Name:	Date:	Period:

3.4 Converting to Vertex Form Notes

Warm up

Multiply: $(2x+1)^2$ → $(2x+1)(2x+1)$

$4x^2 + 4x + 1$ perfect square trinomial

Perfect Square Trinomials

$a^2 + 2ab + b^2$ → $(a+b)(a+b) \rightarrow (a+b)^2$ (a·a, b·b)

$a^2 - 2ab + b^2$ → $(a-b)(a-b) \rightarrow (a-b)^2$

Factor $x^2 + 8x + 16$ (4·x·2; x·x; 4·4)

$(x+4)(x+4)$

Factor $4m^2 - 12m + 9$ (2m·3·2; 2m·2m; 3·3)

$(2m-3)(2m-3)$

Complete the square to make a perfect square trinomial

When a trinomial is a perfect square, there is a relationship between coefficient of the x term and the constant

$(x+3)^2 \rightarrow x^2 + 6x + 9$ Perfect Square Trinomial

$\frac{6}{2} \rightarrow 3 \rightarrow (3)^2$

Find the constant to complete the square (make it a perfect square trinomial.

a. $x^2 - 8x +$ 16 $\left(\frac{-8}{2}\right)^2 = (-4)^2 = 16$

b. $r^2 + 2r +$ 1 $\left(\frac{2}{2}\right)^2 = 1^2 = 1$

Standard Form $f(x)=ax^2+bx+c$ ⬇ Vertex Form $f(x)=a(x-h)^2+k$	If the standard form equation is a perfect square, then factor it. If not, you can use a process called <u>completing the square</u> to write the equation in vertex form.
	1. GROUP (ax^2+bx)
	2. If $a \neq 1$, FACTOR it out so it becomes $a(x^2+bx)$
	3. COMPLETE THE SQUARE by taking half of b and squaring it. This is the new "c". Add this to "x^2+bx". This is the perfect square trinomial
	4. SUBTRACT $a \cdot c$ from the end of the equation.
	5. FACTOR the trinomial and SIMPLIFY the end of the equation.

Directions: Write each function in vertex form. Give the vertex.

<u>Ex1:</u> $f(x) = x^2 + 4x + 4$ (x·x, x·2·2, 2·2)

Already a perfect square

$f(x) = (x+2)^2$

$(-2, 0)$

<u>Ex2:</u> $f(x) = x^2 - 8x + 18$

① $f(x) = (x^2 - 8x + \_\_) + 18 - \_\_$

③ $\left(\frac{-8}{2}\right)^2 = (-4)^2 = 16$

④ $f(x) = (x^2 - 8x + 16) + 18 - 16$

⑤ $f(x) = (x-4)^2 + 2$

vertex $(4, 2)$

Ex3: $f(x) = -x^2 + 6x - 5$

① $(-x^2 + 6x)$

② $f(x) = -(x^2 - 6x + 9) - 5 - (-9)$

③ $\left(\frac{-6}{2}\right)^2 = (-3)^2 = 9$

④ but $(-1)9$ from factored out

⑤ $f(x) = -(x^2 - 6x + 9) - 5 + 9$

$f(x) = -(x-3)^2 + 4$

vertex $(3, 4)$

Ex4: $f(x) = 2x^2 - 12x + 13$

① $(2x^2 - 12x)$

② $f(x) = 2(x^2 - 6x + 9) + 13 - 18$

③ $\left(\frac{-6}{2}\right)^2 = (-3)^2 = 9$

④ $9 \cdot 2$

⑤ $f(x) = 2(x-3)^2 - 5$

vertex $(3, -5)$

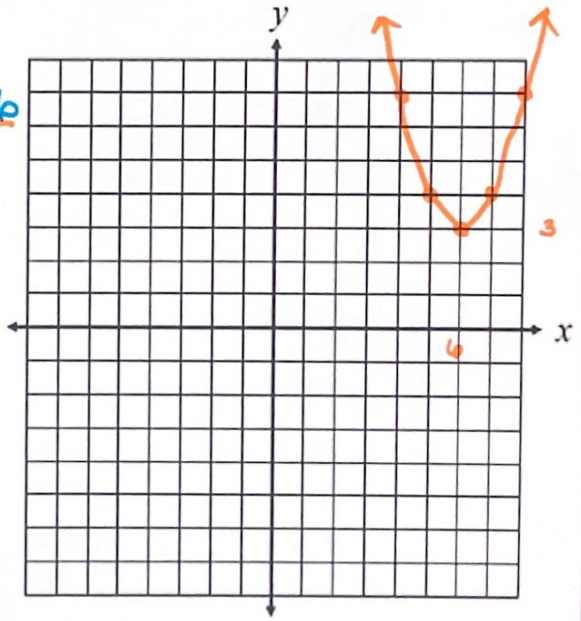
Directions: Convert to vertex form. Identify the vertex, axis of symmetry, then graph it.

Ex5: $f(x) = x^2 - 12x + 39$

$f(x) = x^2 - 12x + 36 + 39 - 36$

$\left(\frac{-12}{2}\right)^2 = (-6)^2 = 36$

$f(x) = (x-6)^2 + 3$



State:

Increasing interval $(6, \infty)$

Decreasing interval $(-\infty, 6)$