

# learning focus:

- ✓ write and graph quadratic functions and identify key attributes
- ✓ find domain and range of quadratic functions
- ✓ determine the effects on the graph of the parent function  $f(x) = x^2$

# QUADRATIC FUNCTIONS UNIT

## 11 DAY TEKS-ALIGNED UNIT



### QUADRATIC FUNCTIONS PACING GUIDE

DAY 1	DAY 2	DAY 3	DAY 4
Attributes of Quadratics I Student Handout 1 Homework 1	Attributes of Quadratics II	Domain and Range of Quadratic Functions	Quiz: Attributes of Quadratic Functions
DAY 6	DAY 7	DAY 8	DAY 9
Dilations of Quadratic Functions Student Handout 5 Homework 5	Translations of Quadratic Functions	Translations of Quadratic Functions	Translations of Quadratic Functions
DAY 11	DAY 10	DAY 10	DAY 10
Quadratic Functions Unit Test	Test	Test	Test

### QUADRATIC FUNCTIONS UNIT Table of Contents

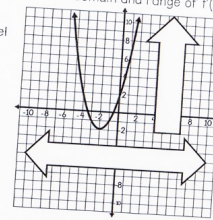
TOPIC	RESOURCE
Sample Pacing Guide	
Ideas For Implementation and Helpful Hints	
Binder Covers, Dividers and Spine Labels	Student Handout 1
5 Attributes of Quadratic Functions I	Homework 1
18 Attributes of Quadratic Functions I	Student Handout 2
20 Attributes of Quadratic Functions II	Homework 2
22 Attributes of Quadratic Functions II	Student Handout 3
23-24 Domain and Range of Quadratic Functions	Homework 3
25-26 Domain and Range of Quadratic Functions	Quiz 1
27-28 Quiz: Attributes of Quadratic Functions	Student Handout 4
29-30 Translations of Quadratic Functions	Homework 4
31-32 Translations of Quadratic Functions	Student Handout 5
33-34 Dilations of Quadratic Functions	Homework 5
35-36 Dilations of Quadratic Functions	Student Handout 6
37-38 Dilations of Quadratic Functions	Homework 6

### DOMAIN AND RANGE OF QUADRATIC FUNCTIONS

For the function  $f(x) = x^2 + 4x + 2$ , she wants to determine the domain and range of  $f(x)$ .

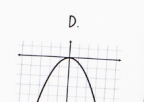
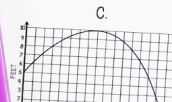
the meaning of "domain." Label the domain.

the meaning of "range." Label the range.



also determine domain and

that has a domain of all real numbers.



# QUADRATIC FUNCTIONS



an 11 day TEKS-aligned unit

TEKS: A.6A, A.6B, A.7A, A.7C, A.8B

ready-to-go, scaffolded  
student materials

## QUADRATIC FUNCTIONS UNIT

### Table of Contents

PAGE	TOPIC	RESOURCE
4	Sample Pacing Guide	
5-6	Ideas for Implementation and Helpful Hints	
7-15	Binder Covers, Dividers and Spine Labels	
17-18	Attributes of Quadratic Functions I	Student Handout 1
19-20	Attributes of Quadratic Functions I	Homework 1
21-22	Attributes of Quadratic Functions II	Student Handout 2
23-24	Attributes of Quadratic Functions II	Homework 2
25-26	Domain and Range of Quadratic Functions	Student Handout 3
27-28	Domain and Range of Quadratic Functions	Homework 3
29-30	Quiz: Attributes of Quadratic Functions	Quiz 1
31-32	Translations of Quadratic Functions	Student Handout 4
33-34	Translations of Quadratic Functions	Homework 4
35-36	Dilations of Quadratic Functions	Student Handout 5
37-38	Dilations of Quadratic Functions	Homework 5
39-40	Quadratic Equations and Vertex Form	Student Handout 6
41-42	Quadratic Equations and Vertex Form	Homework 6
43-44	Quiz: Transforming Quadratics and Vertex Form	Quiz 2
45-46	Quadratic Functions and Data	Student Handout 7
47	Quadratic Functions and Data	Homework 7
49-52	Quadratic Functions Study Guide	Review
53-55	Quadratic Functions Unit Test	Test

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# QUADRATIC FUNCTIONS



an 11 day TEKS-aligned unit

TEKS: A.6A, A.6B, A.7A, A.7C, A.8B

## student friendly + real-world application

graphic organizers

Unit: Quadratic Functions  
Student Handout 4

Name \_\_\_\_\_  
Date \_\_\_\_\_ Pd \_\_\_\_\_

### TRANSLATIONS OF QUADRATIC FUNCTIONS

A \_\_\_\_\_ function is the most basic function of a certain type. While the linear parent function is \_\_\_\_\_, the quadratic parent function is \_\_\_\_\_. Complete a-c to see how changes to the parent function will change the function's graph as well.

1. Complete the table for  $f(x)$  and graph it. Then repeat the steps for  $g(x)$  and  $h(x)$ .

x	$f(x) = x^2$	$g(x) = x^2 + 2$
-2		
-1		
0		
1		
2		

a. Describe how the equation and the graph of  $g(x)$  compare to  $f(x)$ .

b. Describe how the equation and the graph of  $h(x)$  compare to  $f(x)$ .

Summarize your findings by completing the table below.

Transformation	Effect on Graph
Vertical Translations	<ul style="list-style-type: none"> <li>If <math>f(x) = x^2</math>, then <math>g(x) = x^2 + d</math> shifts the graph up <math>d</math> units.</li> <li>If <math>d &gt; 0</math>, <math>f(x)</math> shifts up.</li> <li>If <math>d &lt; 0</math>, <math>f(x)</math> shifts down.</li> </ul>
Horizontal Translations	<ul style="list-style-type: none"> <li>If <math>f(x) = x^2</math>, then <math>g(x) = (x - h)^2</math> shifts the graph right <math>h</math> units.</li> <li>If <math>h &gt; 0</math>, <math>f(x)</math> shifts right.</li> <li>If <math>h &lt; 0</math>, <math>f(x)</math> shifts left.</li> </ul>

2. Lorenzo translated  $f(x)$  to create  $m(x)$ .

The parent function  $f(x) = x^2$  is shown at the right. In a-b, observe how transforming a function using  $f(x - c)$  affects the graph of  $f(x)$ .

a. Enter the function  $p(x) = (x - 2)^2$  into your calculator. Sketch its graph at the right and describe how the equation and the graph compare to  $f(x)$ .

b. Predict how the graph of  $r(x) = (x + 3)^2$  compares to  $f(x)$ . Use your graphing calculator and sketch the graph.

Unit: Quadratic Functions  
Homework 4

Name \_\_\_\_\_  
Date \_\_\_\_\_ Pd \_\_\_\_\_

### TRANSLATIONS OF QUADRATIC FUNCTIONS

Representations A-E show a transformation of the parent function  $f(x) = x^2$ . Use the representations to mark each statement in the table as true or false. Justify your choices.

**A**

**B**

$b(x) = (x + 4)^2$

**C**

$c(x) = x^2 - 8.5$

**D**

$d(x) = (x - 1.5)^2$

**E**

STATEMENT	T/F?	JUSTIFY
1. Function $a(x)$ can be represented by $a(x) = x^2 - 3$ .		
2. Function $b(x)$ represents a vertical shift 4 units up.		
3. Function $c(x)$ will have the same axis of symmetry as the parent function.		
4. Function $d(x)$ will not have the same range as the parent function $f(x)$ .		
5. Function $e(x)$ can be represented by $e(x) = x^2 + 3$ .		

Use your knowledge of translations to answer 6-10.

6. The graph of  $f(x) = x^2$  was transformed to create  $g(x) = f(x) - 9$ . Which of the following represents the vertex of  $g(x)$ ?

a. (0, 9)  
b. (9, 0)  
c. (0, -9)  
d. (-9, 0)

7. Angel believes that a vertical shift of the parent function  $f(x) = x^2$  will always change the domain of the function. Do you agree or disagree? Explain.

error analysis



# QUADRATIC FUNCTIONS



an 11 day TEKS-aligned unit

TEKS: A.6A, A.6B, A.7A, A.7C, A.8B

streamline your planning process with unit overviews

QUADRATIC FUNCTIONS OVERVIEW	
STANDARD	
READINESS	SUPPORTING
<p><b>A.6A</b> determine domain and range of quadratic functions and represent using inequalities</p> <p><b>A.7A</b> graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercept, y-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry</p> <p><b>A.7C</b> determine the effects on the graph of the parent function <math>f(x) = x^2</math> when <math>f(x)</math> is replaced by <math>af(x)</math>, <math>f(x) + d</math>, <math>f(x - c)</math>, <math>f(bx)</math> for specific values of <math>a</math>, <math>b</math>, <math>c</math>, and <math>d</math></p>	<p><b>A.6B</b> write equations of quadratic functions given the vertex and another point on the graph, write the equation in vertex form (<math>f(x) = a(x - h)^2 + k</math>), and rewrite the equation from vertex form to standard form (<math>f(x) = ax^2 + bx + c</math>)</p> <p><b>A.8B</b> write, using technology, quadratic functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems</p>

✓ key vocabulary

✓ vertical alignment

sample pacing calendar

### TEACHING IDEAS

- Quadratic functions form parabolic characteristics depending on the direction of the opening.
- The graphs of the quadratic are related to the original function.
- Vertex form is another way to write a quadratic equation.

### ESSENTIAL QUESTIONS

- How can attributes be used to identify a parabola?
- What are the real-world meanings of the vertex and x-intercepts?
- Which attributes are changeable?
- What advantages are there to using vertex form?

QUADRATIC FUNCTIONS PACING GUIDE				
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DAY 6	DAY 7			
Dilations of Quadratic Functions Student Handout 5 Homework 5	Quadratic Equations and Vertex Form Student Handout 6 Homework 6			
DAY 11				
Quadratic Functions Unit Test Test				

QUADRATIC FUNCTIONS OVERVIEW	
TOPIC	TEACHING TIPS
Attributes of Quadratics	<ul style="list-style-type: none"> <li>• Search desmos.com for "Polygraph: Parabolas" for a fun, interactive game that students can play. Students will try and correctly guess the parabola by asking yes or no questions about the attributes of the graph to narrow down their choices.</li> <li>• Reinforcing that a parabola with a negative a-value will always open down will be helpful when students transform quadratics later in the unit, specifically with reflections.</li> </ul>
Transformations of Quadratics	<ul style="list-style-type: none"> <li>• Desmos.com has a graphing calculator feature that can be especially helpful for demonstrating transformations to your class. You will be able to easily manipulate functions and see the effects on the graph in a way that is easy for students to observe.</li> <li>• Consider the following to help students grasp and practice transforming quadratics:                             <ul style="list-style-type: none"> <li>• Print a large copy of the parent function on a coordinate grid and laminate for each student.</li> <li>• Students can then use a dry erase marker to practice transformations easily.</li> <li>• Other than using dry erase markers, students could line up a pipe cleaner or wiki stix in the shape of the parent function and transform on the paper using their model. This would be especially helpful to establish the vocabulary of "compressing" and "stretching" both vertically and horizontally with dilations.</li> </ul> </li> </ul>
Vertex Form	<ul style="list-style-type: none"> <li>• Keeping track of all the variables in vertex form can be challenging. Have students form the habit of always labeling the x and y-values of the given point as well as "h" and "k" of the vertex to help them substitute the correct variables in the correct places of the formula.</li> <li>• Have students practice using and referencing their formula chart to find vertex form so they are familiar with it when it comes time for standardized testing.</li> </ul>
Quadratic Functions and Data	<ul style="list-style-type: none"> <li>• Students will need extra time on this topic to become familiar with entering data into a list on their graphing calculators and running a quadratic regression.</li> </ul>

teaching ideas

# QUADRATIC FUNCTIONS



an 11 day TEKS-aligned unit

TEKS: A.6A, A.6B, A.7A, A.7C, A.8B

## unit study guide + assessments

✓ quizzes

✓ editable unit test

Unit: Quadratic Functions  
Quiz 1

Name \_\_\_\_\_  
Date \_\_\_\_\_ Pd \_\_\_\_\_

### QUIZ: ATTRIBUTES OF QUADRATIC FUNCTIONS

Show all work and record your solutions in the box at the right.

1. Sketch the axis of symmetry on the quadratic function shown at the right. Then write the equation for the axis of symmetry in the answer bank.

Answers

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

2. Find the vertex of the function  $g(x) = -x^2 + 4x - 4$ .

3. What is the range of  $y = -x^2 + 8x - 14$ ?

a.  $y \leq 4$       b.  $y \leq 2$       c. all real numbers

Use graphs A-C to answer questions 4-6.

4. Which graph represents  $y = x^2 + 6x + 7$ ?

5. What is the vertex of the parabola  $y = x^2 - 4x + 4$ ?

a. -5      b. 6.5  
c. 8      d. -2

Unit: Quadratic Functions  
Review

Name \_\_\_\_\_  
Date \_\_\_\_\_ Pd \_\_\_\_\_

### QUADRATIC FUNCTIONS STUDY GUIDE

Solve each problem below. Be sure to ask questions if you need more help with a topic.

#### I CAN GRAPH QUADRATIC FUNCTIONS AND IDENTIFY KEY ATTRIBUTES. A.7A

1. Complete the table of values to create a graph of the quadratic function  $f(x) = x^2 - 10$ .

x	f(x)
-2	
-1	
0	
1	
2	

2. Use the graph to identify the features of the parabola.

3. Sketch a parabola that meets the following:

- negative "a" value
- vertex in quadrant II
- one positive and one negative zero

5. Harvey graphed  $y = -x^2 + 4x$  and said it has a minimum of 4. Is he correct?

#### I CAN DETERMINE THE DOMAIN AND RANGE OF QUADRATIC FUNCTIONS.

7. Find the domain and range of the quadratic function.

D: \_\_\_\_\_  
R: \_\_\_\_\_

ALGEBRA 1 CURRICULUM

# QUADRATIC FUNCTIONS

UNIT EIGHT: ANSWER KEYS

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answer keys included