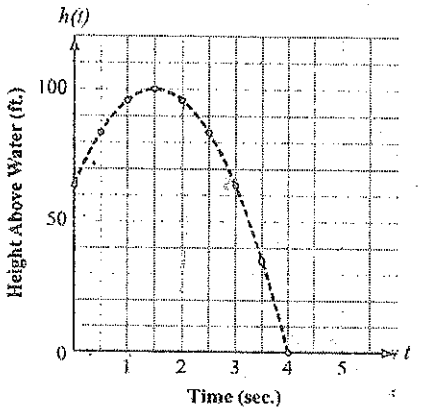
Quadratics Modeled in the Real World

Philip is standing on a rock ledge 64 feet above a lake, and he tosses a rock with a velocity of 48 feet per second. This graph and table represent the height above the water, $h(t)$, as a function of time, t, in seconds after Philip releases the rock.



Time t	Height $h(t)$
0	64
1	96
2	96
3	64
4	0

1. What is the maximum height of the rock? (3, 100)

2. After how many seconds does the rock change direction in the air? 1.5 sec.

3. How can you estimate the maximum height from the table?
   Vertex

4. When does the rock hit the surface of the lake? 4 sec
   What is this point on the graph called? x-intercept
   How can you identify this from the table? y=0

5. Identify the vertex and the axis of symmetry. V(1.5, 100) (highest pt)
   What do these represent in our story? x=1.5

6. At 1 sec, what direction is the rock moving? 98 ft up
   At 2 sec, what direction is the rock moving? 98 ft down

7. Using $h(t) = -16t^2 + v_0t + h_0$, write an equation in standard form for the path of the rock. $h(t) = -16t^2 + t + 56$

8. Will this graph open up or down? down
   Will the vertex be a maximum or a minimum? Why?
   Max, opens down so has a max

9. Using your standard form equation from #1, write the equation in vertex form (decimals are ok).

$y = -5(x - 1.5)^2 + 100$

10. Using the equation from #9, what is the maximum height the rock reaches above the surface of the lake? How did you get this answer?

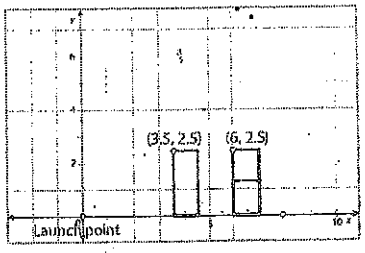
100 ← height of graph

11. Using the equation from #9, after how many seconds did the rock change direction in the air? How did you get this answer?

1.5 sec. is the horizontal shift

12. At 1 sec, what direction is the rock moving? up
At 2 sec, what direction is the rock moving? down

The object of a popular video game is to launch a boulder to over boxes, buildings, and other items. The graph shows an obstacle on the left that the boulder must clear in order to knock over the stack of boxes on the right. The boulder will follow a parabolic path and will launch from (0, 0) and end at (8, 0).



13. What are the x-intercepts for the parabola formed by the path of the boulder?

(0, 0) (8, 0)

14. What is the axis of symmetry for the parabola formed by the path of the boulder?

$x = 4$

15. One possible path for the boulder is $y = -\frac{3}{8}x^2 + 3x$. What is the vertex of the parabola created?

$x = \frac{-3}{2(-\frac{3}{8})}$ $y = 6$ (4, 6)

$x = 4$

16. Will the boulder clear the obstacle in the front? Will it knock down the boxes? How can you tell?

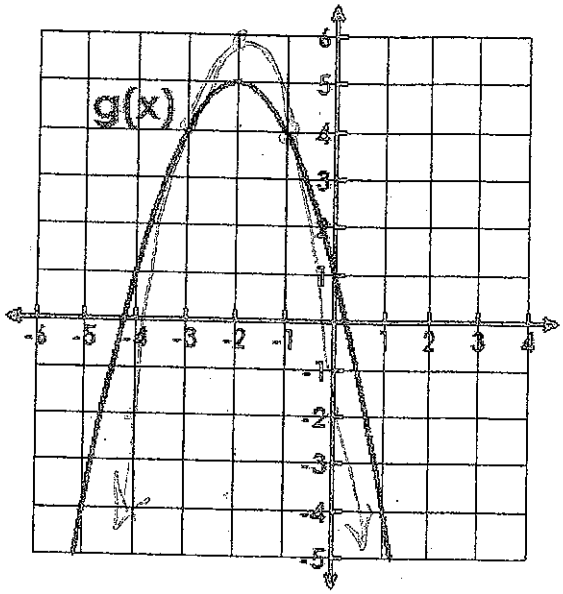
yes, will clear the boxes since vertex is above boxes

Name: _____ Date: _____

Comparing Quadratic Functions

1. Graph the equation $f(x) = -2x^2 - 8x - 2$ on the graph below. Then, answer the questions to compare the two functions.

$x = \frac{8}{-4} = -2 \quad y = -2(4) + 16 - 2 \quad (-2, 6)$



2. Find the axis of symmetry for f(x). How does it compare to the axis of symmetry for g(x)?

$x = -2$; same

3. Find the vertex of f(x). How does it compare to the vertex for g(x)?

$V(-2, 6)$; one up

4. How do the y-intercepts compare?

smaller on g(x)

5. Find the rate of change for both functions from $x_1 = -2$ to $x_2 = 0$. How do the 2 compare? What part of the f(x) equation tells you this should happen?

$g(x) \quad (-2, 5) \quad (0, 1)$ $\qquad f(x) \rightarrow (-2, 6) \quad (0, -2)$

$m = \frac{1-5}{0+2} = \boxed{-2}$ $\qquad m = \frac{-2-6}{0+2} = \boxed{-4}$

The function $f(t) = -16t^2 + 64t + 5$ models the height of a ball that was **hit** into the air, when t is measured in seconds and h is the height in feet. This table represents the height, **g(t)**, of a second ball that was **thrown** into the air.

6. Find the axis of symmetry and vertex for f(t). How do they compare to g(t)?

Time, t (in seconds)	Height, $g(t)$ (in feet)
0	4
1	36
2	36
3	4

7. Which function has the highest start value?

f(t)

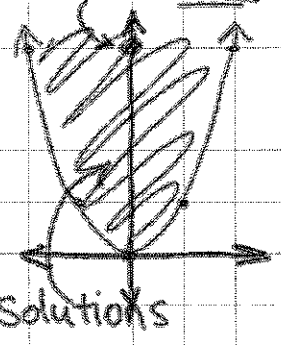
8. Based on your answers to parts a and b, which function do you think will hit the ground first? Explain.

Quadratic Inequalities

Determine whether the given ordered pair is a solution of each inequality.

a. $y \geq x^2$

(0, 4) Solution



b. $y < -x^2 + 6x$ evaluate

(6, −5) Solution

$-5 < -(6)^2 + 6(6)$

$-5 < 0$ TRUE

c. $y \geq 2x^2 + 3x + 2$

(−3, 4) NOT a Solution

$4 \geq 2(-3)^2 + 3(-3) + 2$

$4 \geq 11$ FALSE

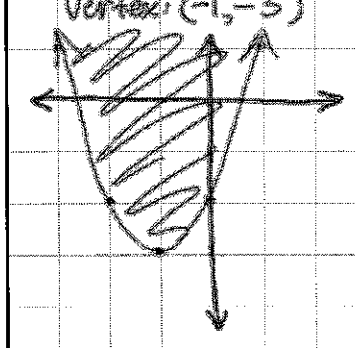
Graph each inequality.

$x = \frac{-b}{2a}$

a. $y \geq x^2 + 2x - 2$

$x = \frac{-2}{2} = -1$

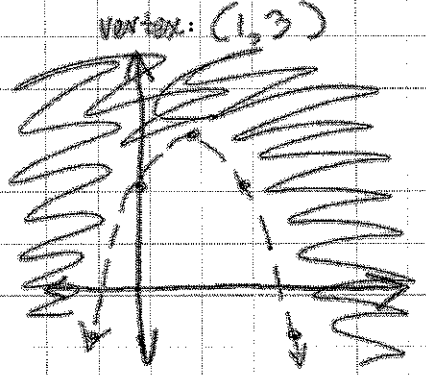
Vertex: $(-1, -3)$



b. $y > -x^2 + 2x + 2$ dotted

$x = \frac{-2}{2} = 1$

vertex: $(1, 3)$



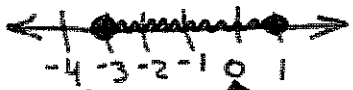
Solve each inequality algebraically.

a. $x^2 + 2x \leq 3$

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

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

$x = -3 \quad x = 1$



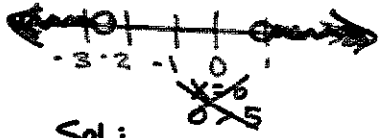
SOLUTION: $[-3, 1]$

b. $2x^2 + 3x > 5$ open circles

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

$(2x+5)(x-1) = 0$

$x = -2.5 \quad x = 1$



Sol: $(-\infty, -2.5) \cup (1, \infty)$

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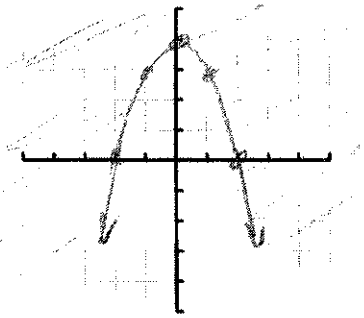
AC Math 1
Quadratic Inequalities WS

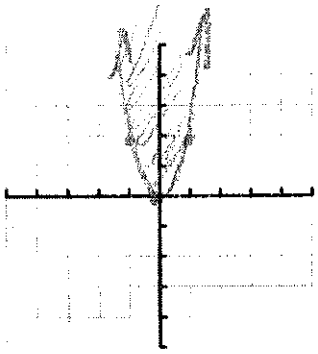
Name Answer Key

Graph each quadratic inequality.

1. $y \geq -x^2 + 4$



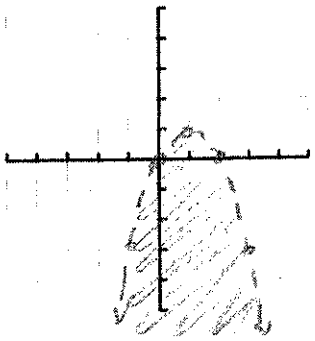
2. $y \geq 2x^2$



3. $y < -x^2 + 2x$

$x = \frac{-2}{-2} = 1$

(1,1)



Graph each quadratic inequality algebraically (using a number line). State the solution set in interval notation.

4. $3x^2 + 2x - 1 \geq 0$

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

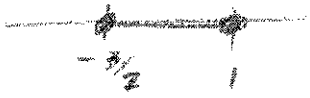
$x = \frac{1}{3} \quad x = -1$

$(-\infty, -1] \cup [\frac{1}{3}, \infty)$

5. $0 \geq 2x^2 + x - 3$

$(2x+3)(x-1) = 0$

$x = -\frac{3}{2} \quad x = 1$



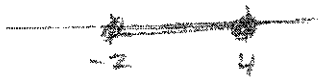
$[-\frac{3}{2}, 1]$

6. $0 \leq -x^2 + 2x + 8$

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

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

$x = 4 \quad x = -2$



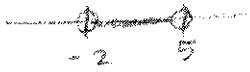
$[-2, 4]$

7. $x^2 < 3x + 10$

$x^2 - 3x - 10 = 0$

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

$x = 5 \quad x = -2$



$(-2, 5)$

8. $2x^2 + 5x \leq 12$

$2x^2 + 5x - 12 = 0$

$(2x-3)(x+4) = 0$

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

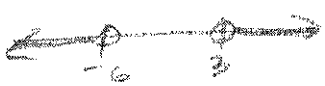
$[-4, \frac{3}{2}]$

9. $x^2 + 3x > 18$

$x^2 + 3x - 18 = 0$

$(x+6)(x-3) = 0$

$x = -6 \quad x = 3$



$(-\infty, -6) \cup (3, \infty)$