3 Chapter Review

FREQUENTLY ASKED Questions

Q: How do you determine the product of two binomials?

A: You can use algebra tiles or an area diagram, or you can multiply symbolically. All three strategies involve the distributive property.

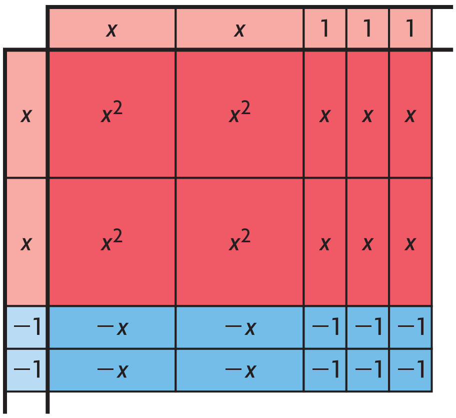
> **Study *Aid***
> - See Lesson 3.4, Examples 1 to 3.
> - Try Chapter Review Questions 13 to 15.

EXAMPLE

Expand and simplify $(2x + 3)(2x - 2)$.

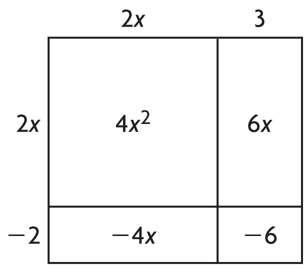
Solution

Using Algebra Tiles



$= 4x^2 - 4x + 6x - 6$
$= 4x^2 + 2x - 6$

Using an Area Diagram



$= 4x^2 - 4x + 6x - 6$
$= 4x^2 + 2x - 6$

Multiplying Symbolically

$(2x + 3)(2x - 2)$

$= 2x(2x - 2) + 3(2x - 2)$
$= 4x^2 - 4x + 6x - 6$
$= 4x^2 + 2x - 6$

Q: How can you determine whether a quadratic model can be used to represent data?

A1: Use the data to create a scatter plot, and draw a curve of good fit. Confirm that your curve of good fit is a parabola.

A2: Create a difference table to see if the second differences are approximately constant.

Q: How can you determine the equation of a parabola of good fit in standard form?

A: Use the data to create a scatter plot. Estimate the zeros of the parabola, and then write a general equation in factored form: $y = a(x - r)(x - s)$. Then substitute the coordinates of a point that is on, or very close to, the curve of good fit. Substitute the value you calculated for a into your equation. Expand and simplify your equation to write it in standard form: $y = ax^2 + bx + c$.

> **Study *Aid***
> - See Lesson 3.4, Example 4, and Lesson 3.5, Examples 1 to 3.
> - Try Chapter Review Questions 16 to 18.

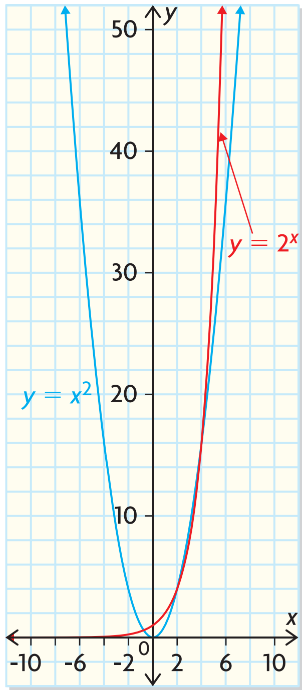
You can check the accuracy of your equation by comparing it with the equation determined using graphing technology and quadratic regression. (Note: This only works when the zeros of the curve of good fit can be estimated or determined.)

Study Aid

- See Lesson 3.6.

Q: How are $y = x^2$ and $y = 2^x$ different?

A: You can see the differences in their graphs.



- The graph of $y = x^2$ is a parabola with y-values that decrease and then increase as you move from left to right along the x-axis. The graph of $y = 2^x$ is a curve with y-values that always increase as you move from left to right along the x-axis.
- The graph of $y = x^2$ has a vertex and a minimum value of 0. The graph of $y = 2^x$ has no vertex. It approaches a minimum value of 0 but will never equal 0.
- The graph of $y = x^2$ has an x-intercept of 0 and a y-intercept of 0. The graph of $y = 2^x$ has no x-intercept and a y-intercept of 1.
- As x increases in the positive direction, the y-values for $y = 2^x$ increase much faster than the y-values for $y = x^2$.

Study Aid

- See Lesson 3.6.
- Try Chapter Review Questions 19 and 20.

Q: How do you evaluate a numerical expression that involves zero or negative exponents?

A: Any non-zero number raised to the exponent 0 equals 1: $a^0 = 1$ for $a \neq 0$.

Any non-zero number raised to a negative exponent equals the reciprocal of the number raised to the opposite exponent: $a^{-n} = \frac{1}{a^n}$ for $a \neq 0$.

EXAMPLE

Evaluate.

a) 4^0 **b)** 6^{-2}

Solution

a) $4^0 = 1$

b) $6^{-2} = \frac{1}{6^2}$
$= \frac{1}{36}$

PRACTICE Questions

Lesson 3.1

1. State whether each relation is quadratic. Justify your decision.

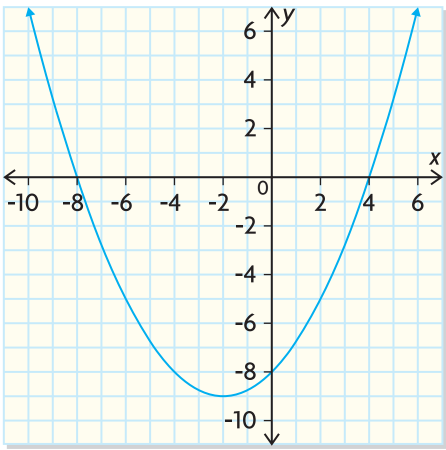
a) $y = 4x - 5$

b)

x	−3	−2	−1	0	1	2	3
y	56	35	18	5	−4	−9	−10

c) $y = 2x(x - 5)$

d)



2. Discuss how the graph of the quadratic relation $y = ax^2 + bx + c$ changes as a, b, and c are changed.

Lesson 3.2

3. Graph each quadratic relation and determine

i) the equation of the axis of symmetry

ii) the coordinates of the vertex

iii) the y-intercept

iv) the zeros

a) $y = x^2 - 8x$ **b)** $y = x^2 + 2x - 15$

4. Verify your results for question 3 using graphing technology.

5. The x-intercepts of a quadratic relation are −2 and 5, and the second differences are negative.

a) Is the y-value of the vertex a maximum value or a minimum value? Explain.

b) Is the y-value of the vertex positive or negative? Explain.

c) Calculate the x-coordinate of the vertex.

6. Create tables of values for three parabolas that go through the point (2, 7). How do you know that each table of values represents a parabola?

7. Use graphing technology to graph the parabola for each relation below. Then determine

i) the x-intercepts

ii) the equation of the axis of symmetry

iii) the coordinates of the vertex

a) $y = -x^2 + 18x$

b) $y = 6x^2 + 15x$

8. What does a in the equation $y = ax^2 + bx + c$ tell you about the parabola?

9. The Rudy Snow Company makes custom snowboards. The company's profit can be modelled with the relation $y = -6x^2 + 42x - 60$, where x is the number of snowboards sold (in thousands) and y is the profit (in hundreds of thousands of dollars).

a) How many snowboards does the company need to sell to break even?

b) How many snowboards does the company need to sell to maximize their profit?

Lesson 3.3

10. The x-intercepts of a parabola are −2 and 7, and the y-intercept is −28.

a) Determine an equation for the parabola.

b) Determine the coordinates of the vertex.

11. Determine an equation for each parabola.

a) The x-intercepts are 5 and 9, and the y-coordinate of the vertex is −2.

b) The x-intercepts are −3 and 7, and the y-coordinate of the vertex is 4.

c) The x-intercepts are −6 and 2, and the y-intercept is −9.

d) The vertex is (4, 0), and the y-intercept is 8.

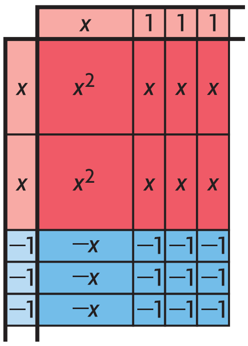
e) The x-intercepts are −3 and 3, and the parabola passes through the point (2, 20).

12. A bus company usually transports 12 000 people per day at a ticket price of \$1. The company wants to raise the ticket price. For every \$0.10 increase in the ticket price, the number of riders per day is expected to decrease by 400. Calculate the ticket price that will maximize revenue.

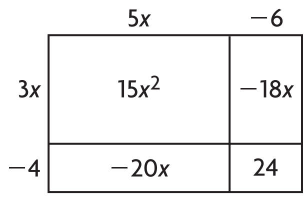
Lesson 3.4

13. Identify the binomial factors and their products.

a)



b)



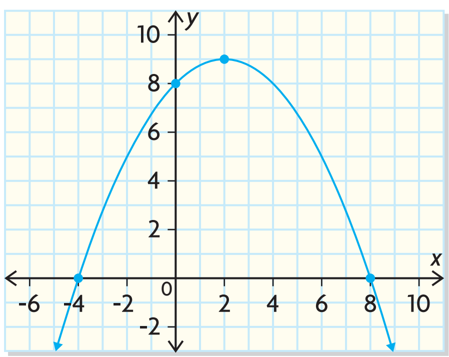
14. Expand and simplify.

a) $(x + 5)(x + 4)$
b) $(x - 2)(x - 5)$
c) $(2x - 3)(2x + 3)$
d) $(4x + 5)(3x - 2)$
e) $(4x - 2y)(5x + 3y)$
f) $(6x - 2)(5x + 7)$

15. Expand and simplify.

a) $(2x + 6)^2$
b) $-2(-2x + 5)(3x + 4)$
c) $2x(4x - y)(4x + y)$

16. Determine the equation of the parabola. Express your answer in standard form.



Lesson 3.5

17. A model rocket is shot straight up into the air. The table shows its height, y, in metres after x seconds.

Time (s)	0	1	2	3	4	5	6
Height (m)	0.0	25.1	40.4	45.9	41.6	27.5	3.6

a) Sketch a curve of good fit.
b) Is the curve of good fit a parabola? Explain.
c) Determine the equation of your curve of good fit. Express your answer in standard form.
d) Estimate the height of the rocket after 4.5 s.
e) When is the rocket at a height of 20 m?

18. A sandbag is dropped into the ocean from a hot air balloon to make the balloon rise. The table shows the height of the sandbag at different times as it falls.

Time (s)	0	2	4	6	8	10
Height (m)	1200	1180	1120	1020	880	700

a) Draw a scatter plot of the data.
b) Sketch a curve of good fit.
c) Is the curve of good fit a parabola? Explain.
d) Determine the equation of your curve of good fit. Express your answer in standard form.
e) Estimate the time when the sandbag hits the water.

Lesson 3.6

19. Evaluate. Express your answers in rational form.

a) 2^{-3}
b) -5^{-1}
c) $\left(\frac{2}{5}\right)^{-2}$
d) $(-9)^0$
e) 4^{-3}
f) $-\left(\frac{1}{6}\right)^{-2}$

20. Which do you think is greater: $\left(\frac{1}{4}\right)^2$ or 3^{-2} ? Justify your decision.

21. For what postive values of x is x^2 greater than 2^x? How do you know?