Quadratic and Other Non-Linear Functions Chapter Questions

1. Describe the characteristics of a quadratic equation.

2. What are the steps for graphing a quadratic function in standard form? In vertex form? In intercept form?

3. How can you compare the maximum of two quadratic functions, written in standard form?
Quadratic and Other Non-Linear Functions Chapter Questions

Characteristics of Quadratic Functions in Standard Form

Class Work
Find the axis of symmetry, the vertex, and the y-intercept of each parabola. Graph the quadratic.

1. \( y = x^2 + 3x - 4 \)
2. \( y = x^2 - 5x + 6 \)
3. \( y = x^2 - 4x - 2 \)
4. \( y = 2x^2 + 6x + 3 \)
5. \( y = 3x^2 - 4x - 2 \)

Homework
Find the axis of symmetry, the vertex, and the y-intercept of each parabola. Graph the quadratic.

6. \( y = x^2 + 2x - 8 \)
7. \( y = x^2 - 3x + 2 \)
8. \( y = x^2 - 5x - 1 \)
9. \( y = 2x^2 + 5x + 4 \)
10. \( y = 3x^2 - 2x \)

Vertex and Intercept Form of Quadratic Functions

Class Work
Graph the quadratic.

11. \( y = -3(x - 5)^2 + 1 \)
12. \( y = (x - 7)(x + 3) \)
13. \( h(x) = 2(x + 4)(x - 6) \)
14. \( g(x) = 0.5(x - 1)^2 - 5 \)
15. \( y = -\frac{1}{3}(x + 6)^2 + 8 \)

Homework

16. \( f(x) = 1.5(x - 2)(x - 10) \)
17. \( g(x) = - (x + 6)^2 - 3 \)
18. \( y = (x - 4)^2 + 7 \)
19. \( h(x) = 2(x - 8)(x + 4) \)
20. \( y = -\frac{1}{2}(x + 3)(x + 9) \)
Transforming and Translating Quadratic Functions

Class Work
Without graphing, does the graph of the given equation open up or down? Is the graph wider or narrower than the parent equation of $y=x^2$? What is the x-intercept or y-intercept? What is the vertex?

21. $f(x) = 2x^2 + 3x - 4$
22. $h(x) = -5(x - 8)^2$
23. $y = -0.75x^2 - 4x + 3$
24. $h(x) = 6x - 7x^2 + 2x + 1$
25. $y = -1.2x^2 + 6$
26. $y = -\frac{3}{4}(x + 7)^2$
27. $y = \frac{7}{5}(x - 1)^2$
28. $g(x) = 3x^2 + 3x$
29. $f(x) = 0.3(x - 9)^2$
30. $y = -4x^2$

Homework
Without graphing, does the graph of the given equation open up or down? Is the graph wider or narrower than the parent equation of $y=x^2$? What is the x-intercept or y-intercept? What is the vertex?

31. $h(x) = 8(x - 2)^2$
32. $y = -\frac{9}{4}(x + 6)^2$
33. $f(x) = -0.6x^2 + 3x - 6$
34. $y = 4(x - 7)^2$
35. $y = 1.7x^2 - 4x + 5$
36. $y = -1.02x^2 + 8$
37. $f(x) = -2.3(x + 5)^2$
38. $g(x) = 1.3x^2 + 4x$
39. $y = 2 - 8x + 0.4x^2 + 3$
40. $y = 0.25x^2$
Comparisons of Types of Functions

Class Work

41. Answer the questions about the table of values and graph below.

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>-11</td>
<td>-7</td>
<td>-3</td>
<td>1</td>
</tr>
</tbody>
</table>

- a. Compare the y-intercepts of the functions.
- b. Compare the rate of change of the functions over the interval $0 \leq x \leq 1$.
- c. Compare the rate of change of the functions over the interval $1 \leq x \leq 2$.

42. Answer the questions about the graph and function below.

$h(x) = \frac{4}{5}x + 3$

- a. Compare the y-intercepts of the functions.
- b. Compare the rate of change over the interval $-1 \leq x \leq 0$.
- c. What is the domain and range of each function?

43. Answer the questions about the two functions below.

$g(x) = -2.5x^2 + 3x + 3$ \hspace{1cm} $f(x) = -0.3(x - 3)(x + 4)$

- a. Compare the maximum value of the functions.
- b. Compare $g(-3)$ and $f(-3)$. 
44. Answer the questions about the table and function below.

\[ g(x) = -4x + 7 \]

<table>
<thead>
<tr>
<th></th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>h(x)</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>27</td>
</tr>
</tbody>
</table>

a. Compare the y – intercepts of the functions.
b. Compare the rate of change over the interval \(-1 \leq x \leq 0\).
c. Compare the rate of change over the interval \(1 \leq x \leq 2\).

45. Answer the questions about the graph below.

a. Compare the y-intercepts of the functions.
b. Compare the rate of change of the functions over the interval \(-1 \leq x \leq 0\).
c. Compare the rate of change of the functions over the interval \(1 \leq x \leq 2\).

46. Answer the questions about the table of values and graph below.

<table>
<thead>
<tr>
<th></th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>g(x)</td>
<td>18</td>
<td>8</td>
<td>-2</td>
<td>-12</td>
</tr>
</tbody>
</table>

a. Compare the y-intercepts of the functions.
b. Compare the rate of change of the functions over the interval \(-1 \leq x \leq 1\).
c. What is the domain and range of the functions?
47. Answer the questions about the table of values and graph below.

\[ f(x) = -\frac{2}{3}x + 4 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>(-2)</th>
<th>(0)</th>
<th>(2)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h(x) )</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>

a. Compare the \( y \)-intercepts of the functions.
b. Compare the rate of change over the interval \(-1 \leq x \leq 0\).
c. What is the domain and range of each function?

48. Answer the questions about the two functions below.

\[ g(x) = 1.2(x - 3)^2 + 1 \quad f(x) = 2x^2 - 2x \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>(-3)</th>
<th>(-2)</th>
<th>(-1)</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

a. Compare the minimum value of the functions.
b. Compare \( g(5) \) and \( f(5) \).

c. Compare the rate of change over the interval \(-1 \leq x \leq 0\).

d. Compare the rate of change over the interval \(0 \leq x \leq 2\).
50. Answer the questions about the table of values and graph below.

a. Compare the y-intercepts of the functions.
b. Compare the rate of change of the functions over the interval $-1 \leq x \leq 0$.
c. Compare the rate of change of the functions over the interval $0 \leq x \leq 1$. 
Unit Review

Multiple Choice—Choose the correct answer for each question. No partial credit will be given.

1. Comparing the graph of \( y = 5x^2 + 4x - 2 \) to its parent function, it:
   A) opens down and is wider than the parent function graph.
   B) opens down and is narrower than the parent function graph.
   C) opens up and is wider than the parent function graph.
   D) opens up and is narrower than the parent function graph.

2. What is the equation of the axis of symmetry of \( y = -3x^2 - 12x - 5 \)?
   A) \( x = -2 \)
   B) \( x = -4 \)
   C) \( x = 4 \)
   D) \( x = 2 \)

3. What are the vertex and axis of symmetry of the parabola \( y = x^2 + 4x + 3 \)?
   A) vertex: (2, -1); axis of symmetry: \( x = 2 \)
   B) vertex: (2, 1); axis of symmetry: \( x = 2 \)
   C) vertex: (-2, -1); axis of symmetry: \( x = -2 \)
   D) vertex: (-2, 1); axis of symmetry: \( x = -2 \)

4. What is the \( y \)-intercept of \( y = -2x^2 + 2x - 3 \)?
   A) \((0, 5)\)
   B) \((3, 0)\)
   C) \((0, -3)\)
   D) \((-3, 0)\)

5. Which graph has more than one root?
6. What are the roots of \( f(x) = -4(x - 6)(x + 3) \)?
   A) \((0, 6)\) and \((0, -3)\)
   B) \((6, 0)\) and \((-3, 0)\)
   C) \((6, 0)\) and \((-3, 0)\)
   D) \((-6, 0)\) and \((3, 0)\)

7. The vertex of \( h(x) = 7(x + 2)^2 - 16 \) is
   A) \((-2, -16)\)
   B) \((7, 2)\)
   C) \((-2, 16)\)
   D) \((2, -16)\)

8. What is the x-intercept of \( y = -0.25(x - 4)^2 \)?
   A) \((-4, 0)\)
   B) \((-0.25, 0)\)
   C) \((0.25, 0)\)
   D) \((4, 0)\)

9. What is the axis of symmetry of \( g(x) = -1.5(x - 7)(x + 4) \)?
   A) \(-1.5\)
   B) \(-5.5\)
   C) \(1.5\)
   D) \(5.5\)

10. What is the minimum value of \( f(x) \) in the function below?
    \[ f(x) = 5x^2 - 4x + 7 \]
    A) \(0.4\)
    B) \(-0.4\)
    C) \(0.8\)
    D) \(6.2\)

11. Use the function and table of values below to answer #’s 11 and 12.
    \( g(x) = 4(2)^x \)

<table>
<thead>
<tr>
<th>x</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>h(x)</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

12. Compare the rate of change of the functions over the interval \(-1 \leq x \leq 0\).
    A) \( g(x) < h(x) \)
    B) \( g(x) > h(x) \)
    C) \( g(x) = h(x) \)

13. Compare the rate of change of the functions over the interval \(1 \leq x \leq 2\).
    A) \( g(x) < h(x) \)
    B) \( g(x) > h(x) \)
    C) \( g(x) = h(x) \)
Short Constructed Response – Write the correct answer for each question.

14. Which function has the greatest maximum value?
   \[ g(x) = -1.5x^2 + 3x - 2 \quad f(x) = -3(x + 1)(x - 5) \]

15. What is the vertex of \( y = (x - 7)(x+3) \)?

Use the graph below to answer #’s 15 and 16.

16. Compare the rate of change of the functions over the interval \( 0 \leq x \leq 2 \).

Extended Constructed Response - Solve the problem, showing all work.

17. Graph the functions below.
   \[ g(x) = -0.25x^2 + 1x + 12 \]
Quadratic Equations CW HW Answer Key

1. axis of sym. = -1.5 vertex (-1.5, -6.25); y-int. = -4
2. axis of sym. = 5/2; vertex (2.5, -.25); y-int. = 6
3. axis of sym. = 2; vertex (2, -6); y-int. = -2
4. axis of sym. = -3/2; vertex (-1.5, -1.5); y-int. = 3
5. axis of sym. = 2/3; vertex (2/3, -10/3); y-int. = -2
6. axis of sym. = -1; vertex (-1, -9); y-int. = -8
7. axis of sym. = 1.5; vertex (1.5, -0.25); y-int. = 2
8. axis of sym. = 2.5; vertex (2.5, -7.25); y-int. = -1
9. axis of sym. = -1.25; vertex (-1.25, .875); y-int. = 4
10. axis of sym. = 1/3; vertex (1/3, -1/3); y-int. = 0
19. Up; Narrower; y-int. = -4; vertex (-0.75, -5.125)

20. Down; Narrower; x-int. = 8; vertex (8, 0)

21. Down; Wide; y-int. = 3; vertex (-8/3, -25/3)

22. Down; Narrower; y-int. = 1; vertex (-4/7, -41/7)

23. Down; Narrower; y-int. = 6; vertex (0, 6)

24. Down; Wide; x-int. = -7; vertex (-7,0)

25. Up; Narrower; x-int. = 1; vertex (1,0)

26. Up; Narrower; y-int. = 0; vertex (-1/2, -3/4)

27. Up; Wide; x-int. = 9; vertex (9,0)

28. Down; Narrower; y-int. = 0; vertex (0,0)

29. Up; Narrower; x-int. = 2; vertex (2, 0)

30. Down; Narrower; x-int. = -6; vertex (-6, 0)

31. Down; Wide; y-int. = -6; vertex (2.5, -34.125)

32. Up; Narrower; x-int. = 7; vertex (7,0)

33. Up; Narrower; y-int. = 5; vertex (20/17, 45/17)

34. Down; Narrower; y-int. = 8; vertex (0, 8)

35. Down; Narrower; x-int. = -5; vertex (-5, 0)

36. Up; Narrower; y-int. = 0; vertex (-20/13, -40/13)

37. Up; Wide; y-int. = 5; vertex (0.025, 4.8)

38. Up; Wide; y-int. = 0; vertex (0, 0)

39. A) g(x) > f(x); B) g(x) < f(x); C) g(x) < f(x)

40. A) g(x) < h(x); B) g(x) > h(x); C) g(x): D→reals, R→reals, h(x): D→reals, R→[-1, ∞)
43. A) \( g(x) > f(x) \); B) \( g(x) < f(x) \)
44. A) \( g(x) > h(x) \); B) \( g(x) > h(x) \); C) \( g(x) < h(x) \)
45. A) \( h(x) < f(x) < g(x) \); B) \( g(x) < f(x) < h(x) \); C) \( g(x) < f(x) < h(x) \)
46. A) \( g(x) > h(x) \); B) \( g(x) > h(x) \); C) \( g(x) : D \rightarrow \text{reals, } R \rightarrow \text{reals}, h(x) : D \rightarrow \text{reals, } R \rightarrow [-4, \infty) \)
47. A) \( g(x) < f(x) \); B) \( g(x) < f(x) \); C) \( g(x) : D \rightarrow \text{reals, } R \rightarrow [5.5, \infty) ; f(x) : D \rightarrow \text{reals, } R \rightarrow \text{reals} \)
48. A) \( g(x) > f(x) \); B) \( g(x) < f(x) \)
49. A) \( h(x) > f(x) \); B) \( h(x) > f(x) \); C) \( h(x) > f(x) \)
50. A) \( f(x) < h(x) < g(x) \); B) \( g(x) < h(x) < f(x) \); C) \( g(x) < f(x) < h(x) \)

Review Answer Key

1. D
2. A
3. C
4. C
5. B, D
6. B
7. C
8. D
9. C
10. D
11. B
12. B
13. f(x)
14. (2, -25)
15. \( g(x) < h(x) < f(x) \)