

Pre-AP Algebra 2

Unit 3 – Lesson 4 – Converting Standard Form to Vertex Form

Objectives: The students will be able to

- Convert from standard form to vertex form by completing the square
- Factor with any value as a in $f(x) = ax^2 + bx + c$

Materials: Do Now worksheet; pairwork; hw #3-4

Time	Activity
5 min	Review Homework Show the answers to hw #3-3 on the overhead. Students correct their answers. Pass around the tally sheets.
10 min	Homework Presentations Review the top 2 or 3 problems.
15 min	Do Now Hand out the Perfect Square Trinomials worksheet to students to complete. Review answers on the overhead.
30 min	Direct Instruction Background: Perfect Square Trinomials Patterns: $(a + b)^2 = (a + b)(a + b) = a^2 + 2ab + b^2$ $(a - b)^2 = (a - b)(a - b) = a^2 - 2ab + b^2$ $(x + 5)^2 = x^2 + 2(5)(x) + 5^2 = x^2 + 10x + 25$ $(3x - 4)^2 = (3x)^2 - 2(3x)(4) + 4^2 = 9x^2 - 24x + 16$ Concepts: <u>Completing the Square:</u> $x^2 + bx + c$ To “complete the square” means to convert a standard form quadratic expression into a Perfect Square Trinomial. 1) “Add and subtract” a number to make $c = (b/2)^2$. 2) Factor the trinomial into $(x + b/2)^2$ 3) If you are solving, work backwards from there. Examples: Convert each standard form parabola into vertex form by completing the square: 1) $y = x^2 + 6x$ 2) $y = x^2 - 8x$ 3) $y = x^2 + 3x$ 4) $y = x^2 + 10x - 3$ <u>Completing the Square:</u> $ax^2 + bx + c$ When a is not 1: 1) Factor out a from first two terms – even if it’s not a factor. 2) Add $(b/2)^2$, <u>inside the parentheses</u>. 3) Subtract $a(b/2)^2$ <u>outside the parentheses</u>. Don’t forget to multiply by a! 4) Factor the trinomial into $a(x + b/2)^2$ and simplify c Example. Convert into vertex form by completing the square: 5) $f(x) = 3x^2 + 5x - 4$
20 min	Pairwork

Perfect Square Trinomials

1) Expand out each of the following. Remember, $(a + b)^2$ IS NOT $a^2 + b^2$.

a. $(x + 5)^2 =$

b. $(x - 10)^2 =$

c. $(7 - x)^2 =$

d. $(2x + 3)^2 =$

e. $(a + b)^2 =$

f. $(a - b)^2 =$

2) Fill in the blanks.

a. $x^2 + 10x + \underline{\hspace{1cm}} = (x + 5)^2$

b. $x^2 - 8x + \underline{\hspace{1cm}} = (x - 4)^2$

c. $x^2 + 6x + 9 = (x + \underline{\hspace{1cm}})^2$

d. $x^2 - 12x + 36 = (x - \underline{\hspace{1cm}})^2$

e. $x^2 + 18x + \underline{\hspace{1cm}} = (\underline{\hspace{1cm}} + \underline{\hspace{1cm}})^2$

Basic Factoring Practice

- 1) Fill in the missing number to make the expression into a **perfect square trinomial**.

a. $x^2 + 8x + \underline{\hspace{1cm}} = (x + 4)^2$

c. $x^2 + 12x + \underline{\hspace{1cm}} = (\underline{\hspace{1cm}} + \underline{\hspace{1cm}})^2$

b. $x^2 - 4x + \underline{\hspace{1cm}} = (x - 2)^2$

d. $x^2 - 10x + \underline{\hspace{1cm}} = (\underline{\hspace{1cm}} - \underline{\hspace{1cm}})^2$

- 2) For each parabola, first find the vertex by using $x = -b/2a$. Then, convert the function into vertex form by completing the square. Do you get the same vertex in its new form?

a. $f(x) = x^2 - 8x + 11$

b. $g(x) = x^2 + 26x + 68$

- 3) Complete the square to convert the standard form quadratic function into vertex form.

a. $y = 3x^2 + 4x + 2$

b. $f(x) = 5x^2 + 40x + 77$

HW #3-4: Converting to Vertex Form

Check for Understanding

Can you complete these problems correctly by yourself

- 1) Complete the square to convert the standard form quadratic function into vertex form. Then find the vertex and the x-intercepts.

a. $f(x) = x^2 + 4x - 14$

b. $f(x) = 2x^2 + 9x$

c. $y = 5x^2 - 4x + 1$

d. $f(x) = 2x^2 - 4x + 8$

e. $y = -3x^2 - 12x - 13$

Spiral

What do you remember from Algebra 1 and our previous units? (these are skills we will need in this unit) Work on a separate sheet a paper

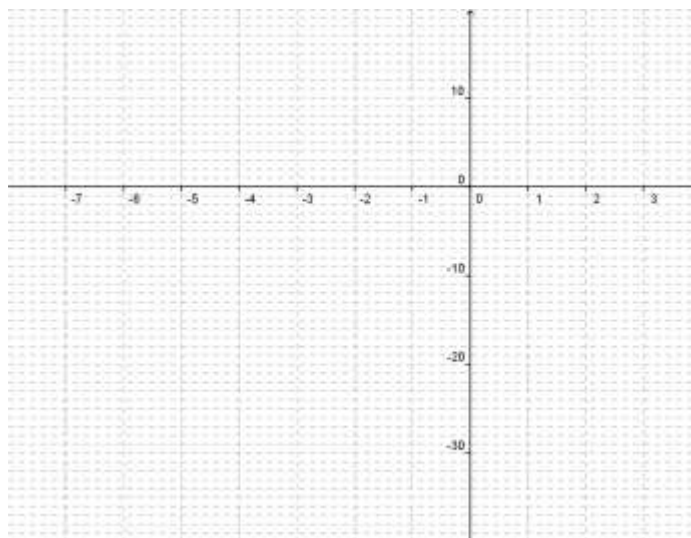
Given $f(x) = 2x^2 + 4x - 30$

1. Find the vertex using $-\frac{b}{2a}$

2. Transform $f(x)$ to intercept form by factoring

3. Transform $f(x)$ to vertex form by completing the square

4. Graph $f(x)$ and label the vertex, the x-intercepts, the axis of symmetry, and the y-intercept.



Use the graph to find the following

5. $f(-3) =$

6. $f(1) =$

7. What value(s) of x make the following true

a. $f(x) = 0$

b. $f(x) \geq 0$

c. $f(x) < 0$

d. $f(x) = -24$

e. $f(x) \geq -24$

f. $f(x) < -24$

g. $f(x) = -32$

h. $f(x) < -32$

i. $f(x) \geq -32$