

## Extend

26. Write in simplest form. Identify any non-permissible values.

a) 
$$\frac{(x+2)^2 - (x+2) - 20}{x^2 - 9}$$

$$\begin{array}{l} a^2 - a - 20 \\ (a-5)(a+4) \end{array}$$

$$\frac{(x+2-5)(x+2+4)}{(x+3)(x-3)}$$

$$\frac{(x-3)(x+6)}{(x+3)(x-3)}$$

$$\frac{x+6}{x+3} \quad x \neq \pm 3$$

$$\begin{array}{l} \sin^2 x - \sin x - 20 \\ (\sin x - 5)(\sin x + 4) \end{array}$$

$$\text{b) } \frac{4(x^2 - 9)^2 - (x + 3)^2}{x^2 + 6x + 9}$$

$$\frac{4[(x+3)(x-3)]^2 - (x+3)^2}{(x+3)^2}$$

$$\frac{4\cancel{(x+3)}^2(x-3)^2 - \cancel{(x+3)}^2}{\cancel{(x+3)}^2}$$

$$\frac{\cancel{(x+3)}^2 [4(x-3)^2 - 1]}{\cancel{(x+3)}^2}$$

$$\boxed{4(x-3)^2 - 1 \quad x \neq -3}$$

$$4(x^2 - 6x + 9) - 1$$

$$4x^2 - 24x + 35 \quad \checkmark$$

$$(2x-7)(2x-5) \quad \checkmark$$

$$c) \frac{(x^2 - x)^2 - 8(x^2 - x) + 12}{(x^2 - 4)^2 - (x - 2)^2}$$

$$\boxed{a^2 - 8a + 12 \text{ numerat.} \\ (a-6)(a-2)}$$

$$\frac{(x^2 - x - 6)(x^2 - x - 2)}{[(x+2)(x-2)]^2 - (x-2)^2}$$

$$\frac{(x-3)(x+2)(x-2)(x+1)}{(x-2)^2 [(x+2)^2 - 1]}$$

$$\frac{(x-3)(x+2)(x+1)}{(x-2)(x^2+4x+3)}$$

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

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

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

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

$$x \neq -3, -1, 2$$

$$d) \frac{(x^2 + 4x + 4)^2 - 10(x^2 + 4x + 4) + 9}{(2x + 1)^2 - (x + 2)^2}$$

numerator  $a^2 - 10a + 9$   
 $(a-9)(a-1)$

$$\frac{(x^2 + 4x + 4 - 9)(x^2 + 4x + 4 - 1)}{(2x + 1)^2 - (x + 2)^2}$$

$$(4x^2 + 4x + 1) - (x^2 + 4x + 4)$$

$$\frac{(x^2 + 4x - 5)(x^2 + 4x + 3)}{3x^2 - 3}$$

$$3x^2 - 3$$

$$\frac{(x+5)(x-1)(x+1)(x+3)}{3(x+1)(x-1)}$$

$$3(x+1)(x-1)$$

$$\frac{(x+5)(x+3)}{3}$$

$$x \neq -\frac{1}{2}, -2, \pm 1$$

## 6.2 Multiplying and Dividing Rational Expressions

### Example 1

#### Multiply Rational Expressions

Multiply. Write your answer in simplest form.  
Identify all non-permissible values.

$$\frac{a^2 - a - 12}{a^2 - 9} \times \frac{a^2 - 4a + 3}{a^2 - 4a}$$

$$\frac{\cancel{(a-4)}\cancel{(a+3)}}{\cancel{(a+3)}\cancel{(a-3)}} \frac{\cancel{(a-3)}(a-1)}{a\cancel{(a-4)}}$$

$$\frac{a-1}{a}$$

$$a \neq \pm 3, 0, 4$$

### Your Turn

Express each product in simplest form.  
What are the non-permissible values?

a)  $\frac{d}{2\pi r} \times \frac{2\pi r h}{d-2}$

$$\frac{\cancel{2\pi} d \cancel{r} h}{\cancel{2\pi} r (d-2)}$$

$$\frac{dh}{d-2}$$

$\frac{dh}{d-2}$	$r \neq 0$
	$d \neq 2$

$$\text{b) } \frac{y^2 - 9}{r^3 - r} \times \frac{r^2 - r}{y + 3}$$

$$\frac{\cancel{(y+3)}(y-3)}{\cancel{r}(r+1)\cancel{(r-1)}} \cdot \frac{\cancel{r}(r-1)}{\cancel{y+3}}$$

$$\boxed{\frac{y-3}{r+1} \quad \begin{array}{l} r \neq 0 \pm 1 \\ y \neq -3 \end{array}}$$

$$\frac{1}{2} \div \frac{2}{3}$$

$$\frac{1}{2} \times \frac{3}{2} = \frac{3}{4}$$



## Example 2

### Divide Rational Expressions

Determine the quotient in simplest form.  
Identify all non-permissible values.

$$\frac{x^2 - 4}{x^2 - 4x} \div \frac{x^2 + x - 6}{x^2 + x - 20}$$

$$\frac{(x+2)(x-2)}{x(x-4)} \div \frac{(x+3)(x-2)}{(x+5)(x-4)} \rightarrow x \neq -5, 4$$

$$\frac{(x+2)\cancel{(x-2)}}{x\cancel{(x-4)}} \cdot \frac{(x+5)\cancel{(x-4)}}{(x+3)\cancel{(x-2)}}$$

$$\frac{(x+2)(x+5)}{x(x+3)}$$

$$x \neq 0, 4, -3, 2, -5$$

0/10

## Your Turn

Simplify. What are the non-permissible values?

$$\frac{c^2 - 6c - 7}{c^2 - 49} \div \frac{c^2 + 8c + 7}{c^2 + 7c}$$

$$\frac{\cancel{(c-7)}\cancel{(c+1)}}{\cancel{(c-7)}(c+7)} \cdot \frac{c\cancel{(c+7)}}{\cancel{(c+1)}\cancel{(c+7)}}$$

$$\frac{c}{c+7} \quad c \neq \pm 7, -1, 0$$

$$6x^2 + 13x + 6$$

$$\begin{array}{l} p \ 36 \\ s \ 13 \\ q \ 4 \end{array}$$

$$\begin{array}{l} x^2 + 6x + 8 \\ (x+4)(x+2) \end{array}$$

$$\underline{6x^2 + 9x} + \underline{4x + 6}$$

$$3x(2x+3) + 2(2x+3)$$

$$\rightarrow (2x+3)(3x+2)$$

$$\rightarrow \begin{array}{l} b^2 - 4ac \\ 169 - 144 \end{array}$$

25 perfect square  
 $\therefore$  factors.

### Example 3

#### Multiply and Divide Rational Expressions

Simplify. What are the non-permissible values?

$$\frac{2m^2 - 7m - 15}{2m^2 - 10m} \div \frac{4m^2 - 9}{6} \times (3 - 2m)$$

$$\frac{\cancel{(2m+3)}\cancel{(m-5)}}{\cancel{2m}\cancel{(m-5)}} \cdot \frac{\cancel{6} \cdot 3}{\cancel{(2m+3)}(2m-3)} \cdot \frac{(3-2m)}{1}$$

$$\frac{3\cancel{(3-2m)}}{m(2m-3)}$$

$$-\frac{3}{m} \quad m \neq 0, 5, \pm \frac{3}{2}$$

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