Algebra 1 · Unit 7 Worksheet

Introduction to Quadratic Functions

Name: _____ Date: _____

Part A · Recognizing Quadratic Patterns

1. Three patterns:

a. Compute the FIRST differences for A and B (change in y at each step). What do you notice?

b. Now compute the SECOND differences for B. What do you find?

c. How can you tell a sequence is quadratic FROM A TABLE of values?

x	A (linear)	B (quadratic)	C (exponential)
0	5	0	1
1	8	1	3
2	11	4	9
3	14	9	27
4	17	16	81

Part B · Modeling with Quadratic Functions

2. A ball is thrown upward from a 5-ft platform with initial speed 32 ft/s. Its height after t seconds is $h(t) = -16t^2 + 32t + 5$.

a. What is h(0)? What does it mean?

---

b. Compute h(1) and h(2). What's happening to the ball between t = 1 and t = 2?

---

c. Find the TIME when the ball hits the ground (h = 0). Use the quadratic formula if needed — round to 0.01 sec.

---

d. What is the MAXIMUM HEIGHT of the ball? When does it occur?

---

e. What is a REASONABLE domain for this problem? (Hint: it's not all real numbers.)

Part C · Standard, Factored, and Vertex Forms

3. Consider three forms of the SAME function:

a. Verify that these three are equivalent. Show ONE algebraic step.

---

b. From the FACTORED form, what are the x-intercepts (zeros) of f? _____ and _____

c. From the VERTEX form, what is the vertex of f? _____

d. From the STANDARD form, what is the y-intercept? _____

e. ★ Each form reveals something different. What KEY FEATURE does each form give you immediately?

Standard: $f(x) = x^2 - 4x + 3$

Factored: $f(x) = (x - 1)(x - 3)$

Vertex: $f(x) = (x - 2)^2 - 1$

Part D · Graphing

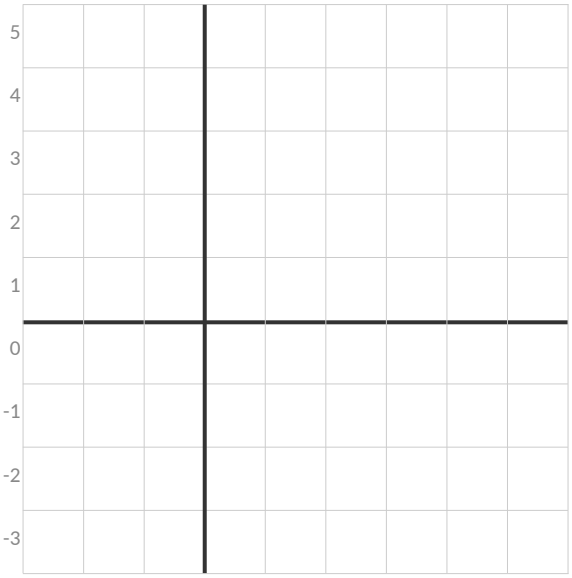
4. Sketch $g(x) = (x + 1)(x - 3)$ on the grid.

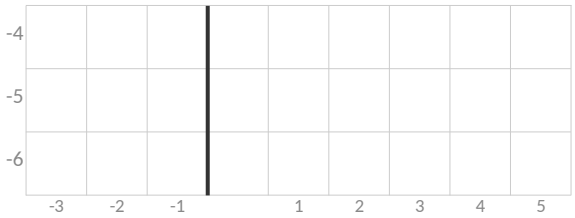
a. x-intercepts: _____ and _____

b. x-coordinate of vertex (HINT: midpoint of zeros): _____

c. y-coordinate of vertex (plug x into g): _____

d. y-intercept (g(0) = ?): _____





5. How does the graph of $f(x) = a \cdot x^2$ change as a varies? Sketch each on the same axes (rough sketch is fine).

a. $a = 1$ (the parent function)

---

b. $a = 3$

---

c. $a = 1/4$

---

d. $a = -1$

---

e. What does the SIGN of a control? What does the MAGNITUDE control?

Part E · Quadratic vs. Other Functions

6. A geometric pattern: at step n, an L-shape has $2n + 1$ squares in the base and n squares stacked on the side.

a. Find a formula for total squares at step n. (Simplify.)

---

b. Is the function linear, quadratic, or exponential? How can you tell from your formula?

---

c. What's the total at step 10? At step 100?

---

7. Eventually, exponential growth outpaces quadratic growth. Verify by computing for $f(x) = x^2$ and $g(x) = 2^x$:

x	$f(x) = x^2$	$g(x) = 2^x$
1		
5		
10		
20		

At what x does g overtake f for good? Approximate from your table.

Part F · Vertex Form and Transformations

8. Compare $f(x) = x^2$ with $g(x) = -2(x - 3)^2 + 4$.

a. Vertex of g: _____. Why?

---

b. Does g open UP or DOWN? Why?

---

c. Is g wider, narrower, or the same as f? Why?

---

d. Does g have a max or a min? What is the value?

e. Describe the transformations from f to g, IN ORDER.

Part G · Error Analysis

9. Two errors:

a. Andre simplified $(x + 3)^2 = x^2 + 9$. What's the correct expansion? Why is Andre's wrong?

b. Lin says: 'The vertex of $f(x) = (x - 5)^2 + 2$ is $(-5, 2)$ because it's the part inside the parentheses.' What's wrong with Lin's reasoning?

10. Open: A farmer has 100 feet of fencing to enclose a rectangular pen against a wall (only 3 sides of fencing needed).

a. Let the side perpendicular to the wall be x. Express the area A in terms of x.

b. What is the MAXIMUM area? At what x?

c. What is the realistic domain of x?

d. Sketch A(x). Where is its vertex? Vertex: _____