

**Simplify. Write the answer with positive exponents.**

1)  $(7x)^0 + 7x^0$

2)  $\frac{x^{8a-7} \cdot x^{3a}}{x^a}$

3)  $\frac{32x^{-3}y^7}{4xy^{-1}}$

4)  $\left(\frac{-4x^5y^{-3}}{3z^7}\right)^{-2}$

5)  $\left(\frac{4x^{-2}y^2}{12x^{-4}y^{-1}}\right)^3$

**Write the number in scientific notation.**

6) 0.00005637

**Write the number in standard notation.**

7) There are  $2.122 \times 10^6$  miles of highways, roads, and streets in a certain country.

**Perform the indicated operation. Write the answer in scientific notation.**

8)  $\frac{6.75 \times 10^{-9}}{2.5 \times 10^3}$

**Simplify.**

9) If  $Q(x) = 3x^2 - 6x - 7$ , find  $Q(-3)$ .

**Perform the indicated operations.**

10)  $(4x^2 - xy - y^2) + (x^2 + 11xy + 5y^2)$

11)  $(4y^2 + 9) - (-13y^4 - 2y^2 + 9)$

12)  $-5x^4(-5x^7 + 4x^5 - 12)$

13)  $(8y + 11)(7y^2 - 2y - 6)$

14)  $(9xy + 10z)(9xy - 10z)$

15)  $(6x + 11y)(6x - 11y)$

16)  $(11x + 7)(11x - 7)$

17)  $(x - 5)(x + 5)(x^2 + 25)$

18)  $(x + 6)(x - 6)(3x + 8)$

**Factor the polynomial completely.**

19)  $x^3 + 4x^2 + x + 4$

20)  $x^2 + 39x + 40$

21)  $x^2 + 3xy - 54y^2$

22)  $6x^2 - 6x - 36$

23)  $5x^2 - 35x + 50$

24)  $x^2y^2 + 9xy^2 + 18y^2$

25)  $6x^2 - 5x - 6$

26)  $15x^2 + 4x - 4$

27)  $10x^3 + 21x^2 - 10x$

28)  $x^2 - 6x + 36$

29)  $x^2 + 16xy + 64y^2$

30)  $3x^2 - 75$

31)  $4x^2 - 81y^2$

32)  $x^2 - 4x + 4 - y^2$

33)  $(3x + y)^2 - 4$

34)  $x^3 - 729$

35)  $216x^3 + 1$

36)  $81x^3y - 24y^4$

**Solve the equation.**

37)  $x^2 + 2x = 120$

38)  $x(5x + 8) = 4$

39)  $x^3 = 64x$

40)  $x^3 - x = -2x^2 + 2$

41)  $x^3 + 2x^2 = 24x$

**Solve.**

42) A certain rectangle's length is 1 feet longer than its width. If the area of the rectangle is 132 square feet, find its dimensions.

43) One leg of a right triangle is 14 inches longer than the smaller leg, and the hypotenuse is 16 inches longer than the smaller leg. Find the lengths of the sides of the triangle.

44) An object is thrown upward from the top of a 160-foot building with an initial velocity of 48 feet per second. The height  $h$  of the object after  $t$  seconds is given by the quadratic equation  $h = -16t^2 + 48t + 160$ . When will the object hit the ground?

45) The sum of a number and its square is 30. Find the number.

**Find the domain of the rational function.**

46)  $f(x) = \frac{1 - 7x}{x^3 - 6x^2 - 40x}$

47)  $f(x) = \frac{3x - 7}{x^2 - 25}$

**Simplify the rational expression.**

48)  $\frac{3x + 2}{12x^2 + 17x + 6}$

49)  $\frac{x^2 + 7x + 10}{x^2 + 11x + 30}$

**Multiply or divide as indicated. Simplify completely.**

50)  $\frac{x^2 - 19x + 84}{x^2 - 11x + 30} \cdot \frac{x^2 - 9x + 20}{x^2 - 15x + 56}$

51)  $\frac{x^2 + 5x - 6}{x^2 + 9x + 18} \div \frac{x^2 - 1}{x^2 + 7x + 12}$

52)  $\frac{x^2 + 10x + 21}{x^2 + 11x + 24} \cdot \frac{x^2 + 8x}{x^2 + 3x - 28}$

53)  $\frac{35r^2 - 67rt + 30t^2}{14r^2 - 45rt + 25t^2} \div \frac{25r^2 - 15rt - 18t^2}{30r^2 + 53rt + 21t^2}$

**Perform the indicated operation. Simplify if possible.**

54)  $\frac{x^2 - 7x}{x - 5} + \frac{10}{x - 5}$

55)  $\frac{9x - 6}{x^2 + 4x + 3} + \frac{9 - 8x}{x^2 + 4x + 3}$

56)  $\frac{3}{y^2 - 3y + 2} + \frac{7}{y^2 - 1}$

57)  $\frac{6x}{x + 1} + \frac{7}{x - 1} - \frac{12}{x^2 - 1}$

58)  $\left(\frac{x}{x + 1} - \frac{x}{x - 1}\right) \div \frac{x}{5x + 5}$

59)  $\frac{5}{x} \cdot \left(\frac{2}{x + 2} - \frac{2}{x - 2}\right)$

**Simplify.**

60)  $\frac{4 + \frac{2}{x}}{\frac{x}{4} + \frac{1}{8}}$

61)  $\frac{\frac{25t^2 - 64s^2}{st}}{\frac{5}{s} - \frac{8}{t}}$

$$62) \frac{\frac{5}{x+3} + \frac{10}{x+5}}{\frac{3x+11}{x^2+8x+15}}$$

$$63) \frac{1 - \frac{4}{x}}{x - \frac{16}{x}}$$

$$64) (a^{-1} + b^{-1})^{-1}$$

$$65) \frac{x^{-2}}{x^{-2} - y^{-2}}$$

**Divide.**

$$66) (4x^3 - 9x) \div (2x - 1)$$

$$67) (-2x^5 - x^3 - 4x^2 + 12x + 8) \div (x^2 - 2)$$

**Use synthetic division to divide.**

$$68) (2x^3 + 14x^2 + 24x + 20) \div (x + 5)$$

$$69) (x^4 + 16) \div (x - 2)$$

$$70) (25x^3 + 25x^2 + 7x - 4) \div (x + \frac{2}{5})$$

**For the given polynomial P(x) and the given c, use the remainder theorem to find P(c).**

$$71) P(x) = 8x^3 + 7x^2 - x - 89; 2$$

$$72) P(x) = 9x^4 - 3x^3 + x^2 - x - 9; \frac{1}{3}$$

**Solve the equation.**

$$73) 1 + \frac{1}{x} = \frac{56}{x^2}$$

$$74) \frac{4}{x+4} - \frac{7}{x-4} = \frac{10}{x^2-16}$$

$$75) \frac{1}{x+5} + \frac{3}{x+4} = \frac{-1}{x^2+9x+20}$$

$$76) \frac{x+6}{x^2-4x-5} - \frac{6}{x^2+2x+1} = \frac{x-6}{x^2-4x-5}$$

**Solve.**

77) A painter can finish painting a house in 3 hours. Her assistant takes 5 hours to finish the same job. How long would it take for them to complete the job if they were working together?

78) A boat moves 7 kilometers upstream in the same amount of time it moves 20 kilometers downstream. If the rate of the current is 5 kilometers per hour, find the rate of the boat in still water.

79) One pump can drain a pool in 8 minutes. When a second pump is also used, the pool only takes 4 minutes to drain. How long would it take the second pump to drain the pool if it were the only pump in use?

80) A car travels 400 miles on level terrain in the same amount of time it travels 160 miles on mountainous terrain. If the rate of the car is 30 miles per hour less in the mountains than on level ground, find its rate in the mountains.

81) A baker can decorate the day's cookie supply four times as fast as his new assistant. If they decorate all the cookies working together in 16 minutes, how long would it take for each of them to decorate the cookies working individually?

82) The amount of gas that a helicopter uses is directly proportional to the number of hours spent flying. The helicopter flies for 4 hours and uses 28 gallons of fuel. Find the number of gallons of fuel that the helicopter uses to fly for 6 hours.

- 83) When the temperature stays the same, the volume of a gas is inversely proportional to the pressure of the gas. If a balloon is filled with 80 cubic inches of a gas at a pressure of 14 pounds per square inch, find the new pressure of the gas if the volume is decreased to 40 cubic inches.
- 84) While traveling in a car, the centrifugal force a passenger experiences as the car drives in a circle varies jointly as the mass of the passenger and the square of the speed of the car. If the a passenger experiences a force of 220.5 newtons when the car is moving at a speed of 70 kilometers per hour and the passenger has a mass of 50 kilograms, find the force a passenger experiences when the car is moving at 80 kilometers per hour and the passenger has a mass of 90 kilograms.
- 85) The amount of paint needed to cover the walls of a room varies jointly as the perimeter of the room and the height of the wall. If a room with a perimeter of 40 feet and 8-foot walls requires 3.2 quarts of paint, find the amount of paint needed to cover the walls of a room with a perimeter of 55 feet and 6-foot walls.

# Answer Key

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- 1) 8
- 2)  $x^{10}a - 7$
- 3)  $\frac{8y^8}{x^4}$
- 4)  $\frac{9y^6z^{14}}{16x^{10}}$
- 5)  $\frac{x^6y^9}{27}$
- 6)  $5.637 \times 10^{-5}$
- 7) 2,122,000
- 8)  $2.7 \times 10^{-12}$
- 9) 38
- 10)  $5x^2 + 10xy + 4y^2$
- 11)  $13y^4 + 6y^2$
- 12)  $25x^{11} - 20x^9 + 60x^4$
- 13)  $56y^3 + 61y^2 - 70y - 66$
- 14)  $81x^2y^2 - 100z^2$
- 15)  $36x^2 - 121y^2$
- 16)  $121x^2 - 49$
- 17)  $x^4 - 625$
- 18)  $3x^3 + 8x^2 - 108x - 288$
- 19)  $(x^2 + 1)(x + 4)$
- 20) prime polynomial
- 21)  $(x - 6y)(x + 9y)$
- 22)  $6(x + 2)(x - 3)$
- 23)  $5(x - 2)(x - 5)$
- 24)  $y^2(x + 6)(x + 3)$
- 25)  $(3x + 2)(2x - 3)$
- 26)  $(3x + 2)(5x - 2)$
- 27)  $x(2x + 5)(5x - 2)$
- 28) prime polynomial
- 29)  $(x + 8y)^2$
- 30)  $3(x + 5)(x - 5)$
- 31)  $(2x + 9y)(2x - 9y)$
- 32)  $(x - 2 + y)(x - 2 - y)$
- 33)  $(3x + y + 2)(3x + y - 2)$
- 34)  $(x - 9)(x^2 + 9x + 81)$
- 35)  $(6x + 1)(36x^2 - 6x + 1)$
- 36)  $3y(3x - 2y)(9x^2 + 6xy + 4y^2)$
- 37) -12, 10
- 38)  $\frac{2}{5}, -2$
- 39) -8, 0, 8
- 40) -1, 1, -2
- 41) -6, 0, 4
- 42) 11 ft by 12 ft
- 43) 10 in., 24 in., 26 in.
- 44) 5 sec
- 45) 5 or -6
- 46)  $\{x \mid x \text{ is a real number and } x \neq 10, x \neq -4, x \neq 0\}$
- 47)  $\{x \mid x \text{ is a real number and } x \neq 5, x \neq -5\}$
- 48)  $\frac{1}{4x + 3}$
- 49)  $\frac{x + 2}{x + 6}$
- 50)  $\frac{(x - 12)(x - 4)}{(x - 6)(x - 8)}$
- 51)  $\frac{x + 4}{x + 1}$
- 52)  $\frac{x}{x - 4}$
- 53)  $\frac{6r + 7t}{2r - 5t}$
- 54)  $x - 2$
- 55)  $\frac{1}{x + 1}$
- 56)  $\frac{10y - 11}{(y - 1)(y + 1)(y - 2)}$
- 57)  $\frac{6x - 5}{x - 1}$
- 58)  $-\frac{10}{(x - 1)}$
- 59)  $-\frac{40}{x(x + 2)(x - 2)}$
- 60)  $\frac{16}{x}$
- 61)  $8t + 5s$
- 62) 5
- 63)  $\frac{1}{x + 4}$
- 64)  $\frac{ab}{a + b}$
- 65)  $\frac{y^2}{y^2 - x^2}$
- 66)  $2x^2 + x - 4 - \frac{4}{2x - 1}$
- 67)  $-2x^3 - 5x - 4 + \frac{2x}{x^2 - 2}$
- 68)  $2x^2 + 4x + 4$
- 69)  $x^3 + 2x^2 + 4x + 8 + \frac{32}{x - 2}$
- 70)  $25x^2 + 15x + 1 - \frac{22}{5(x + \frac{2}{5})}$
- 71) 1

## Answer Key

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72)  $-\frac{83}{9}$

73)  $-8, 7$

74)  $-18$

75)  $\emptyset$

76)  $-7$

77)  $1\frac{7}{8}$  hours

78)  $10\frac{5}{13}$  kilometers per hour

79) 8 minutes

80) 20 mph

81) baker: 20 minutes

assistant: 80 minutes

82) 42 gallons

83) 28 pounds per square inch

84) 518.4 newtons

85) 3.3 quarts