Topic: IM2 – 3.3 (N – 1) Key Characteristics of Quadratics Revealed	**Standard(s):** F.IF.8	Notes
Essential Question: Which key features are revealed by each of the three quadratic forms: standard, factored, and vertex?		

Questions / Big Ideas

Quadratic Forms

Parent Function: $\boldsymbol{y = x^2}$ *or* $\boldsymbol{y = ax^2}$

Standard Form: $\boldsymbol{y = ax^2 + bx + c}$

Factored Form: $\boldsymbol{y = a(x - r_1)(x - r_2)}$

Vertex Form: $\boldsymbol{y = a(x - h)^2 \pm k}$

Common Parameter $\boldsymbol{a}$

a: Must be a non-zero number.

- Reveals Concavity & Extrema
  - $+a$: parabola opens up, has a minimum.
  - $-a$: parabola opens down, has a maximum.
- Reveals Dilation
  - No Dilation: $a = 1$
  - Stretch: $a > 1$
  - Compress: $0 < a < 1$

Standard Form of a Quadratic Equation

Standard Form ≡ $\boldsymbol{y = ax^2 + bx + c}$

- For the standard form of a quadratic equation, the parameters are $a, b, and\ c$.
- $\boldsymbol{b}$, the coefficient of the x-term, changes the location of the vertex of a parabola.
- $\boldsymbol{c}$ represents the y-value when the x-value is zero. This is the y-value of the y-intercept (0, c).

Questions / Big Ideas	**Standard Form Reveals**
	• y-intercept: c
	• Concavity: a
	• Extrema: a
	• Dilation: a
	
	Standard Form Example
	• $y = 3x^2 + 8x - 9$
	  ○ y-intercept: $(0, -9)$, b/c: $c = -9$
	  ○ Concavity: parabola opens upward, b/c: +
	  ○ Extrema: has a minimum point, b/c: +
	  ○ Dilation: stretched by 3, b/c: 3
	
	Guided Practice
	
	1. $y = 5x^2 + 2x + 6$
	Concavity: Opens Up / Down
	Dilation Value: _____
	None / Stretch / Compress
	Extrema: Minimum / Maximum
	y-intercept: $(0, \_\_\_\_)$
	
	2. $y = -0.6x^2 + 5x - 8$
	Concavity: Opens Up / Down
	Dilation Value: _____
	None / Stretch / Compress
	Extrema: Minimum / Maximum
	y-intercept: $(0, \_\_\_\_)$
	
	3. $y = \frac{1}{3}x^2 - 15x - 12$
	Concavity: Opens Up / Down
	Dilation Value: _____
	None / Stretch / Compress
	Extrema: Minimum / Maximum
	y-intercept: $(0, \_\_\_\_)$
	
	4. $y = -x^2 + 3x - 2$
	Concavity: Opens Up / Down
	Dilation Value: _____
	None / Stretch / Compress
	Extrema: Minimum / Maximum
	y-intercept: $(0, \_\_\_\_)$
	
	5. Write the standard form of a parabola that opens down, has a compression of 0.7, and has the y-intercept (0, 5).
	
	6. Write the standard form of a parabola that has a minimum, has a stretch of 2, and has the y-intercept (0, -9).

Questions / Big Ideas	**Factored Form of a Quadratic Equation**

Factored Form: $\boldsymbol{y = a(x - r_1)(x - r_2)}$

- For the factored form of a quadratic equation, the parameters are $a, r_1, and\ r_2$.

- $\boldsymbol{r}$, a root value.
  - Roots can be positive or negative values
  - Roots are related to x-intercepts and zeros.

Factored Form Reveals

- Zeros: $x = r_1$ and $x = r_2$
- x-intercepts: $(r_1, 0)$ and $(r_2, 0)$
- Concavity: a
- Extrema: a
- Dilation: a

Factored Form Example

- $y = 2(x - 4)(x + 3)$
  - Zeros: $x = 4$, b/c: $r_1 = 4$ and $x = -3$, b/c: $r_2 = -3$
  - x-intercepts: $(4, 0)$, b/c: $r_1 = 4$ and $(-3, 0)$, b/c: $r_2 = -3$
  - Concavity: parabola opens upward, b/c: +
  - Extrema: has a minimum point, b/c: +
  - Dilation: stretched by 2, b/c: 2

Guided Practice

1. $y = (x + 2)(x - 4)$
   $y = (x - [\quad])(x - [\quad])$

   Zeros: _____ and _____

   x-intercepts: _____ and _____

   Concavity: Opens Up / Down Extrema: Minimum / Maximum

   Dilation: None / Stretch / Compress Value: _____

2. Write the factored form of a parabola that opens up, has a compression of $\frac{2}{3}$, and has the roots $-2 \quad and \quad 9$.

Questions / Big Ideas	**Vertex Form of a Quadratic Equation**

<u>*Vertex Form*</u>: $\boldsymbol{y = a(x - h)^2 + k}$

- For the vertex form of a quadratic equation, the parameters are $a, h, and\ k$.

- $\boldsymbol{h}$, the x-value of the vertex
- $\boldsymbol{k}$, the y-value of the vertex

Vertex Form Reveals
- Vertex: (h, k)
- Concavity: a
- Extrema: a
- Dilation: a

Vertex Form Example
- $y = -6(x - 8)^2 - 2$
  - Vertex: $(8, -2)$
  - Concavity: parabola opens downward, b/c: $-$
  - Extrema: has a maximum point, b/c: $-$
  - Dilation: stretched by 6, b/c: 6

Guided Practice

1. $y = -2(x + 7)^2 + 4$
   $y = [\quad\quad](x - [\quad\quad])^2 + [\quad\quad]$

   Vertex: (,)

   Concavity: Opens Up / Down Extrema: Minimum / Maximum

   Dilation: None / Stretch / Compress Value: _____

2. Write the vertex form of a parabola that has a minimum, has a compression of 0.8, and has the vertex $(3, -5)$.

Summary: _____

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