8 Algebra CC **15-4**

Essential Question: How do we transform a quadratic equation written in standard form to vertex form?

Do Now: $a=-2 \quad b=8 \quad c=-6$ $\qquad x=\frac{-b}{2a} \qquad x=\frac{-8}{2(-2)} \qquad x=2$

a) Graph $\mathbf{y = -2x^2 + 8x - 6}$ using a table of values.

b) Determine the coordinates of the vertex. (2,2) $\qquad y=-2(2)^2+8(2)-6 \qquad y=2$

c) State whether the vertex is a *maximum* or a *minimum* point. maximum

d) State and graph the equation of the **axis of symmetry.** $x=2$

e) State the **roots** of the parabola. $\{1,3\}$

f) State the **y-intercept.** -6

g) State the **domain** of the function. $(-\infty,\infty)$

h) State the **range** of the function. $(-\infty,2]$ or $y\le 2$

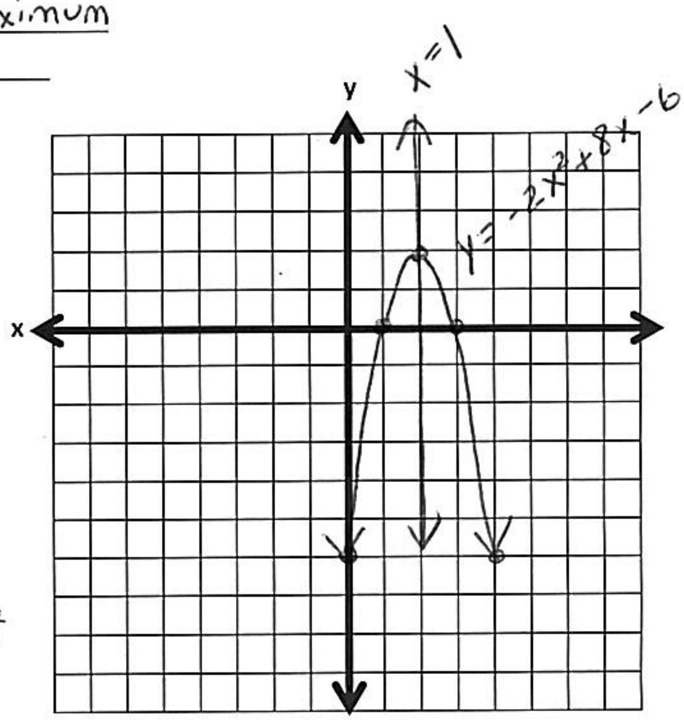
i) State the interval for which the function is increasing. $x<2$

j) State the interval for which the function is decreasing. $x>2$

X	Y
-1	-16
0	-6
1	0
2	2
3	0
4	-6
5	-16

look at x value of vertex

interval will either be less than that number or greater than that number



VERTEX FORM OF A QUADRATIC FUNCTION

$$f(x) = a(x-h)^2 + k$$

where ***h*** and ***k*** are real numbers and **(*h*, *k*)** is the vertex

Example: Convert $y = x^2 + 12x + 32$ into vertex form, and state the vertex.

$y=x^2+12x+32$ $y-32=x^2+12x$ $y-32+36=x^2+12x+36$ $y+4=x^2+12x+36$ $y+4=(x+6)(x+6)$ $y+4=(x+6)^2$ $\boxed{y=(x+6)^2-4}$ $\quad$ $\boxed{\text{Vertex: } (-6,-4)}$	1) Since we will be "completing the square," isolate the x^2 and x terms and move the "c" term to the other side of the equal sign. 2) Find the perfect square trinomial. Take half of the coefficient of the x term, square it, and add it to both sides of the equation. 3) Simplify and factor the perfect square trinomial. 4) Isolate the y term.

Rewrite the following equations in <u>vertex form</u> by completing the square and state the vertex.
<u>Check your answer with the table of values on the calculator</u>.

$y = a(x-h)^2 + k$ **Vertex: (h, k)**

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

$y + 4 = x^2 + 2x$ $\quad \left(\frac{2}{2}\right)^2$

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

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

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

vertex $(-1, -5)$

2. $y = x^2 - 12x + 4$

$y - 4 = x^2 - 12x$ $\quad \left(\frac{-12}{2}\right)^2$

$y - 4 + 36 = x^2 - 12x + 36$

$y + 32 = (x-6)^2$

$y = (x-6)^2 - 32$

vertex : $(6, -32)$

Let's try some more complicated examples. 

3. $y = 3x^2 + 18x - 36$

$y + 36 = 3x^2 + 18x$

$y + 36 = 3(x^2 + 6x \quad)$ $\quad \left(\frac{6}{2}\right)^2$

$y + 36 + 27 = 3(x^2 + 6x + 9)$

$y + 63 = 3(x+3)^2$

$y = 3(x+3)^2 - 63$

vertex : $(-3, -63)$

4. $f(x) = -6x^2 - 12x + 48$

$y = -6x^2 - 12x + 48$

$y - 48 = -6x^2 - 12x$

$y - 48 = -6(x^2 + 2x \quad)$ $\quad \left(\frac{2}{2}\right)^2$

$y - 48 - 6 = -6(x^2 + 2x +$

$y - 54 = -6(x+1)^2$

$y = -6(x+1)^2 + 54$

vertex : $(-1, 54)$

A quadratic function written in <u>standard form</u> (**$y = ax^2 + bx + c$**) can be rewritten in <u>vertex form</u> (**$y = a(x-h)^2 + k$**) by <u>completing the square</u>. When the function is written in vertex form, the vertex can easily by identified by the ordered pair (<u>h</u>, <u>k</u>).

TAKE AWAY