8.2 Start Thinking

Identify the y-intercept of the equation $y = mx + b$. What is the y-intercept of the equation $y = mx$? Explain how different y-intercept values relate to translations of the graph of $y = mx$.

Use your knowledge of the graph of $y = ax^2$ to describe the effect of the constant c in the equation $y = ax^2 + c$. Describe the difference in the appearance of the graphs of $y = -ax^2$ and $y = x^2 - c$.

8.2 Warm Up

Find the *x*- and *y*-intercepts.

1. $x + y = 4$

2. $y = x - 11$

3. $y = 2x - 13$

4. $2x - 5y = -1$

5. $6x - y = 12$

6. $y = \frac{1}{6}x + 3$

8.2 Cumulative Review Warm Up

Complete the statement with *always*, *sometimes*, or *never*. Explain your reasoning.

1. If $x^2 = y^2$, then $|x|$ is _______________ equal to $|y|$.

2. If x and y are real numbers, then $|x + y|$ is _______________ equal to $|y + x|$.

3. For any real number d, the equation $|x + 5| = d$ will _______________ have no solution.

Name ____ Date __________

8.2 Practice A

In Exercises 1–3, graph the function. Compare the graph to the graph of $f(x) = x^2$.

1. $g(x) = x^2 + 4$

2. $h(x) = x^2 + 7$

3. $k(x) = x^2 - 2$

In Exercises 4–6, graph the function. Compare the graph to the graph of $f(x) = x^2$.

4. $g(x) = -x^2 + 1$

5. $h(x) = -x^2 - 3$

6. $j(x) = 3x^2 - 2$

In Exercises 7 and 8, describe the transformation from the graph of *f* to the graph of *g*. Then graph *f* and *g* in the same coordinate plane. Write an equation that represents *g* in terms of *x*.

7. $f(x) = 2x^2 + 1$
$g(x) = f(x) - 3$

8. $f(x) = \frac{1}{3}x^2 - 1$
$g(x) = f(x) + 4$

In Exercises 9–12, find the zeros of the function.

9. $y = x^2 - 4$

10. $y = x^2 - 64$

11. $f(x) = -x^2 + 16$

12. $f(x) = 2x^2 - 50$

13. You drop a stick from a height of 64 feet. At the same time, your friend drops a stick from a height of 144 feet.

a. After how many seconds does your stick hit the ground?

b. How many seconds later does your friend's stick hit the ground?

In Exercises 14–17, sketch a parabola with the given characteristics.

14. The parabola opens down and the vertex is $(0, 2)$.

15. The vertex is $(0, -4)$ and one of the x-intercepts is 3.

16. The related function is decreasing when $x < 0$ and the zeros are -2 and 2.

17. The lowest point on the parabola is $(0, -1)$.

18. Your friend claims that in the equation $y = ax^2 + c$, the vertex changes when the value of c changes. Is your friend correct? Explain your reasoning.

Name____________________ Date__________

8.2 Practice B

In Exercises 1–3, graph the function. Compare the graph to the graph of $f(x) = x^2$.

1. $g(x) = x^2 + 5$

2. $h(x) = x^2 + 10$

3. $j(x) = x^2 - 5$

In Exercises 4–6, graph the function. Compare the graph to the graph of $f(x) = x^2$.

4. $g(x) = -2x^2 + 4$

5. $h(x) = -\frac{1}{4}x^2 - 1$

6. $k(x) = \frac{1}{3}x^2 + 5$

In Exercises 7 and 8, describe the transformation from the graph of *f* to the graph of *g*. Then graph *f* and *g* in the same coordinate plane. Write an equation that represents *g* in terms of *x*.

7. $f(x) = -\frac{1}{2}x^2 - 4$
$g(x) = f(x) - 2$

8. $f(x) = 2x^2 + 7$
$g(x) = f(x) - 9$

In Exercises 9–12, find the zeros of the function.

9. $y = -x^2 + 81$

10. $y = 3x^2 - 75$

11. $f(x) = -5x^2 + 20$

12. $f(x) = -12x^2 + 27$

13. The function $y = -16x^2 + 100$ represents the height y (in feet) of a pencil x seconds after falling out the window of a school building. Find and interpret the x- and y-intercepts.

14. The paths of water from three different waterfalls are given below. Each function gives the height h (in feet) and the horizontal distance d (in feet) of the water.

Waterfall 1: $h = -2.4d^2 + 1.5$

Waterfall 2: $h = -2.4d^2 + 3$

Waterfall 3: $h = -1.4d^2 + 3$

a. Which waterfall drops water from the lowest point?

b. Which waterfall sends water the farthest horizontal distance?

c. What do you notice about the paths of Waterfall 1 and Waterfall 2?

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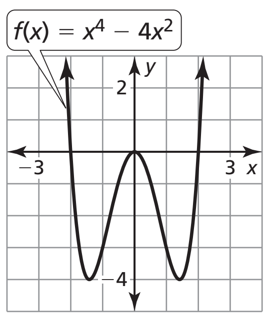
8.2 Enrichment and Extension

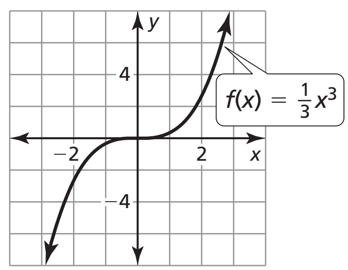
Even and Odd Functions

Contrary to common assumption, even or odd functions are not determined by the degree of the polynomial. The graphs of even functions are symmetric about the y-axis. If $f(-x) = f(x)$ for all values of x, then the function is even. On the other hand, the graphs of odd functions are symmetric about the origin. If $f(-x) = -f(x)$ for all values of x, then the function is odd.

Even



Odd



Example: Determine whether the function $f(x) = x^3 - x$ is *even*, *odd*, or *neither*.

$$\begin{aligned} f(x) &= x^3 - x \\ f(-x) &= (-x)^3 - (-x) \\ &= -x^3 + x \\ &= -(x^3 - x) \end{aligned}$$

So, $f(x)$ is odd.

Determine whether the function is *even*, *odd*, or *neither*.

1. $f(x) = 2x^3$

2. $f(x) = -3x^4$

3. $f(x) = -x^5$

4. $f(x) = x^3 + x^2$

5. $f(x) = x^2 + 3$

6. $f(x) = x^3 + 3$

7. $f(x) = -x^3 - 4x^2 - 3x$

8. $f(x) = -7x^7 + 8x^5 + 3x^3 - x$

9. $f(x) = x^4 + 3x^2 - 5$

10. $f(x) = -x^5 - x + 7$

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8.2 Puzzle Time

Where Do Birds Relax In Their Houses?

Write the letter of each answer in the box containing the exercise number.

Compare the graph of the function to the graph of $f(x) = x^2$.

1. $j(x) = x^2 - 5$

2. $m(x) = x^2 + 4$

3. $c(x) = -x^2 - 8$

4. $r(x) = 6x^2 - 7$

5. $g(x) = \frac{1}{3}x^2 + 9$

6. $p(x) = -\frac{5}{12}x^2 - 14$

Write an equation that represents g in terms of x.

7. $f(x) = 6x^2 + 5$
$g(x) = f(x) + 3$

8. $f(x) = \frac{3}{4}x^2 + 7$
$g(x) = f(x) - 10$

9. $f(x) = -\frac{8}{9}x^2 - 13$
$g(x) = f(x) - 2$

10. $f(x) = 14x^2 - 25$
$g(x) = f(x) + 18$

Find the zeros of the function.

11. $y = x^2 - 4$

12. $y = x^2 - 81$

13. $f(x) = -x^2 + 36$

14. $f(x) = 3x^2 - 75$

15. The function $y = -2x^2 + 98$ represents the height y (in inches) of a penny x seconds after falling to the ground. Find the x-intercept.

Answers

E. $x = 9, x = -9$

N. $x = -5, x = 5$

H. $x = 7$

T. $x = -2, x = 2$

O. $x = -6, x = 6$

B. $x = 10$

T. $g(x) = 14x^2 - 7$

E. $g(x) = \frac{3}{4}x^2 - 3$

C. $g(x) = 6x^2 + 8$

O. $g(x) = -\frac{8}{9}x^2 - 15$

R. reflection in the x-axis, translation 8 units down

F. vertical shrink by a factor of $\frac{1}{3}$, translation 9 units up

H. translation 4 units up

P. reflection in the x-axis, vertical shrink by a factor of $\frac{5}{12}$, translation 14 units down

N. vertical stretch by a factor of 6, translation 7 units down

R. translation 5 units down

9	14		11	2	8		5	1	13	4	10		6	12	3	7	15