

Unit 6 - Quadratic Functions - Study Guide



Important Vocabulary

standard form: $y = ax^2 + bx + c$
 leading coefficient: the "a" in standard form
 roots/zeros/x-intercepts/solutions: the x-values of the x-intercepts, when $y = 0$
 vertex: the turning point of the parabola: max/min
 y-intercept: the point where the graph crosses the y-axis, when $x = 0$
 axis of symmetry: the x-value of the vertex; $x =$
 maximum: the highest y-value
 minimum: the lowest y-value
 concave up: vertex is a minimum
 concave down: vertex is a maximum

Graphing on the TI-Nspire

In Graphing Scratchpad...

- **ADD A FUNCTION**
Press TAB, then \uparrow or \downarrow to change between functions
- **CHANGE WINDOW**
Pick #'s: MENU \rightarrow 4 \rightarrow 1
ZOOM FIT: MENU \rightarrow 4 \rightarrow A

Simplifying Radicals

1. Find the BIGGEST perfect square factor
2. Write as the product of 2 radicals
(make sure the perfect square is first)
3. Evaluate the perfect square

Perfect Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, ...

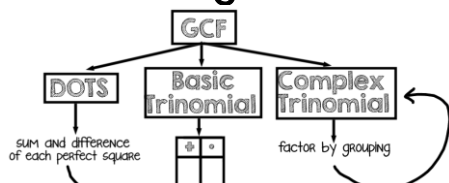
EXAMPLE: Simplify $x = 3\sqrt{48}$

$$x = 3 \cdot \sqrt{16} \cdot \sqrt{3}$$

$$x = 3 \cdot 4 \cdot \sqrt{3}$$

$$x = 12\sqrt{3}$$

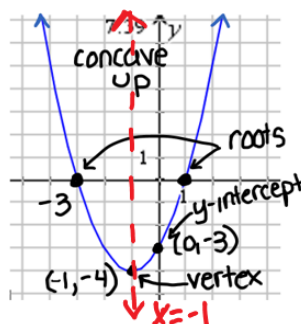
Factoring REVIEW



REPEAT UNTIL FACTORED COMPLETELY

Different Forms of a Parabola

FORM	TELLS US	EXAMPLE
Standard Form	ax^2 • Opens: UP: a is + DOWN: a is - • NARROW: $a > 1$ WIDE: $0 < a < 1$ • y-intercept: is the CONSTANT	$y = x^2 + 2x - 3$ \Rightarrow opens up b/c x^2 is positive \Rightarrow y-intercept at $(0, -3)$
Vertex Form	$a(x - h)^2 + k$ • Opens: UP: a is + DOWN: a is - • NARROW: $a > 1$ WIDE: $0 < a < 1$ • Vertex: $(-h, k)$ h is always OPPOSITE SIGN	$y = (x + 1)^2 - 4$ \Rightarrow opens up b/c number in front of parenthesis is positive \Rightarrow vertex: $(-1, -4)$
Factored Form	• roots/zeros set each factor = 0	$y = (x - 1)(x + 3)$ \Rightarrow roots at $x = 1$ and $x = -3$



The SAME function written 3 different ways!

$$y = x^2 + 2x - 3$$

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

$$y = (x - 1)(x + 3)$$

axis of symmetry: $x = -\frac{b}{2a}$
 the x-value of the vertex: $x =$

Completing the Square

- GOAL: Write in vertex form (or solve...found on back)
- Just re-writing: it should always be the SAME equation from start to end

EXAMPLE #1

$$y = x^2 - 8x + 22$$

$$y = x^2 - 8x + 22$$

$$y = x^2 - 8x + 16 - 16 + 22$$

$$y = (x - 4)^2 + 6$$

$$y = x^2 - 8x + 22$$

is the same as

$$y = (x - 4)^2 + 6$$

EXAMPLE #2

$$0 = -2x^2 + 20x - 61$$

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$$0 = -2(x^2 - 10x + 25) + 50 - 61$$

$$0 = -2(x - 5)^2 - 11$$

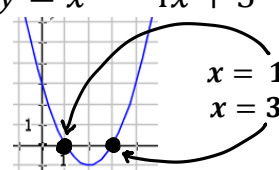
$$0 = -2(x - 5)^2 - 11$$

$$0 = -2x^2 + 20x - 61$$

is the same as

$$0 = -2(x - 5)^2 - 11$$

Solving Quadratic Equations ~ Finding Roots/Zeros

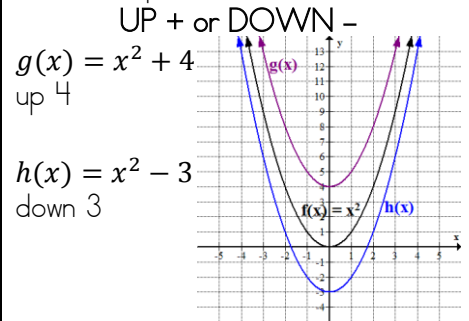
	Steps	Examples
Graphically	Graph to find the x-intercepts/roots ***Using the TI-Nspire: MENU→6→1 Do this for EVERY root	$y = x^2 - 4x + 3$ 
Factoring	1. Factor 2. Set each factor = 0 3. Solve to find roots	$y = x^2 + 7x - 18$ $0 = x^2 + 7x - 18$ $0 = (x + 9)(x - 2)$ $0 = x + 9 \quad 0 = x - 2$ $x = -9 \quad x = 2$ SET = 0!!!
Inverse Operations	1. Move constant to other side 2. Take square root of both sides (±!!!!) ***use when there isn't a "bx" term	$y = x^2 - 25$ $0 = x^2 - 25$ $25 = x^2$ $x = \sqrt{25}$ $x = \pm 5$ so... $x = -5$ and $x = 5$ SET = 0!!!
Completing the Square	1. Write in vertex form 2. Move constant to other side 3. Take square root of both sides 4. Spit into 2 equations 5. Solve ***use only if you CAN'T factor & when "b" is EVEN	$y = x^2 + 6x - 1$ $0 = x^2 + 6x - 1$ $0 = x^2 + 6x + 9 - 9 - 1$ $0 = (x + 3)^2 - 10$ $\pm\sqrt{10} = x + 3$ $x + 3 = +\sqrt{10} \quad x + 3 = -\sqrt{10}$ $x = -3 + \sqrt{10} \quad x = -3 - \sqrt{10}$ (in simplest radical form) SET = 0!!!
Quadratic Formula	1. Identify a, b and c 2. Substitute and solve ***use only if you CAN'T factor and when "b" is ODD ***Using the TI-Nspire: MENU→3→3	$y = x^2 + 4x - 3$ $0 = x^2 + 4x - 3$ $a = 1 \quad b = 4 \quad c = -3$ $x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-3)}}{2(1)}$ $x = -2 + \frac{\sqrt{28}}{2} \quad x = -2 - \frac{\sqrt{28}}{2}$ $x = 0.6 \quad x = -4.6$ (rounded to the nearest tenth) SET = 0!!!

Solving: Linear versus Quadratic

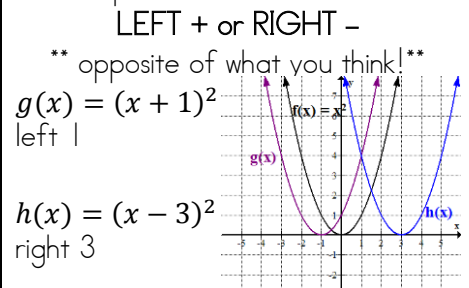
Linear: get x alone	Quadratic: set = 0
$5x - 8 + 3x = 6(x - 1)$ $5x - 8 + 3x = 6x - 6$ $5x + 3x - 6x = 8 - 6$ $-1x = 2$ $x = -2$	$x^2 - 7 = x + 5$ $x^2 - x - 7 - 5 = 0$ $x^2 - x - 12 = 0$ $(x - 4)(x + 3) = 0$ $x - 4 = 0 \quad x + 3 = 0$ $x = 4 \quad x = -3$

Transforming Parabolas

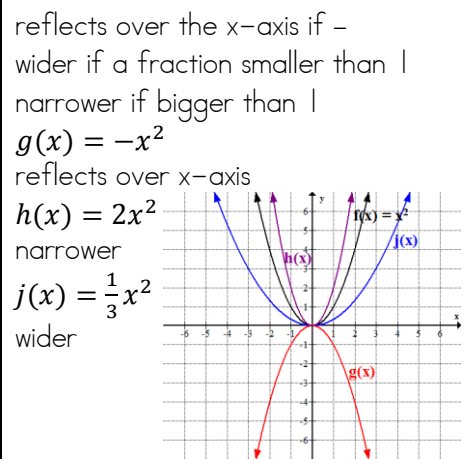
OUTSIDE parenthesis (constant):



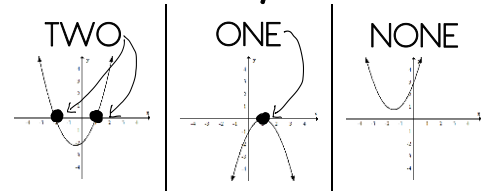
INSIDE parenthesis



IN FRONT



How many roots?



Quadratic Formula

In the quadratic $0 = ax^2 + bx + c$, the roots can be found using...

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Quadratic Word Problems Tips: always define variables and make sure the answer makes sense!