Name: _____

Graphing Quadratic Inequalities

Graphing quadratic inequalities is just like graphing any quadratic, with two differences:

1. A quadratic inequality will have shading that is either
   above the vertex ($f(x) \geq or\ f(x) >$)
   or **below the vertex** ($f(x) \leq or\ f(x) <$)
   The shading CANNOT cross the quadratic curve!
2. The curve of the quadratic will be drawn as either
   solid ($\geq or \leq$)
   or **dotted** ($> or <$)

The process for determining the details of the quadratic does not change, however. For these examples, I will use the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

EXAMPLE $f(x) = -x^2 + 2x + 8$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(2) \pm \sqrt{(2)^2 - 4(-1)(+8)}}{2(-1)}$$

$$x = \frac{-2 \pm \sqrt{4 - 4(-8)}}{-2} = \frac{-2 \pm \sqrt{4 + 32}}{-2} = \frac{-2 \pm \sqrt{36}}{-2} = \frac{-2 \pm 6}{-2}$$

$$x = \frac{-2}{-2} \pm \frac{6}{-2} = \frac{2}{2} \pm \frac{6}{2} = 1 \pm 3$$

Zeros:

$x = 1 - 3\ or\ 1 + 3$

$x = -2\ or\ 4$

Vertex:

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

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

$y = -(1)^2 + 2(-1) - 8$

$y = -1 + 2 + 8 = 1 + 8$

$y = \boxed{9}$

y-int: $\boxed{(0, 8)}$ *(It's the last number.)*

Vertex: $\boxed{(1, 9)}$ *($x = \frac{-b}{2a}$, which you plug into the original equation to find y.)*

Zeros: $\boxed{(-2, 0)\ \&\ (4, 0)}$

(I used the quadratic formula: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$)

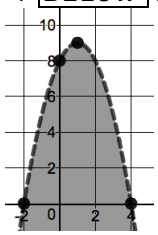
"OR EQUAL"	***NOT "OR EQUAL"***
Shaded Inside: $[zero, zero]$	*Shaded Inside:* $(zero, zero)$
Shaded Outside: $(-\infty, zero] \cup [zero, \infty)$	*Shaded Outside:* $(-\infty, zero) \cup (zero, \infty)$

All of the inequalities will have the same information! y-int: $(0, 8)$, vertex: $(1, 9)$, and zeros: $(-2, 0)$ & $(4, 0)$.

EXAMPLEa. $f(x) < -x^2 + 2x + 8$

~~SOLID or~~ $<$ ***is a*** $\boxed{\textbf{\textit{DOTTED}}}$ Line?

Shade ~~ABOVE or~~ $\boldsymbol{f(x) <}$ $\boxed{\textbf{\textit{BELOW}}}$ the vertex?



Is it shaded on the $\boxed{INSIDE}$ or OUTSIDE?

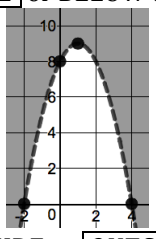
Zeros in Interval Notation:

Inside and NOT equal: $(zero, zero) = \boxed{(-2, 4)}$

EXAMPLEb. $f(x) > -x^2 + 2x + 8$

~~SOLID or~~ $>$ ***is a*** $\boxed{\textbf{\textit{DOTTED}}}$ Line?

Shade $\boldsymbol{f(x) >}$ $\boxed{\textbf{\textit{ABOVE}}}$ ~~or BELOW~~ the vertex?



Is it shaded on the INSIDE or $\boxed{OUTSIDE}$?

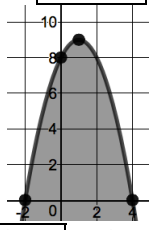
Zeros in Interval Notation: ***Outside and NOT equal***:

$(-\infty, zero) \cup (zero, \infty) = \boxed{(-\infty, -2) \cup (4, \infty)}$

EXAMPLEc. $f(x) \leq -x^2 + 2x + 8$

$\leq$ ***is a*** $\boxed{\textbf{\textit{SOLID}}}$ ~~or DOTTED~~ Line?

Shade ~~ABOVE or~~ $\boldsymbol{f(x) \leq}$ $\boxed{\textbf{\textit{BELOW}}}$ the vertex?



Is it shaded on the $\boxed{INSIDE}$ or OUTSIDE?

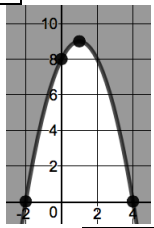
Zeros in Interval Notation:

Inside and EQUAL: $[zero, zero] = \boxed{[-2, 4]}$

EXAMPLEd. $f(x) \geq -x^2 + 2x + 8$

$\geq$ ***is a*** $\boxed{\textbf{\textit{SOLID}}}$ ~~or DOTTED~~ Line?

Shade $\boldsymbol{f(x) \geq}$ $\boxed{\textbf{\textit{ABOVE}}}$ ~~or BELOW~~ the vertex?



Is it shaded on the INSIDE or $\boxed{OUTSIDE}$?

Zeros in Interval Notation: ***Outside and EQUAL***:

$(-\infty, zero] \cup [zero, \infty) = \boxed{(-\infty, -2] \cup [4, \infty)}$

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

y-int:

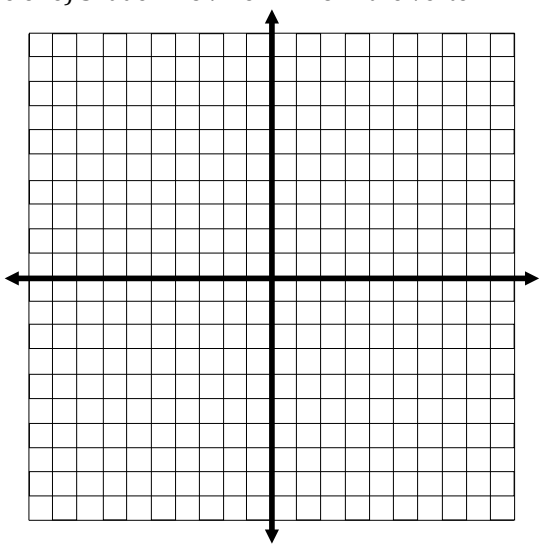
Vertex:

Zeros:

"OR EQUAL"	***NOT "OR EQUAL"***
Shaded Inside: $[zero, zero]$ *Shaded Outside:* $(-\infty, zero] \cup [zero, \infty)$	*Shaded Inside:* $(zero, zero)$ *Shaded Outside:* $(-\infty, zero) \cup (zero, \infty)$

1a. $f(x) < x^2 + 4x + 3$

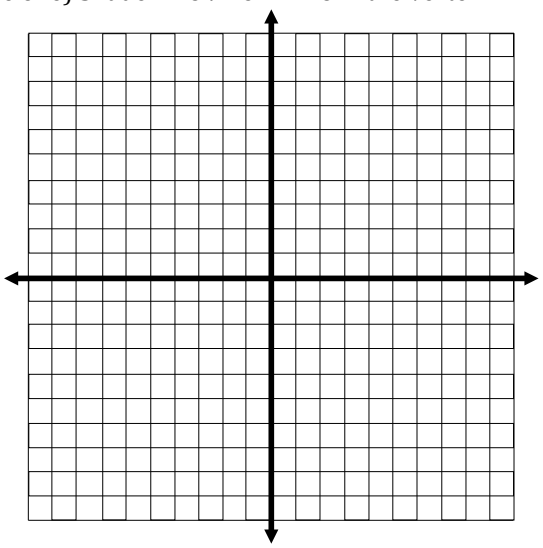
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

1b. $f(x) > x^2 + 4x + 3$

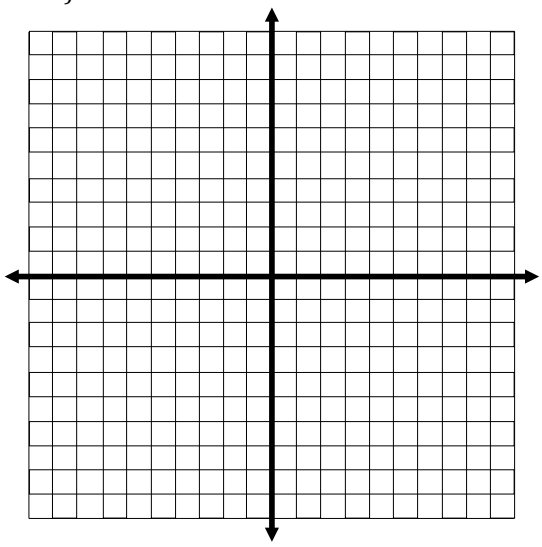
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

1c. $f(x) \leq x^2 + 4x + 3$

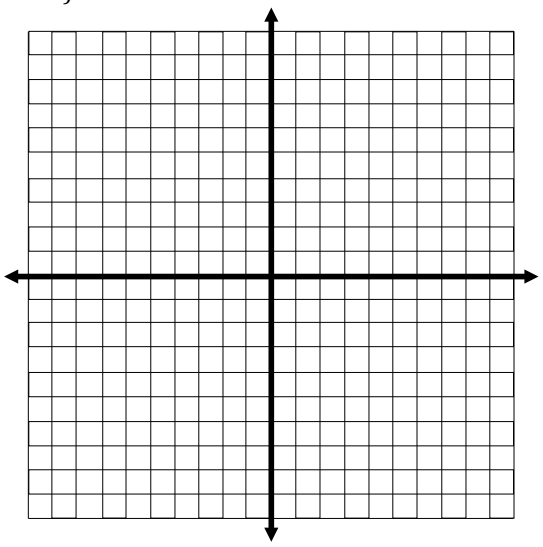
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

1d. $f(x) \geq x^2 + 4x + 3$

(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

2. $g(x) = -x^2 + 7x + 8$

y-int:

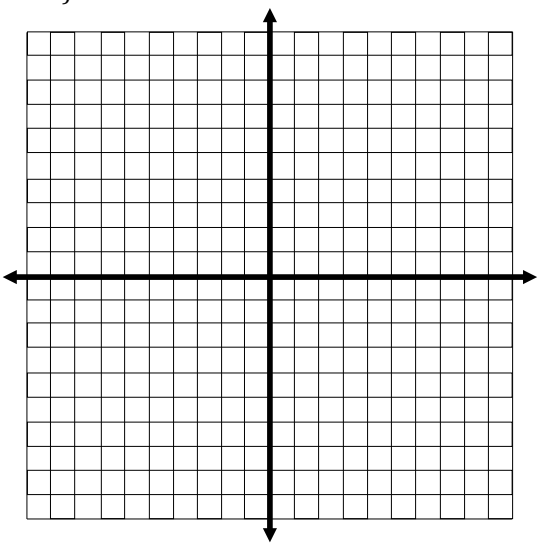
Vertex:

Zeros:

"OR EQUAL"	***NOT "OR EQUAL"***
Shaded Inside: $[zero, zero]$	*Shaded Inside:* $(zero, zero)$
Shaded Outside: $(-\infty, zero] \cup [zero, \infty)$	*Shaded Outside:* $(-\infty, zero) \cup (zero, \infty)$

2a. $g(x) \geq -x^2 + 7x + 8$

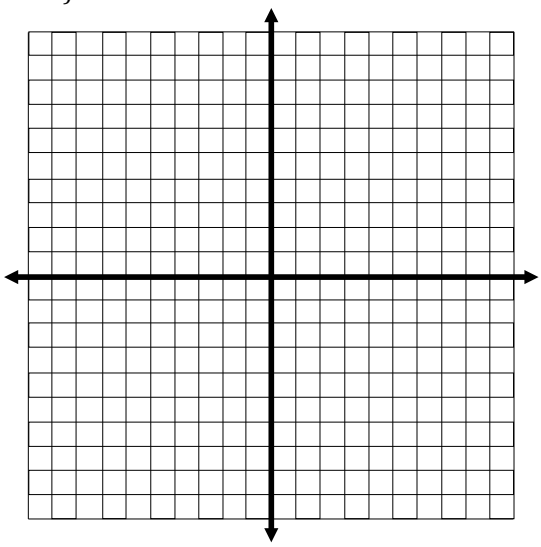
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

2b. $g(x) \leq -x^2 + 7x + 8$

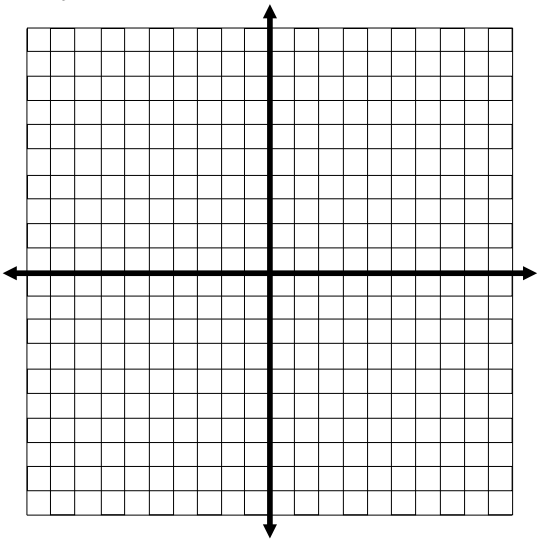
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

2c. $g(x) > -x^2 + 7x + 8$

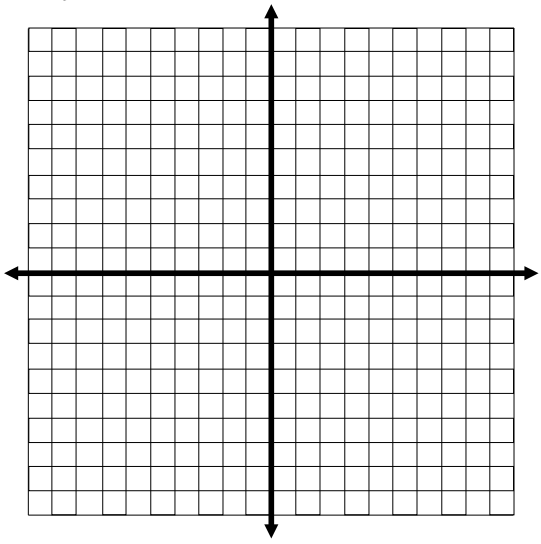
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

2d. $g(x) < -x^2 + 7x + 8$

(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

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

y-int:

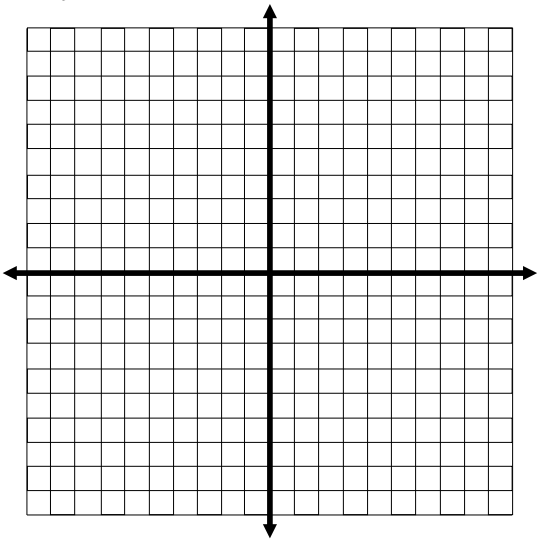
Vertex:

Zeros:

"OR EQUAL"	***NOT "OR EQUAL"***
Shaded Inside: $[zero, zero]$	*Shaded Inside:* $(zero, zero)$
Shaded Outside: $(-\infty, zero] \cup [zero, \infty)$	*Shaded Outside:* $(-\infty, zero) \cup (zero, \infty)$

3a. $h(x) \leq 2x^2 - 4x + 6$

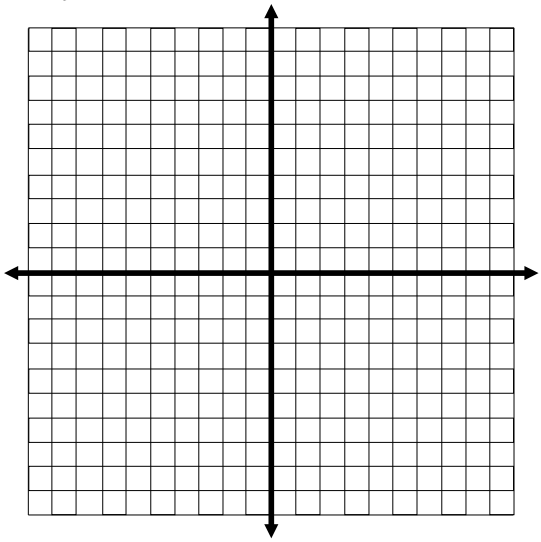
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

3b. $h(x) < 2x^2 - 4x + 6$

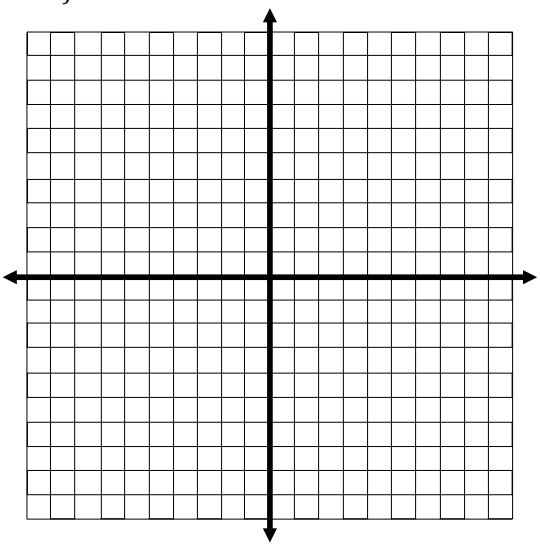
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

3c. $h(x) \geq 2x^2 - 4x + 6$

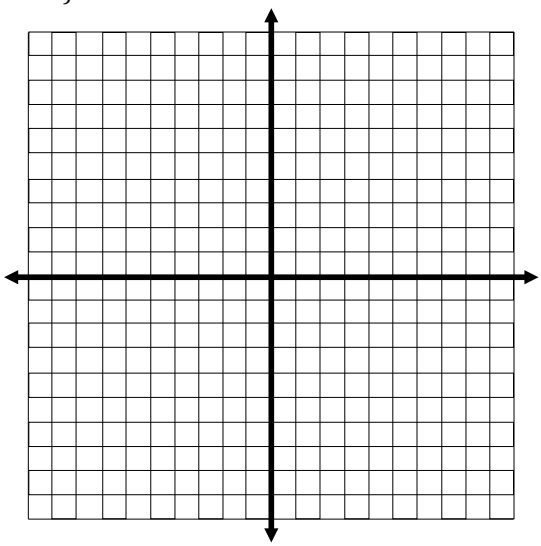
(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation:

3d. $h(x) > 2x^2 - 4x + 6$

(Circle one) SOLID or DOTTED Line?
(Circle one) Shade ABOVE or BELOW the vertex?



(Circle one) Is it shaded on the INSIDE or OUTSIDE?
Zeros in Interval Notation: