

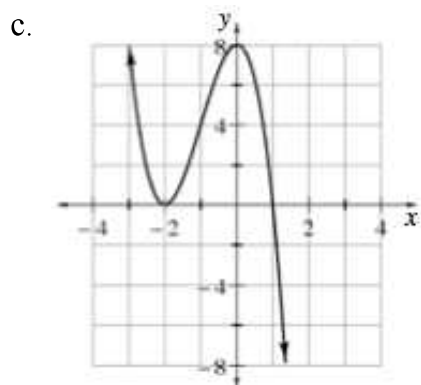
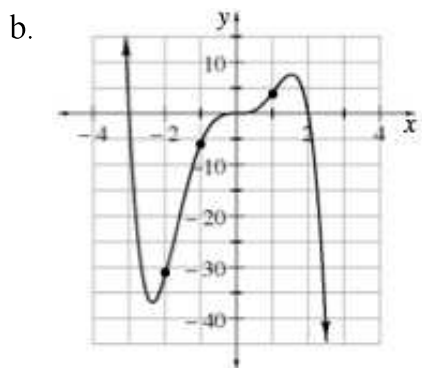
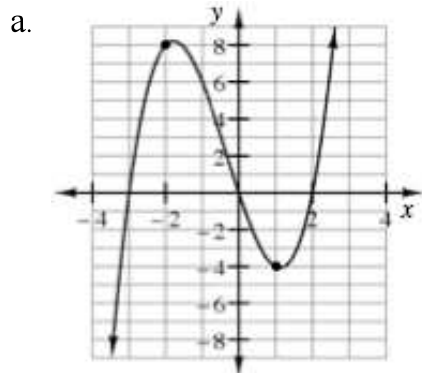
8.1.3 How can I find the equation?

Stretch Factors for Polynomial Functions



In Lesson 8.1.2 you found possible equations for the graphs of polynomial functions based on their x -intercepts. Many of the sketches you used did not even include the scale on the y -axis. In this lesson, you will focus on figuring out equations that represent *all* of the points on the graphs.

8-45. Find reasonable equations for each of the following polynomial functions. Without using a graphing calculator, how can you check the accuracy of your equations? Were each of your equations accurate? If not, why do you think your equation(s) were not accurate?

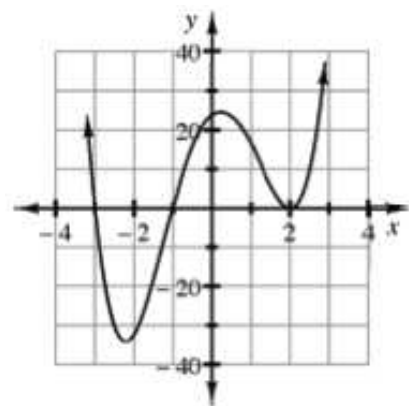


8-46. What is the difference between the graphs of the functions $y = x^2(x - 3)(x + 1)$ and $y = 3x^2(x - 3)$

$(x + 1)$?

8-47. ARE THE INTERCEPTS ENOUGH?

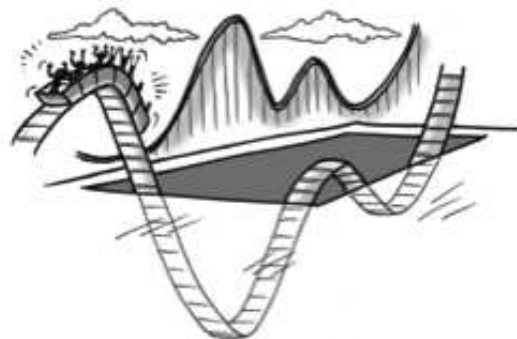
Melvin wrote the equation $y = (x + 3)(x + 1)(x - 2)^2$ to represent the graph at right.



- Explain how you can decide how well the equation represents the graph. What can you do to the equation to make it a better fit for the graph? What equation would fit better?
- Before you figured it out, you could have written the polynomial for this graph as $P(x) = a(x + 3)(x + 1)(x - 2)^2$. What if you did not have a graphing calculator, but you were told that the graph goes through the point $(1, 16)$? How could you use that information to determine the exact equation? Once you have decided on a method with your team, try it. How can you test the accuracy of your equation?

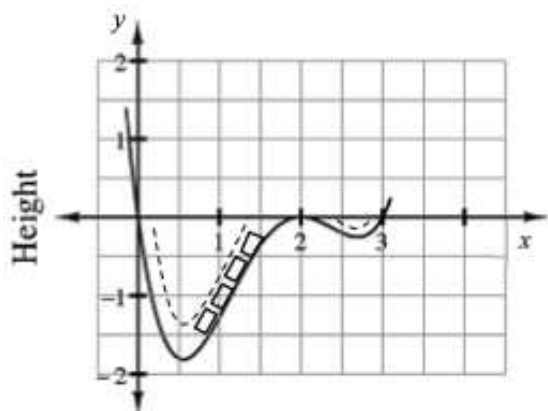
8-48. THE COUNTY FAIR COASTER RIDE

Now that you have more expertise with polynomial equations and their graphs, the Mathamericaland Carnival Company has hired your team to find the *exact* equation to represent its roller-coaster track.



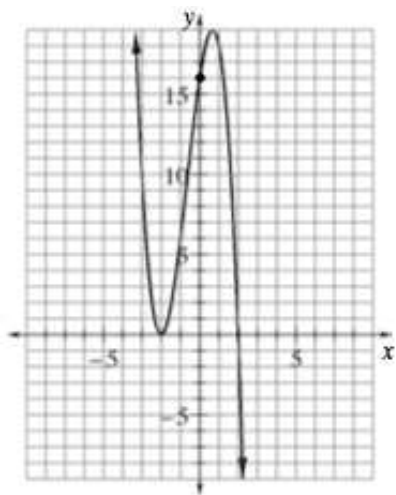
The numbers along the x -axis are in hundreds of feet. At 250 feet, the track will be 20 feet below the surface. This gives the point $(2.5, -0.2)$.

- What degree polynomial represents the portion of the roller coaster represented by the graph at right?
- What are the roots?
- Find an exact equation for the polynomial that will generate the curve of the track.
- What is the deepest point of the roller coaster's tunnel?

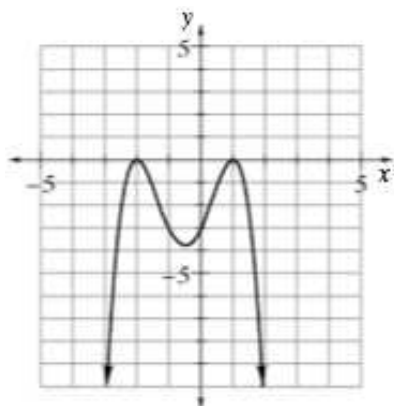


8-49. Some polynomials have a stretch factor, just like the a in parabolas and other parent functions. Write an exact equation, including the stretch factor, for each graph below.

a.



b.



8-50. Write a polynomial equation for a function with a graph that bounces off the x -axis at $(-1, 0)$, crosses it at $(4, 0)$, and goes through the point $(-2, -18)$.

8-51. Armando came up with the equation $y = 3(x + 1)^4(x - 4)$ for problem 8-50. Does his equation fit all of the given criteria? Why or why not? Is it the same as the equation you came up with?

8-52. What if problem 8-50 also had said that the graph went through the point $(1, -36)$? Is there still more than one possible equation? Explain.

8-53. What information about the graph of a polynomial function is necessary to determine exactly one correct equation? Discuss this with your team.



METHODS AND MEANINGS

MATH NOTES

Notation for Polynomials

The **general equation** of a second-degree (quadratic) polynomial is often written in the form $f(x) = ax^2 + bx + c$, and the general equation of a third-degree (cubic) polynomial is often written in the form $f(x) = ax^3 + bx^2 + cx + d$.

For a polynomial with an undetermined degree n , it is unknown how many letters will be needed for the coefficients. Instead of using a, b, c, d, e , etc., mathematicians use only the letter a , and they used subscripts, as shown below.

$$f(x) = (a_n)x^n + (a_{n-1})x^{(n-1)} + \dots + (a_1)x^1 + a_0$$

This general polynomial has degree n and coefficients $a_n, a_{n-1}, \dots, a_1, a_0$.

For example, for $7x^4 - 5x^3 + 3x^2 + 7x + 8$, the degree is 4. In this specific case, a_n is a_4 and $a_4 = 7$, a_{n-1} is $a_3 = -5$, a_{n-2} is $a_2 = 3$, $a_1 = 7$, and $a_0 = 8$.



8-54. What is the stretch factor for the equation of the graph in part (c) of problem 8-45? Write the exact equation of the function. [Homework Help](#)

8-55. For each of the following polynomial expressions, find the degree, list the coefficients, and then label them a_0 through a_n . Refer to the example in the Math Notes box above about polynomial notation.

[Homework Help](#)

a. $6x^4 - 3x^3 + 5x^2 + x + 8$

b. $-5x^3 + 10x^2 + 8$

c. $-x^2 + x$

d. $x(x - 3)(x - 5)$

e. x

f. 10


8-56. Write a polynomial equation for a graph that passes through the point $(-1, 60)$ and has three x -intercepts: $(-4, 0)$, $(1, 0)$, and $(3, 0)$. [Homework Help](#)

8-57. The x -intercepts of a quadratic polynomial are given below. Find a possible quadratic equation in standard form. [Homework Help](#)

a. $x = \frac{3}{4}, x = -2$

b. $x = -\sqrt{5}, x = \sqrt{5}$

8-58. Solve the equation $\sqrt{5-2x} + 7 = 4$ and check your solution. [Homework Help](#) 


8-59. Find the center and radius of each circle below. [Homework Help](#) 

a. $(y-7)^2 = 25 - (x-3)^2$

b. $x^2 + y^2 + 10y = -9$

c. $x^2 + y^2 + 18x - 8y + 47 = 0$

d. $y^2 + (x-3)^2 = 1$

8-60. Without using a calculator, find the solution to each equation. [Homework Help](#) 


a. $2^x = 17$

b. $\log_3(x+1) = 5$

c. $\log_3(3^x) = 4$

d. $4^{\log_4(x)} = 7$



8-61. Solve each absolute value inequality. [Homework Help](#) 

a. $|2x+1| < 5$

b. $2|3x-2| \geq 10$

8-62. Write a possible equation for the graph below. [Homework Help](#) 