

## Lesson 4 – Graphs of Quadratic Functions – Student Version

Math SL1 - Santowski

### BIG PICTURE

- Each type of function that we will be studying in this course will have some **features common** with other types of functions BUT will also have some features **unique** to itself
- Sometimes the same function type can be written in a **variety of different forms**. WHY?
- Is there a **connection** between the form that the **equation** is written in and some of the key features of the **graphs**????

8/14/2010

Math SL1 - Santowski

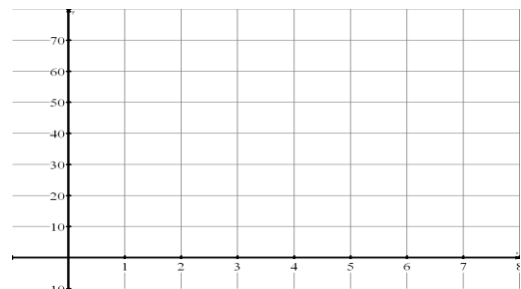
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### (A) Context for Quadratic Relations

- If a projectile has an initial velocity of 34.3 m/s and is launched 2.1 m above the ground, graphically determine:
  - the time at which the projectile reaches the maximum height
  - the maximum height reached by the projectile
  - Evaluate and interpret  $h(2)$
  - Solve and interpret  $12 = h(t)$
  - State the domain and range of the relation and explain WHY
  - The x-intercepts and their significance
  - The total time of flight of the projectile

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### (A) Context for Quadratic Relations

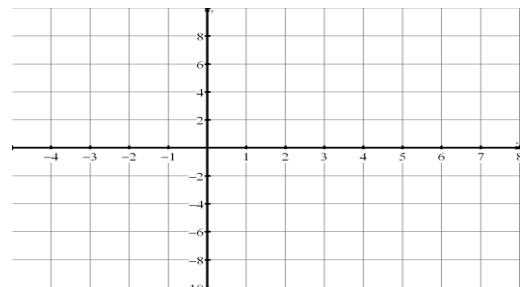


### (B) Graphic Analysis of Parabolas – Standard form Quadratic Equations

- Graph the parabola  $f(x) = -x^2 + 4x + 5$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
- Domain and Range,
- Y-intercept(s), X-intercepts (AKA roots, zeroes),
- extrema (AKA maximum, minimum, Vertex),
- Direction of opening,
- Axis of symmetry,
- Intervals of increase/decrease

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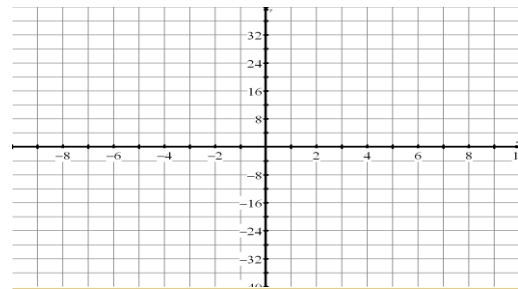
$$f(x) = -x^2 + 4x + 5$$



### (B) Graphic Analysis of Parabolas – Standard form Quadratic Equations

- Graph the parabola  $f(x) = 2x^2 + 8x - 24$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
- Domain and Range,
- Y-intercept(s), X-intercepts (AKA roots, zeroes),
- extrema (AKA maximum, minimum, Vertex),
- Direction of opening,
- Axis of symmetry,
- Intervals of increase/decrease

$$f(x) = 2x^2 + 8x - 24$$



### (B) Graphic Analysis of Parabolas – Standard form Quadratic Equations

- Given the various features that you have seen in the graphs and listed in your analysis, is there an easy/apparent connection between the equation  $f(x) = ax^2 + bx + c$  and:
- The equation and the y-intercept
- The equation and the axis of symmetry
- The eqn and intervals of inc/dec
- The equation and the vertex
- The equation and the range
- The equation and the direction of opening
- The equation and the concavity

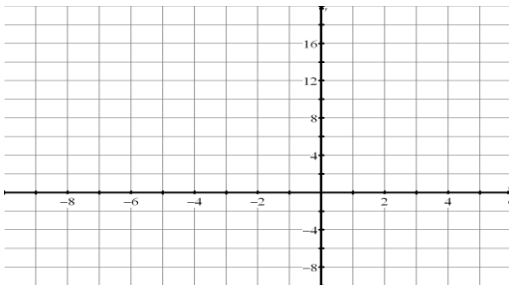
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### (C) Graphic Analysis of Parabolas - Vertex Form of Quadratic Equations

- Graph the parabola  $f(x) = 2(x + 3)^2 - 8$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
- Domain and Range,
- Y-intercept(s), X-intercepts (AKA roots, zeroes),
- extrema (AKA maximum, minimum, Vertex),
- Direction of opening,
- Axis of symmetry,
- Intervals of increase/decrease

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$$f(x) = 2(x + 3)^2 - 8$$

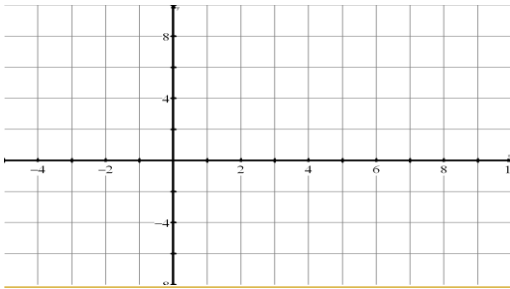


### (C) Graphic Analysis of Parabolas - Vertex Form of Quadratic Equations

- Graph the parabola  $f(x) = -\frac{1}{2}(x - 5)^2 + 8$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
- Domain and Range,
- Y-intercept(s), X-intercepts (AKA roots, zeroes),
- extrema (AKA maximum, minimum, Vertex),
- Direction of opening,
- Axis of symmetry,
- Intervals of increase/decrease

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$$f(x) = -\frac{1}{2}(x - 5)^2 + 8$$



### (B) Graphic Analysis of Parabolas – Standard form Quadratic Equations

- Given the various features that you have seen in the graphs and listed in your analysis, is there an easy/apparent connection between the equation  $f(x) = a(x - k)^2 + h$  and:
  - The equation and the y-intercept
  - The equation and the axis of symmetry
  - The eqn and intervals of increase/decrease
  - The equation and the vertex
  - The equation and the range
  - The equation and the direction of opening
  - The equation and the concavity

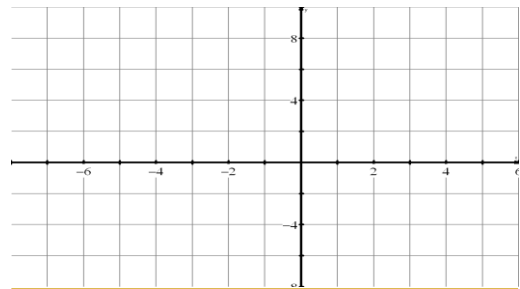
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### (C) Graphic Analysis of Parabolas - Factored Form of Quadratic Equations

- Graph the parabola  $f(x) = -\frac{1}{2}(x + 4)(x - 2)$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
  - Domain and Range,
  - Y-intercept(s), X-intercepts (AKA roots, zeroes),
  - extrema (AKA maximum, minimum, Vertex),
  - Direction of opening,
  - Axis of symmetry,
  - Intervals of increase/decrease

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$$f(x) = -\frac{1}{2}(x + 4)(x - 2)$$

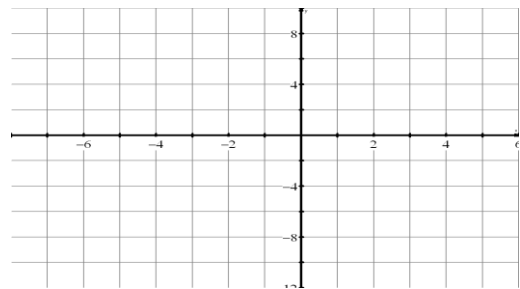


### (C) Graphic Analysis of Parabolas - Factored Form of Quadratic Equations

- Graph the parabola  $f(x) = 3(x - \frac{1}{2})(x + 3.5)$  and provide a complete graphical analysis of the parabola. Use your TI-84 to graph and analyze the parabola
  - Domain and Range,
  - Y-intercept(s), X-intercepts (AKA roots, zeroes),
  - extrema (AKA maximum, minimum, Vertex),
  - Direction of opening,
  - Axis of symmetry,
  - Intervals of increase/decrease

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$$f(x) = 3(x - \frac{1}{2})(x + 3.5)$$



### (C) Graphic Analysis of Parabolas - Factored Form of Quadratic Equations

- Given the various features that you have seen in the graphs and listed in your analysis, is there an easy/apparent connection between the equation  $f(x) = a(x - r_1)(x - r_2)$  and:
  - The equation and the y-intercept
  - The equation and the roots/zeroes
  - The equation and the axis of symmetry
  - The eqn and intervals of increase/decrease
  - The equation and the vertex
  - The equation and the range
  - The equation and the direction of opening
  - The equation and the concavity