RLP-ALG1B · RLP Algebra 1B — Functions, Exponential and Quadratic Models

Unit 3: Introduction to Quadratic Functions

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 3.1 — A New Pattern: Area, Second Differences and Quadratic Growth

FLUENCY

1. If $f(x) = -x^2 + 4x + 3$, find $f(5)$.

2. If $f(x) = 2x^2 + 4x - 4$, find $f(-3)$.

3. If $f(x) = 3x^2 - 2x + 6$, find $f(4)$.

4. If $f(x) = -3x^2 - 6x - 1$, find $f(-1)$.

5. Find the first and second differences of $y = 2x^2 + 1$ for $x = 0$ to 4 (1, 3, 9, 19, 33).

6. A table has first differences 9, 7, 5, 3. What type of function is it likely to be, and what are the next two outputs if the last output is 30?

APPLICATION

7. A 60 m fence encloses a rectangular plot against a school wall (three sides fenced). Write the area as a function of the side x perpendicular to the wall and find the maximum area.

8. For $A(x) = x(20 - x)$, find $A(7)$ and explain why $A(13)$ is the same.

9. For whole numbers $n \geq 1$, after which n does 1.5^n stay above n^2 for good?

CHALLENGE

10. Show that among rectangles with perimeter P, the square has the greatest area, $P^2/16$. Check with P = 40.

REVIEW

11. A quantity starts at 15,000 and grows by 4% each year. Write a model and find its value after 15 years, to the nearest whole number.

12. Solve: $6x - 2 = -3x - 29$

Lesson 3.2 — Polynomial Arithmetic: Adding, Subtracting and Multiplying

FLUENCY

1. Multiply: $(x + 6)(-2x^2 - 3x - 3)$

2. Multiply: $(-3x + 2)(3x^2 - 4x + 1)$

3. Multiply: $(4x + 4)(-2x^2 - 6x + 5)$

4. Expand $(x + 4)(x - 6)$.

5. Expand $(2x - 3)^2$.

6. Expand $(x + 7)(x - 7)$.

7. Expand $(3x + 2)(x - 5)$.

8. Subtract: $(5x^2 - 2x + 1) - (2x^2 + 4x - 6)$.

APPLICATION

9. A garden plot measures $(x + 3)$ m by $(x + 5)$ m. Write its area as a polynomial and evaluate it for $x = 4$.

10. An 8 in by 10 in photo gets a frame of width w on every side. Write the total area as a polynomial.

11. Use a difference of squares to compute $51^2 - 49^2$ mentally.

CHALLENGE

12. Show that $(n + 1)^2 - n^2 = 2n + 1$ and use it to find $101^2 - 100^2$.

REVIEW

13. A geometric sequence has first term 6 and common ratio 1/2. Write an explicit formula, then find term 5 and the sum of the first 5 terms.

14. Evaluate exactly: $27^{4/3}$

Lesson 3.3 — Three Forms, One Parabola: Vertex Form and Transformations

FLUENCY

1. Complete the square to write $y = x^2 - 4x + 3$ in vertex form, and give the vertex.

2. Complete the square to write $y = x^2 + 6x + 14$ in vertex form, and give the vertex.

3. Complete the square to write $y = x^2 - 4x + 1$ in vertex form, and give the vertex.

4. Complete the square to write $y = x^2 - 4x - 3$ in vertex form, and give the vertex.

5. Give the vertex of $y = (x - 2)^2 + 3$ and describe the shift from $y = x^2$.

6. Describe $y = -(x + 4)^2$ compared with $y = x^2$.

7. Describe $y = 3x^2$ compared with $y = x^2$.

8. If $f(x) = x^2$, describe the graph of $f(x) - 5$.

APPLICATION

9. For $g(x) = 2(x - 3)^2 - 8$, give the vertex, the y-intercept, the x-intercepts and the factored form.

10. A parabola has vertex $(-2, 5)$ and passes through $(0, 1)$. Find its equation in vertex form.

11. Classify $f(x) = x^2 - 4$, $g(x) = x^3 - x$ and $h(x) = (x - 1)^2$ as even, odd or neither.

CHALLENGE

12. For $f(x) = x^2$, show that $f(2x) = 4f(x)$. Describe the graph of $y = f(2x)$ two ways.

REVIEW

13. A quantity starts at 1,200 and decreases by 2% each year. Write a model and find its value after 3 years, to the nearest whole number.

14. Find the inverse of $f(x) = -3x + 6$.

Lesson 3.4 — Falling Objects and Revenue: Quadratic Models in Context

FLUENCY

1. If $f(x) = 2x^2 - 5x + 3$, find $f(4)$.

2. If $f(x) = 3x^2 + 4x + 9$, find $f(3)$.

3. If $f(x) = 3x^2 + 3x + 7$, find $f(-2)$.

4. For $h(t) = -4.9t^2 + 19.6t + 1.5$, find h(1), h(2) and h(3).

5. For $R(p) = p(800 - 25p)$, find R(10) and R(22). Why are they equal?

6. Write $h(t) = 1.5 + 19.6t - 4.9t^2$ as a sum of a constant, a linear and a quadratic function, and say what each part means.

APPLICATION

7. A ball is thrown upward at 19.6 m/s from 1.5 m. Find its maximum height and when it lands, to the nearest hundredth of a second.

8. A student club's revenue is $R(p) = p(800 - 25p)$ dollars at price p (illustrative). Find the best price, the maximum revenue and the zeros.

9. A phone is dropped from 45 m. Using $h = 45 - 4.9t^2$, when does it land?

CHALLENGE

10. Find the average rate of change of $h(t) = -4.9t^2 + 19.6t + 1.5$ from $t = 0$ to $t = 4$ and explain the result.

REVIEW

11. Solve the system: $-4x - 5y = -44$ and $x + 3y = 18$

12. For the data 2, 10, 14, 21, 27, 32, 37, 38, 39, 40: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

Unit 3 checkpoint

1. First differences 19, 17, 15, 13 suggest a function that is…
   A. quadratic
   B. linear
   C. exponential
   D. constant
2. With 40 m of fence, the maximum rectangle area is _____ m^2.
3. Expand $(x + 3)(x - 5)$.
   A. $x^2 - 2x - 15$
   B. $x^2 - 15$
   C. $x^2 + 2x - 15$
   D. $x^2 - 8x - 15$
4. True or false: $(x + 5)^2 = x^2 + 25$.
5. True or false: The product of two polynomials is always a polynomial.
6. The vertex of $y = -2(x + 1)^2 + 8$ is…
   A. $(-1, 8)$
   B. $(1, 8)$
   C. $(8, -1)$
   D. $(-1, -8)$
7. Compared with $y = x^2$, $y = (x - 4)^2 + 1$ is moved…
   A. right 4, up 1
   B. left 4, up 1
   C. right 4, down 1
   D. left 4, down 1
8. $-2(x + 1)^2 + 8$ in factored form is $-2(x - 1)(x +$ _____$)$.

9. $h(t) = -4.9t^2 + 14.7t + 2$ reaches its maximum at $t =$ _____ s.

10. In $h(t) = -4.9t^2 + 14.7t + 2$, the 14.7 is…
    A. the initial upward speed
    B. the maximum height
    C. gravity
    D. the landing time

11. $R(p) = p(600 - 20p)$ is greatest at $p =$ _____.

12. True or false: $f(x) = x^2 + 5$ is an even function.

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