

## 2.2 Multiplication and Division of Rational Expressions

## Solutions

Multiply and simplify.

1.

$$\frac{16x^2}{y^4} \cdot \frac{5x^2}{4y^2}$$

$$= \frac{\overset{4}{\cancel{16}} \cdot 5 \cdot \overset{2}{\cancel{x^2}} \cdot \overset{2}{\cancel{x^2}}}{\cancel{4} \cdot y^4 \cdot y^2}$$

$$= \frac{20x^4}{y^6}$$

2.

$$\frac{12x^3y}{6xy^5} \cdot \frac{5xy^2}{25x^4y^4}$$

3.

$$\frac{3a^2}{a+2} \cdot \frac{a^2-4}{3a}$$

$$= \frac{\cancel{3} \cdot \overset{2}{\cancel{a}} \cdot a \cdot \overset{2}{\cancel{(a+2)}} \cdot \overset{2}{\cancel{(a-2)}}}{\cancel{3} \cdot \overset{2}{\cancel{a}} \cdot \cancel{a}}$$

$$= a(a-2)$$

4.

$$\frac{y-1}{4y} \cdot \frac{8y^2-16y}{3-3y}$$

5.

$$\frac{x-4}{3-x} \cdot \frac{x-3}{3x-12}$$

$$= \frac{\overset{x-4}{\cancel{-(x-3)}} \cdot \overset{x-3}{\cancel{3(x-4)}}}{\overset{x-4}{\cancel{-(x-3)}} \cdot \overset{x-3}{\cancel{3(x-4)}}}$$

$$= -\frac{1}{3}$$

6.

$$\frac{x^2-4}{3x+12} \cdot \frac{x+4}{2-x}$$

Answers: 1.  $\frac{20x^4}{y^6}$ ; 3.  $a(a-2)$ ; 5.  $-\frac{1}{3}$

Multiply and simplify.

7.

$$\frac{x^2 + 5x + 6}{x^2 - 5x - 14} \cdot \frac{x^2 - 3x - 28}{x^2 + 4x + 3}$$
$$= \frac{(x+2)(x+3)}{(x+2)(x-7)} \cdot \frac{(x-7)(x+4)}{(x+3)(x+1)}$$
$$= \frac{x+4}{x+1}$$

8.

9.

$$\frac{2y^2 - 5y - 12}{4y^2 + 8y + 3} \cdot \frac{2y^2 + 7y + 3}{y^2 - 16}$$
$$= \frac{(2y+3)(y-4)}{(2y+3)(2y+1)} \cdot \frac{(2y+1)(y+3)}{(y+4)(y-4)}$$
$$= \frac{y+3}{y+4}$$

10.

$$\frac{x^2 - 7x + 12}{x^2 + 2x - 15} \cdot \frac{x^2 - 25}{x^2 - 16}$$

Answers: 7.  $\frac{x+4}{x+1}$ ; 9.  $\frac{y+3}{y+4}$

Divide and simplify.

11.

$$\begin{aligned}\frac{9x^3}{4} \div \frac{3}{16y^2} &= \frac{9x^3}{4} \cdot \frac{16y^2}{3} \\ &= \frac{\overset{3}{\cancel{9}}x^3}{\underset{4}{\cancel{4}}} \cdot \frac{\overset{4}{\cancel{16}}y^2}{\underset{3}{\cancel{3}}} \\ &= 12x^3y^2\end{aligned}$$

12.

$$\frac{12x^8}{3y^4} \div \frac{16x^3}{6y}$$

13.

$$\begin{aligned}\frac{y^2+2y}{6y} \div \frac{y^2-4}{3y^2} &= \frac{y^2+2y}{6y} \cdot \frac{3y^2}{y^2-4} \\ &= \frac{\overset{y}{\cancel{y}}(\overset{2}{\cancel{2}}y)}{\underset{2}{\cancel{6}}y} \cdot \frac{\overset{3}{\cancel{3}}y^2}{(\overset{y}{\cancel{y}}+2)(y-2)} \\ &= \frac{y^2}{2(y-2)}\end{aligned}$$

14.

$$\frac{3y+15}{y} \div \frac{y+5}{y}$$

15.

$$\begin{aligned}\frac{y^2-36}{y^2-8y+16} \div \frac{3y-18}{y^2-y-12} \\ &= \frac{(y+6)(\overset{y}{\cancel{y}}-\overset{6}{\cancel{6}})}{(y-4)(\overset{y}{\cancel{y}}-\overset{4}{\cancel{4}})} \cdot \frac{(y+3)(\overset{y}{\cancel{y}}-\overset{4}{\cancel{4}})}{3(\overset{y}{\cancel{y}}-\overset{6}{\cancel{6}})} \\ &= \frac{(y+6)(y+3)}{3(y-4)}\end{aligned}$$

16.

$$\frac{y^2+y-12}{y^3+9y^2+20y} \div \frac{y^2-9}{y^3+3y^2}$$

Answers: 11.  $12x^3y^2$ ; 13.  $\frac{y^2}{2(y-2)}$ ; 15.  $\frac{(y+6)(y+3)}{3(y-4)}$

Simplify completely.

17.

$$\frac{2x^2 - 3x - 14}{2x^2 - 9x + 7} \div \frac{6x^2 + x - 15}{3x^2 + 2x - 5} \cdot \frac{6x^2 - 7x - 3}{2x^2 - x - 3}$$

$$\frac{\cancel{(2x-7)}(x+2)}{\cancel{(2x-7)}\cancel{(x-1)}} \cdot \frac{\cancel{(3x+5)}\cancel{(x-1)}}{\cancel{(3x+5)}(2x-3)} \cdot \frac{\cancel{(3x+1)}\cancel{(2x-3)}}{\cancel{(2x-3)}(x+1)}$$

$$= \frac{(x+2)(3x+1)}{(2x-3)(x+1)}$$

18.

$$\frac{10x^2 - 17x + 3}{15x^2 - 8x + 1} \div \frac{4x^2 - 12x + 9}{3x^2 + 3xy - x - y} \cdot \frac{6x^2 - 11x + 3}{2x^2 - 11x + 12}$$

19.

$$\frac{x^3 - 27}{x^2 - 9} \cdot \frac{x^2 - 6x + 9}{x^2 + 3x + 9}$$

$$= \frac{\cancel{(x-3)}(x^2 + 3x + 9)}{\cancel{(x-3)}(x+3)} \cdot \frac{(x-3)\cancel{(x-3)}}{\cancel{x^2 + 3x + 9}}$$

$$= \frac{(x-3)(x-3)}{x+3}$$

20.

$$\frac{x^3 - 64}{x^3 + 64} \div \frac{x^2 - 16}{x^2 - 4x + 16}$$

Answers: 17.  $\frac{(x+2)(3x+1)}{(2x-3)(x+1)}$ ; 19.  $\frac{(x-3)^2}{x+3}$