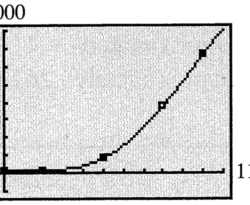


Quartic model

Figure 36

(c) The best-fitting quartic function is defined by

$$y = -1.619x^4 + 36.09x^3 - 155.5x^2 + 218.1x + 127.$$

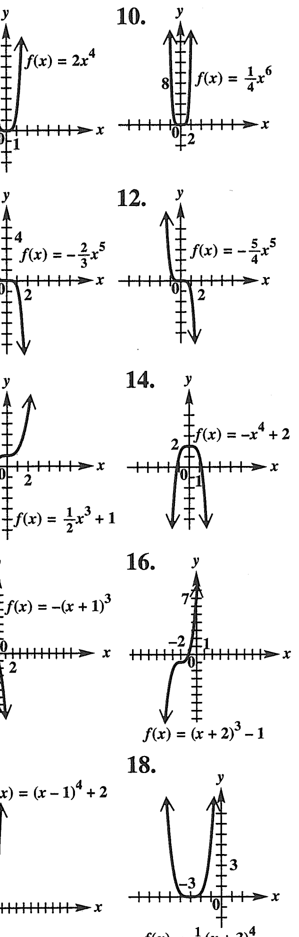
See Figure 36.

(d) Find the correlation coefficient values R^2. Figure 34 shows R^2 for the quadratic function. The others are .9982771996 for the cubic function and 1 for the quartic function. Therefore, the quartic function provides the best fit.

Now try Exercise 97.

Exercises

2. B 3. one 4. C
nd D 6. B
) = $x(x+5)^2(x-3)$
) = $-(x+6)\cdot$
)$^2(x-3)(x-5)$



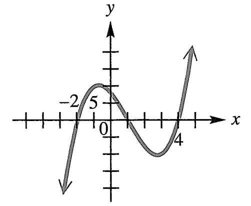
Concept Check *Comprehensive graphs of four polynomial functions are shown in A–D. They represent the graphs of functions defined by these four equations, but not necessarily in the order listed.*

$y = x^3 - 3x^2 - 6x + 8$ $\qquad y = x^4 + 7x^3 - 5x^2 - 75x$

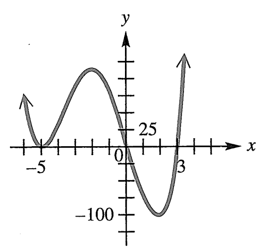
$y = -x^3 + 9x^2 - 27x + 17$ $\qquad y = -x^5 + 36x^3 - 22x^2 - 147x - 90$

Apply the concepts of this section to answer each question.

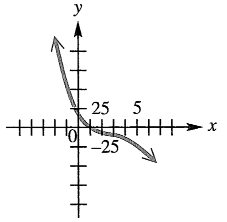
A.



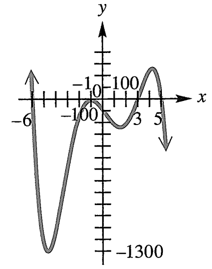
B.



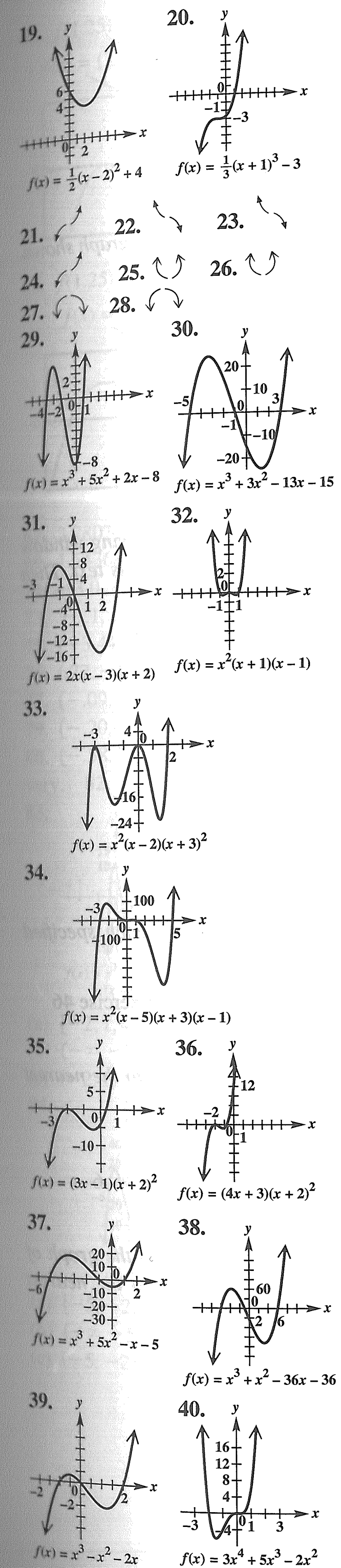
C.



D.



1. Which one of the graphs is that of $y = x^3 - 3x^2 - 6x + 8$?
2. Which one of the graphs is that of $y = x^4 + 7x^3 - 5x^2 - 75x$?
3. How many real zeros does the graph in C have?
4. Which one of C and D is the graph of $y = -x^3 + 9x^2 - 27x + 17$? (*Hint:* Look at the y-intercept.)
5. Which of the graphs cannot be that of a cubic polynomial function?
6. Which one of the graphs is that of a function whose range is *not* $(-\infty, \infty)$?
7. The function defined by $f(x) = x^4 + 7x^3 - 5x^2 - 75x$ has the graph shown in B. Use the graph to factor the polynomial.
8. The function defined by $f(x) = -x^5 + 36x^3 - 22x^2 - 147x - 90$ has the graph shown in D. Use the graph to factor the polynomial.



Sketch the graph of each polynomial function. See Examples 1 and 2.

9. $f(x) = 2x^4$
10. $f(x) = \frac{1}{4}x^6$
11. $f(x) = -\frac{2}{3}x^5$
12. $f(x) = -\frac{5}{4}x^5$
13. $f(x) = \frac{1}{2}x^3 + 1$
14. $f(x) = -x^4 + 2$
15. $f(x) = -(x+1)^3$
16. $f(x) = (x+2)^3 - 1$
17. $f(x) = (x-1)^4 + 2$
18. $f(x) = \frac{1}{3}(x+3)^4$
19. $f(x) = \frac{1}{2}(x-2)^2 + 4$
20. $f(x) = \frac{1}{3}(x+1)^3 - 3$

Use an end behavior diagram, to describe the end behavior of the graph of each polynomial function. See Example 3.

21. $f(x) = 5x^3 + 2x^2 - 3x + 4$
22. $f(x) = -6x^3 - 4x^2 + 2x - 1$
23. $f(x) = -4x^5 + 3x^2 - 1$
24. $f(x) = 8x^7 - x^5 + x - 1$
25. $f(x) = 9x^4 - 3x^2 + x - 2$
26. $f(x) = 12x^6 - x^5 + 2x - 2$
27. $f(x) = 3 + 2x - 4x^2 - 5x^8$
28. $f(x) = 8 + 2x - 5x^2 - 10x^4$

Graph each polynomial function. Factor first if the expression is not in factored form. See Example 4.

29. $f(x) = x^3 + 5x^2 + 2x - 8$
30. $f(x) = x^3 + 3x^2 - 13x - 15$
31. $f(x) = 2x(x-3)(x+2)$
32. $f(x) = x^2(x+1)(x-1)$
33. $f(x) = x^2(x-2)(x+3)^2$
34. $f(x) = x^2(x-5)(x+3)(x-1)$
35. $f(x) = (3x-1)(x+2)^2$
36. $f(x) = (4x+3)(x+2)^2$
37. $f(x) = x^3 + 5x^2 - x - 5$
38. $f(x) = x^3 + x^2 - 36x - 36$
39. $f(x) = x^3 - x^2 - 2x$
40. $f(x) = 3x^4 + 5x^3 - 2x^2$
41. $f(x) = 2x^3(x^2 - 4)(x-1)$
42. $f(x) = x^2(x-3)^3(x+1)$

Use the intermediate value theorem for polynomials to show that each polynomial function has a real zero between the numbers given. See Example 5.

43. $f(x) = 2x^2 - 7x + 4$; 2 and 3
44. $f(x) = 3x^2 - x - 4$; 1 and 2
45. $f(x) = 2x^3 - 5x^2 - 5x + 7$; 0 and 1
46. $f(x) = 2x^3 - 9x^2 + x + 20$; 2 and 2.5
47. $f(x) = 2x^4 - 4x^2 + 4x - 8$; 1 and 2
48. $f(x) = x^4 - 4x^3 - x + 3$; .5 and 1
49. $f(x) = x^4 + x^3 - 6x^2 - 20x - 16$; 3.2 and 3.3
50. $f(x) = x^4 - 2x^3 - 2x^2 - 18x + 5$; 3.7 and 3.8
51. $f(x) = x^4 - 4x^3 - 20x^2 + 32x + 12$; -1 and 0
52. $f(x) = x^5 + 2x^4 + x^3 + 3$; -1.8 and -1.7

Show that the real zeros of each polynomial function satisfy the given conditions. See Example 6.

53. $f(x) = x^4 - x^3 + 3x^2 - 8x + 8$; no real zero greater than 2
54. $f(x) = 2x^5 - x^4 + 2x^3 - 2x^2 + 4x - 4$; no real zero greater than 1
55. $f(x) = x^4 + x^3 - x^2 + 3$; no real zero less than -2