Lesson 2.4 Objective: SWBAT find parabolas in different forms.

Kickoff $ax^2+bx+c=0$

Write each of the following in standard form.

1) $4x^2=-6x+1$ $4x^2+6x-1=0$

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

3) $-9=5x+9x^2$ $9x^2+5x+9=0$

Different Forms of a Parabola

Classifying a Polynomial Function

Polynomial functions are classified by the degree of the polynomial (largest exponent)

Examples: Classify these polynomials

$f(x) = a$ Constant function (degree 0)

$f(x) = mx + b$ Linear function (degree 1)

$f(x) = ax^2 + bx + c$ Quadratic function (degree 2)

Quadratic Function

$f(x) = ax^2 + bx + c$ Parabola

$a < 0$ neg downward (concave down)

$a > 0$ positive upward (concave up)

Symmetric- a mirror image through a line of reflection

Axis of Symmetry

$f(x) = ax^2 + bx + c$ $x=\frac{-b}{2a}$

$y=x^2$ y-axis

Examples: Find the axis of symmetry

a) $f(x) = x^2 - 8x + 7$ $x=\frac{-(-8)}{2(1)}=4$

b) $f(x) = 2x^2 - 7x + 6$ $x=\frac{7}{4}$

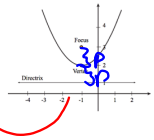
c) $f(x) = x^2 - 7$ $x=0$ (y-axis)

Three Forms of Parabolas are:

1) Standard Form $ax^2+bx+c=0$

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

3) Modified vertex form $(x-h)^2=4p(y-k)$ (h,k) Vertex



To put into vertex form:

1) put in the form $f(x)-C=ax^2+bx$

2) make $a=1$ (divide by a)

3) Complete the Square.

4) put in vertex form $f(x)=a(x-h)^2+k$ (Solve for $f(x)$)

1. $f(x) = 2x^2 + 8x + 7$

$\frac{f(x)-7}{2}=\frac{2x^2+8x}{2}$

$\frac{f(x)}{2}-\frac{7}{2}=x^2+4x+4$ $+4$

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

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

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

Examples:

2. $f(x) = -x^2 + 6x - 8$

$+8 \quad +8$

$\frac{f(x)+8}{-1} = \frac{-x^2+6x}{-1}$

$-f(x) - 8 + 9 = x^2 - 6x + 9$

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

$\frac{-f(x)}{-1} = \frac{(x-3)^2 - 1}{-1}$

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

3. Put in standard form: $f(x) = -(x+7)^2 - 10$

$f(x) = -(x^2+14x+49) - 10$

$f(x) = -x^2 - 14x - 49 - 10$

$f(x) = -x^2 - 14x - 59$

To put in modified vertex form

1) Put in the form $f(x) - C = ax^2 + bx$

2) Make $a = 1$

3) Complete the Square

★ 4) Write in the form $(x-h)^2 = 4p(y-k)$ or $4p(y-k) = (x-h)^2$

4. $y = -\frac{1}{2}x^2 + 2x + \frac{1}{2}$

$-\frac{1}{2} \quad -\frac{1}{2}$

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

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

$+4$

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

$-2\left(y - \frac{5}{2}\right) = (x-2)^2$

Examples:

5. $x^2 - 3x - 4y + 9 = 0$

$-3\left(\frac{1}{2}\right)\left(-\frac{3}{2}\right)^2 = \frac{9}{4}$

$+14y \quad -5 \quad +14y - 5$

$x^2 - 3x + \frac{9}{4} = 4y - 5 + \frac{9}{4}$

$\left(x - \frac{3}{2}\right)^2 = 4y - \frac{11}{4}$

$\left(x - \frac{3}{2}\right)^2 = 4\left(y - \frac{11}{16}\right)$

6. Put in standard form: $(x+5)^2 = -8(y+2)$

$(x+5)(x+5)$

$x^2 + 10x + 25 = -8y - 16$

$+16 \quad +16$

$\frac{x^2 + 10x + 41}{-8} = \frac{-8y}{-8}$

$-\frac{1}{8}x^2 - \frac{5}{4}x - \frac{41}{8} = y$

Lesson 2.4- Objective: SWBAT write quadratic equations in different forms.

Kickoff

In your own words, describe why you think we would want to write a quadratic equation in a different form.

Finding the vertex when you have NO calculator + you need to graph.

To find the directrix / vertex / focus

-to find different info

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

(6) $y = -x^2 - 14x - 59$

$+59 \quad +59$

$\frac{y+59}{-1} = \frac{-x^2-14x}{-1}$

$-y - 59 + 49 = x^2 + 14x + 49$

$-y - 10 = (x+7)^2$

(11) $y = \frac{1}{4}x^2 - \frac{7}{2}x + \frac{65}{4}$

$-\frac{65}{4} \quad -\frac{65}{4}$

$4\left(y - \frac{65}{4} = \frac{1}{4}x^2 - \frac{7}{2}x\right)$

$4y - 65 = x^2 - 14x + 49$

$+49$

$\frac{y}{4} \quad 4y - 16 = (x-7)^2$

$y \cdot \frac{4}{1} = 4y$

Practice:

Put each of the following into vertex form.

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

2) $y = 2x^2 + 36x + 170$

$\frac{y - 170}{2} = \frac{2x^2 + 36x}{2}$

$\frac{y}{2} - 85 = x^2 + 18x + 81$

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

$y = 2(x+9)^2 + 4$

★ 3) $\frac{1}{2}(y+4) = (x-7)^2$

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

$2\left(\frac{1}{2}y = (x-7)^2 - 2\right)$

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

4) $162x + 731 = -y - 9x^2$

$+9x^2 - 731 \quad +9x^2 - 731$

$\frac{9x^2 + 162x}{9} = \frac{-y - 731}{9}$

$x^2 + 18x + 81 = \frac{-y}{9} - \frac{731}{9} + 81$

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

$+\frac{2}{9} \quad +\frac{2}{9}$

$-9\left((x+9)^2 + \frac{2}{9} = -\frac{y}{9}\right)(-9)$

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

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

5) $6x^2 + 12x + y + 13 = 0$

6) $y = -x^2 - 14x - 59$

Put each of the following into modified vertex form.

7) $x^2 + 4x + 6y - 2 = 0$

8) $y = \frac{1}{12}x^2 + \frac{1}{3}x + \frac{4}{3}$

9) $x^2 - 6x - 10y - 1 = 0$

10) $x^2 + 8x + 8y + 32 = 0$

11) $y = \frac{1}{4}x^2 - \frac{7}{2}x + \frac{65}{4}$

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

Put each of the following in standard form.

13) $y = -6(x + 1)^2 - 7$

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

15) $(x - 3)^2 = 4(y - 3)$

16) $y = \frac{1}{4}(x + 4)^2 + 3$

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

18) $(x - 8)^2 = 8(y - 1)$