

WARM UP

Completely factor the polynomial.

1. $5x^2 - 15x^3$

3. $9x^2 - 6x + 1$

5. $z^2 + 4z + 3$

7. $3 + 8x - 3x^2$

9. $s^3 + s^2 - 4s - 4$

2. $16x^2 - 9$

4. $9 + 12y + 4y^2$

6. $x^2 - 15x + 50$

8. $3x^2 - 46x + 15$

10. $y^3 + 64$

P.4 Exercises

In Exercises 1–10, find the domain of the expression.

1. $3x^2 - 4x + 7$

2. $2x^2 + 5x - 2$

3. $4x^3 + 3, x \geq 0$

4. $6x^2 - 9, x > 0$

5. $\frac{1}{x - 2}$

6. $\frac{x + 1}{2x + 1}$

7. $\frac{x - 1}{x^2 - 4x}$

8. $\frac{2x + 1}{x^2 - 9}$

9. $\sqrt{x + 1}$

10. $\frac{1}{\sqrt{x + 1}}$

In Exercises 11–16, find the missing factor in the numerator so that the two fractions will be equivalent.

11. $\frac{5}{2x} = \frac{5(\quad)}{6x^2}$

12. $\frac{3}{4} = \frac{3(\quad)}{4(x + 1)}$

13. $\frac{x + 1}{x} = \frac{(x + 1)(\quad)}{x(x - 2)}$

14. $\frac{3y - 4}{y + 1} = \frac{(3y - 4)(\quad)}{y^2 - 1}$

15. $\frac{3x}{x - 3} = \frac{3x(\quad)}{x^2 - 3x}$

16. $\frac{1 - z}{z^2} = \frac{(1 - z)(\quad)}{z^3 + z^2}$

In Exercises 17–30, write the rational expression in reduced form.

17. $\frac{15x^2}{10x}$

18. $\frac{18y^2}{60y^5}$

19. $\frac{3xy}{xy + x}$

20. $\frac{9x^2 + 9x}{2x + 2}$

21. $\frac{x - 5}{10 - 2x}$

22. $\frac{x^2 - 25}{5 - x}$

23. $\frac{x^3 + 5x^2 + 6x}{x^2 - 4}$

24. $\frac{x^2 + 8x - 20}{x^2 + 11x + 10}$

25. $\frac{y^2 - 7y + 12}{y^2 + 3y - 18}$

26. $\frac{3 - x}{x^2 + 11x + 10}$

27. $\frac{2 - x + 2x^2 - x^3}{x - 2}$

28. $\frac{x^2 - 9}{x^3 + x^2 - 9x - 9}$

29. $\frac{z^3 - 8}{z^2 + 2z + 4}$

30. $\frac{y^3 - 2y^2 - 3y}{y^3 + 1}$

In Exercises 31 and 32, complete the table. What can you conclude?

31.

x	0	1	2	3	4	5	6
$\frac{x^2 - 2x - 3}{x - 3}$							
$x + 1$							

32.

x	0	1	2	3	4	5	6
$\frac{x - 3}{x^2 - x - 6}$							
$\frac{1}{x + 2}$							

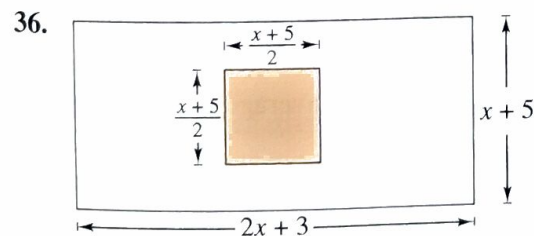
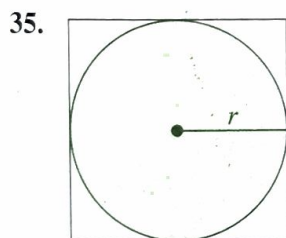
33. **Error Analysis** Describe the error.

$$\frac{5x^3}{2x^3 + 4} = \frac{5x^3}{2x^3 + 4} = \frac{5}{2 + 4} = \frac{5}{6}$$

34. **Think About It** Is the following statement true for all nonzero real numbers a and b ? Explain.

$$\frac{ax - b}{b - ax} = -1$$

In Exercises 35 and 36, find the ratio of the area of the shaded portion of the figure to the total area of the figure.



In Exercises 37–50, perform the multiplication or division and simplify.

37. $\frac{5}{x - 1} \cdot \frac{x - 1}{25(x - 2)}$ 38. $\frac{x + 13}{x^3(3 - x)} \cdot \frac{x(x - 3)}{5}$

39. $\frac{(x + 5)(x - 3)}{x + 2} \cdot \frac{1}{(x + 5)(x + 2)}$

40. $\frac{(x - 9)(x + 7)}{x + 1} \cdot \frac{x}{9 - x}$

41. $\frac{r}{r - 1} \cdot \frac{r^2 - 1}{r^2}$ 42. $\frac{4y - 16}{5y + 15} \cdot \frac{2y + 6}{4 - y}$

43. $\frac{t^2 - t - 6}{t^2 + 6t + 9} \cdot \frac{t + 3}{t^2 - 4}$

44. $\frac{y^3 - 8}{2y^3} \cdot \frac{4y}{y^2 - 5y + 6}$

45. $\frac{x^2 + xy - 2y^2}{x^3 + x^2y} \cdot \frac{x}{x^2 + 3xy + 2y^2}$

46. $\frac{x^3 - 1}{x + 1} \cdot \frac{x^2 + 1}{x^2 - 1}$

47. $\frac{3(x + y)}{4} \div \frac{x + y}{2}$

48. $\frac{x + 2}{5(x - 3)} \div \frac{x - 2}{5(x - 3)}$

49. $\left[\frac{x^2}{(x + 1)^2} \right]$

50. $\left(\frac{x^2 - 1}{x} \right)$

50. $\left[\frac{x}{(x + 1)^3} \right]$

50. $\left[\frac{(x - 1)^2}{x} \right]$

In Exercises 51–64, perform the addition or subtraction and simplify.

51. $\frac{5}{x - 1} + \frac{x}{x - 1}$

52. $\frac{2x - 1}{x + 3} + \frac{1 - x}{x + 3}$

53. $6 - \frac{5}{x + 3}$

54. $\frac{3}{x - 1} - 5$

55. $\frac{3}{x - 2} + \frac{5}{2 - x}$

56. $\frac{2x}{x - 5} - \frac{5}{5 - x}$

57. $\frac{2}{x^2 - 4} - \frac{1}{x^2 - 3x + 2}$

58. $\frac{x}{x^2 + x - 2} - \frac{1}{x + 2}$