**Algebra 3-4**

**Unit 4: Quadratic Functions**

Designer(s): OPS Secondary Math Department Grade Level: Algebra 3-4, 2013

Quadratic Functions

A parabola is a graph of a quadratic function. It is a two dimensional, mirror-symmetrical curve, which is approximately U-shaped and can be in any orientation in its plane.

Parabolas can be seen all over the place. You can find them in the designs of buildings, microphones, automobile headlights, satellite dishes, tlelscopes and in design of planes and missiles.

Parabolas are frequently used in calculations in physics and engineering.

Unit Overview

|  |  |  |
| --- | --- | --- |
| **Unit 4: Quadratic Functions** | | |
| **Essential Questions** | **Standard** | **Objectives**  F= Factual C=Conceptual D=Debatable |
| 1. What are the advantages of a quadratic function in vertex form? In standard form? | MA 12.3.1.e | * Students will identify the vertex, line of symmetry, maximum or minimum, domain, range, and translations of a quadratic function. (C) * Students will graph quadratic functions with and without graphing calculators. (C) * Students will use quadratic functions as models. (C) |
| 1. How is any quadratic functions related to the parent quadratic function,? | MA 12.3.1.e | * Students will graph transformations of the parent quadratic function . (C) * Students will compare translations to the parent quadratic function. (F) |
| 1. How are the real solutions of a quadratic equation related to the graph of the quadratic function? | MA 12.3.1.e  MA 12.1.1.b | * Students will identify the x-intercepts of the graphs of related quadratic functions. (C) |

**Unit 4: Quadratic Functions**

**Critical Content and Skills:**

|  |  |
| --- | --- |
| *Knowledge Statements*  Students will know…   1. **Vocabulary**: Quadratic Function, Vertex Form, Parent Graph, Transformation, Standard Form, Axis of Symmetry, Vertex, Parabola, Domain, Range, Perfect Square Trinomial, Quadratic Formula, Zero of a Function, Discriminant, Imaginary Unit, Complex Number, Complex Conjugate. 2. **Tools to Solve:** Quadratic Formula, Factoring (Common monomials, Trinomials, Factor by grouping, Difference of squares), Completing the Square. 3. **Graphing:** Standard and Vertex form. 4. **Complex Numbers:** Imaginary unit = , , . | *Key Skill Statements*  Students will know how to…   1. Find the characteristics of a quadratic.   Standard Form  Vertex Form  Opens  Leading Coefficient  Constant Term  *y*-intercept  *x*-intercept  *Vertex*   1. Solve Quadratics using various methods.   Finding Square Roots  Factoring  Complete the Square  Quadratic Formula   1. Sketch quadratics in standard/vertex form. 2. Write the equation of a quadratic given its characteristics. 3. Add, subtract, multiply and divide complex numbers. 4. Find the absolute value of a complex number. 5. Graph a complex number. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Algebra 3-4**  **Unit 4: Quadratic Functions** | | | |
| **Advanced**  **Score 4.0** | In addition to the Proficient (3.0) performance, makes ***indepth*** inferences and extended applications of what was learned, including connections to other experiences. | | * Apply knowledge of qaudratic functions in real life applications. * Apply solving methods to the falling object models NOT provided the equation. * Investigate the pattern that appears when the imaginary unit *i* is raised to successively higher powers. |
|  | **Proficient +**  **Score 3.5** | In addition to the complex ideas and processes (Proficient 3.0) performance, ***partial success*** at in-depth inferences and extended applications of what was learned, including connections to other experiences. | |
| **Proficient**  **Score 3.0** | ***No major*** errors or omissions regarding any of the information and simple (Basic, 2.0) or complex processes (Proficient, 3.0) that was explicitly taught. | | • Sketch the graph of any quadratic function.  • Find the solutions of a quadratic function by:  o Factoring   * Trinomial, a ≠ 1. * Multi-step factoring.   o Multi-Step Square Roots  o Completing the Square  o Quadratic Formula  • Write the equation of a quadratic function in various forms given its characteristics.  • Apply solving methods to the falling object models provided the equation.  • Divide complex numbers. |
|  | **Basic +**  **Score 2.5** | ***No major*** errors or omissions regarding any of the information and/or simpler details and processes (Basic, 2.0) and ***partial*** knowledge of the more complex ideas and processes (Proficient, 3.0) | |
| **Basic**  **Score 2.0** | ***No major*** errors or omissions regarding the simpler details and processes (Basic, 2.0), but ***major*** errors or omissions regarding the more complex ideas and processes (Proficient, 3.0). | | * Identify the characteristics of a quadratic function in vertex and standard form. * Convert from vertex form to standard form. * Find the solutions of a quadratic function by:   + Factoring     - Common monomial/GCF.     - Difference of two squares.     - Trinomial, a = 1.     - Factor by grouping.   + One-step Square Roots * Complete the square. * Graph a complex number. * Add/subtract/multiply complex numbers. * Find the absolute value of a complex number. |
| **Below Basic**  **Score 1.0** | A ***partial*** understanding of ***some*** of the simpler details and processes (Basic, 2.0), but ***major*** errors or omissions regarding the more complex ideas and processes. | | |
| **Failing**  **Score 0** | ***No*** evidence or ***insufficient*** evidence of student learning. | | |

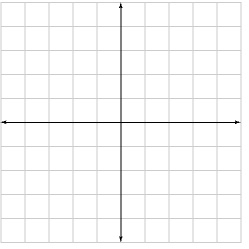
Algebra 3-4 Name

Pd Date

**Unit 4 Assessment**

Write answers in the blanks provided. Show all necessary work.

**ANSWERS**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. a. Vertex: \_\_\_\_\_\_\_\_\_\_\_\_

AoS: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Simplify **[L2]** 2. Simplify: **[L2]**

3. Simplify:  **[L2]** 4. Simplify: **[L2]**

5. Divide: . **[L3]**

6. Graph and label the points on the graph provided **[L2]**:

A.

B.

C.

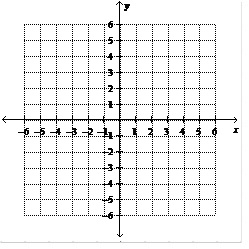
7. What steps transform the graph of to ? **[L2]**

|  |  |
| --- | --- |
| a. | translate 3 units to the right, translate down 5 units |
| b. | translate 3 units to the left, translate up 5 units |
| c. | reflect across the x-axis, translate 3 units to the left, translate up 5 units |
| d. | reflect across the x-axis, translate 3 units to the right, translate down 5 units |

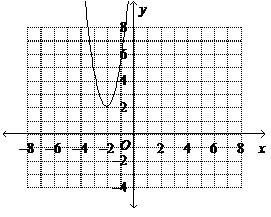
8.

1. Identify the vertex and the axis of symmetry of the graph of the function. **[L2]**

b. How is the graph of a translation of ? **[L2]**

 c. Graph the function. **[L3]**

9. Use the vertex form to write the equation of the parabola pictured below. **[L3]**



**ANSWERS**

1. a. Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_

AoS: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

b.

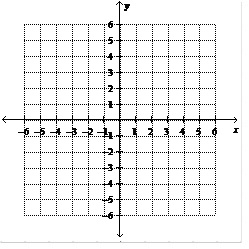
1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10.

a. Identify the vertex and the axis of symmetry of the graph of the function. **[L2]**

b. Graph the function. .**[L3]**

11. The function models the height *y,* in feet, of your pet frog's jump, where *x* is the horizontal distance, in feet, from the start of the jump. How high did the frog jump? How far did the frog jump? Round your answer to the nearest hundredth. **[L4]**

12. Complete the square: **[L2]**

13. Solve: **[L2]** 14. Solve: **[L2]**

15. Solve: **[L2]** 16. Solve: **[L3]**

17. Solve: **[L3]**18. Solve: [**L3]**

19. Suppose you cut a square into two rectangles as shown below. Write an expression for the area of the square. **[L4]**

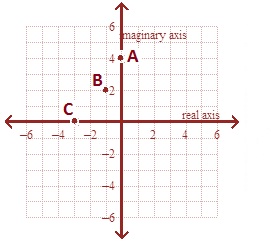
20. The function models the height *y* in feet of a stone *t* seconds after it is dropped from the edge of a vertical cliff. How long will it take the stone to hit the ground? Round to the nearest hundredth of a second. **[L3]**

Algebra 3 Name

Pd Date

**Unit 4 Assessment**

**ANSWERS**

1. 
2. C
3. a. Vertex: (–3, 4)

AoS: x = –3

b. up 4 unit(s) left 3 unit(s)

c.

Write answers in the blanks provided. Show all necessary work.

1. Simplify **[L2]** 2. Simplify: **[L2]**

3. Simplify:  **[L2]** 4. Simplify: **[L2]**

5. Divide: . **[L3]**

6. Graph and label the points on the graph provided **[L2]**:

A.

B.

C.

7. What steps transform the graph of to ? **[L2]**

|  |  |
| --- | --- |
| a. | translate 3 units to the right, translate down 5 units |
| b. | translate 3 units to the left, translate up 5 units |
| c. | reflect across the x-axis, translate 3 units to the left, translate up 5 units |
| d. | reflect across the x-axis, translate 3 units to the right, translate down 5 units |

8.

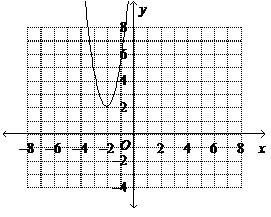
1. Identify the vertex and the axis of symmetry of the graph of the function. **[L2]**

b. How is the graph of a translation of ? **[L2]**

c. Graph the function. **[L3]**



9. Use the vertex form to write the equation of the parabola pictured below. **[L3]**



10.

**ANSWERS**

1. a. Vertex: ( 1, 4)

AoS: x = 1

b.

1. Height of 3.15 ft

Distance of 22.92 ft

1. 81
2. x = –6, x = –8
3. x = 0, x =
4. x = , x =
5. x = 4, x = –2
7. 5.51 seconds

a. Identify the vertex and the axis of symmetry of the graph of the function. **[L2]**



1. Graph the function. .**[L3]**

11. The function models the height *y,* in feet, of your pet frog's jump, where *x* is the horizontal distance, in feet, from the start of the jump. How high did the frog jump? How far did the frog jump? Round your answer to the nearest hundredth. **[L4]**

12. Complete the square: **[L2]**

13. Solve: **[L2]** 14. Solve: **[L2]**

15. Solve: **[L2]** 16. Solve: **[L3]**

17. Solve: **[L3]**18. Solve: [**L3]**

19. Suppose you cut a square into two rectangles as shown below. Write an expression for the area of the square. **[L4]**

20. The function models the height *y* in feet of a stone *t* seconds after it is dropped from the edge of a vertical cliff. How long will it take the stone to hit the ground? Round to the nearest hundredth of a second. **[L3]**

|  |  |
| --- | --- |
| **Learning Experiences** | **Text Pages/Resources** |
| **Vocabulary**   * Word wall * Foldable – See Glencoe @2010 Foldables by Dinah Zike for more information * Matching the word to the definition, graph, or example * Anticipation guide (pre and post) |  |
| * **Lessons Resources at the end of each section.** * **Online resources at pearsonsuccessnet.com** | Pearson Algebra 2  4.1  4.2  4.4  4.5  4.6  4.7  4.8 |
| **General:**  **Test-Taking Strategy**  Be sure to check the reasonableness of your answer. If students are asked for the balance of a bank account where you were dealing with amounts in the hundreds, it is not reasonable to give an answer in the millions. To make sure the answer to a problem is reasonable, you can estimate before you calculate. If the answer is close to your estimate, your answer is probably correct. |  |

**Teacher Notes/Additional Resources**

**General Algebra & Math sites:**

* AlgebraLAB: Making Math & Science Connections [www.algebralab.org](http://www.algebralab.org)
* Classzone from Holt McDougall’s free site includes really cool animations. You and your students will simply need to figure out which chapter in their book relates to what we’re studying. <http://www.classzone.com/cz/books/algebra_1_2011_na/book_home.htm?state=NE>
* Kuta software <http://www.kutasoftware.com> Excellent free worksheets (with answers) <http://www.kutasoftware.com/free.html>
* NCTM’s Figure This! Web site has several challenge problems that are designed for families to do together. <http://figurethis.org/download.htm> These challenges (there are 80 of them!) could be used for daily warm-ups in class (several involve estimation), weekly Problem-of-the-Week, and even a challenge problem along with their homework, if relevant.
* Math is Fun! Includes an illustrated math dictionary and helpful tutorials for students. [www.mathisfun.com](http://www.mathisfun.com)
* Daily Math Review <http://www.aea11.k12.ia.us/E2T2/dmr.html>
* Great online timer: <http://www.online-stopwatch.com>
* Porta Portal’s consolidated resource list <http://guest.portaportal.com/mrburke>
* Algebra2Go <http://www.saddleback.edu/faculty/lperez/algebra2go/index.html>
* About.com Education site has great warm ups <http://712educators.about.com/cs/warmups/l/blwarmmath.htm>
* Southern Regional Education Boards Instructional Resources <http://www.evalutech.sreb.org/InstResources/index.asp>

**Books:**

* Various resources provided by publishers for the book selection process

**Videos:**

* BrainPop [www.brainpop.com](http://www.brainpop.com)
* Teacher Tube [www.teachertube.com](http://www.teachertube.com)