3.5 DIVIDING POLYNOMIALS

1. The binomial is a factor of the polynomial.

3. The quotient is $x+6$. The remainder is 5. We write the result as $\left(x^2+5x-1\right)\div\left(x-1\right)=x+6+\dfrac{5}{x-1}$

5. The quotient is $3x+2$. The remainder is 0. We write the result as $\left(3x^2+23x+14\right)\div\left(x+7\right)=3x+2$

7. The quotient is $x-5$. The remainder is 0. We write the result as $\left(6x^2-25x-25\right)\div\left(6x+5\right)=x-5$

9. The quotient is $2x-7$. The remainder is 16. We write the result as $\left(2x^2-3x+2\right)\div\left(x+2\right)=2x-7+\dfrac{16}{x+2}$

11. The quotient is $x-2$. The remainder is 6. We write the result as $\left(3x^2-5x+4\right)\div\left(3x+1\right)=x-2+\dfrac{6}{3x+1}$

13. The quotient is $2x^2-3x+5$. The remainder is 0. We write the result as
$\left(2x^3+3x^2-4x+15\right)\div\left(x+3\right)=2x^2-3x+5$

15. The result is $2x^2+2x+1$. The remainder is 10. Thus, $\left(2x^3-6x^2-7x+6\right)\div(x-4)=2x^2+2x+1+\dfrac{10}{x-4}$

17. Thus, we find $\dfrac{2x^3-6x^2-\dfrac{5}{2}x-\dfrac{1}{2}}{x+\dfrac{1}{2}}=2x^2-7x+1-\dfrac{1}{x+\dfrac{1}{2}}$ so $\dfrac{\left(4x^3-12x^2-5x-1\right)}{(2x+1)}=2x^2-7x+1-\dfrac{2}{2x+1}$

19. Thus, we find $\dfrac{-3x^3+\dfrac{1}{2}x^2-2}{x-\dfrac{3}{2}}=-3x^2-4x-6-\dfrac{11}{\left(x-\dfrac{3}{2}\right)}$ so $\dfrac{\left(-6x^3+x^2-4\right)}{(2x-3)}=-3x^2-4x-6-\dfrac{22}{2x-3}$

21. Thus, we find $\dfrac{-3x^3+\dfrac{1}{2}x^2-2}{x-\dfrac{3}{2}}=x^2+5x+1$ so $\dfrac{\left(2x^3+7x^2-13x-3\right)}{(2x-3)}=x^2+5x+1$

23. The result is $4x^2-21x+84$. The remainder is -323. Thus,
$\left(4x^3-5x^2+13\right)\div(x+4)=4x^2-21x+84-\dfrac{323}{x+4}$

25. The result is $x^2-14x+49$. The remainder is 0. Thus, $\left(x^3-21x^2+147x-343\right)\div\left(x-7\right)=x^2-14x+49$

27. Thus, we find $\dfrac{3x^3-\dfrac{1}{3}x+\dfrac{2}{3}}{x-\dfrac{1}{3}}=3x^2+x+\dfrac{2/3}{\left(x-\dfrac{1}{3}\right)}$ so $\dfrac{\left(9x^3-x+2\right)}{(3x-1)}=3x^2+x+\dfrac{2}{3x-1}$

29. The result is x^3-3x+1. The remainder is 0. Thus, $\left(x^4+x^3-3x^2-2x+1\right)\div\left(x+1\right)=x^3-3x+1$

31. The result is x^3-x^2+2. The remainder is 0. Thus, $\left(x^4+2x^3-3x^2+2x+6\right)\div\left(x+3\right)=x^3-x^2+2$

33. The result is $x^3-6x^2+12x-8$. The remainder is 0. Thus,
$\left(x^4-8x^3+24x^2-32x+16\right)\div\left(x-2\right)=x^3-6x^2+12x-8$

35. The result is $x^3-9x^2+27x-27$. The remainder is 0. Thus,
$\left(x^4-12x^3+54x^2-108x+81\right)\div\left(x-3\right)=x^3-9x^2+27x-27$

37. Thus, we find $\dfrac{2x^4+x^3-2x^2+x+1}{x+\dfrac{1}{2}}=2x^3-2x+2$ so $\dfrac{\left(4x^4+2x^3-4x^2+2x+2\right)}{(2x+1)}=2x^3-2x+2$

39. The quotient is $3x^3-5$. The remainder is 0 . Thus, $x-2$ is a factor of? $3x^4-6x^3-5x+10$ We write the result as $\dfrac{3x^4-6x^3-5x+10}{\left(x-2\right)}=(3x^3-5)$

41. The quotient is $4x^3+8x^2+x+2$. The remainder is 0 . Thus, $x-2$ is a factor of $4x^4-15x^2-4$. We write the result as $\dfrac{4x^4-15x^2-4}{\left(x-2\right)}=4x^3+8x^2+x+2$

43. The quotient is $3x^3-3$. The remainder is 2 . Thus, $x+\dfrac{1}{3}$ is not a factor of $3x^4+x^3-3x+1$

45. The graph shows a zero at $x=k=1$. This confirms that $x-1$ is a factor of the graph. Multiply the factors to get the third-degree polynomial. $f(x)=\left(x-1\right)\left(x^2+2x+4\right)$

47. The graph shows a zero at $x=k=5$. This confirms that $x-5$ is a factor of the graph. Multiply the factors to get the third-degree polynomial. $f(x)=\left(x-5\right)\left(x^2+x+1\right)$

49. The quotient is $4x^2+8x+16$. The remainder is -1 .

51. The quotient is $3x^2+3x+5$. The remainder is 0 .

53. The quotient is x^3-2x^2+4x-8. The remainder is -6 .

55. $x^6-x^5+x^4-x^3+x^2-x+1$.

57. $x^3-x^2+x-1+\dfrac{1}{x+1}$.

59. The quotient is 1. The remainder is $1+i$. We write the result as $\dfrac{x+1}{x-i}=1+\dfrac{1+i}{x-i}$

61. The quotient is 1. The remainder is $1-i$. We write the result as

63. The quotient is x^2+ix-1. The remainder is $1-i$. We write the result as $\dfrac{x^3+1}{x-i}=x^2+ix-1+\dfrac{1-i}{x-i}$

65. The width of the rectangle is $2x^2+3$.

67. The height of the box is $2x+3$.

69. The height of the box is $x+2$.

71. The height of the cylinder is $x-3$.

73. The quotient is $3x^2-2$ and the remainder is 0. The height of the cylinder is $3x^2-2$.