

# Simplifying Rational Expressions Part 2

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## PRE-CALCULUS 11 RATIONAL EXPRESSIONS SIMPLIFYING RATIONAL EXPRESSIONS PART 2

### A. Definitions

1. **rational expression:** an algebra expression that can be written in the form of a fraction.
2. **non-permissible values (undefined value):** values that make the denominator of the fraction zero.

### B. Examples

- 1) Determine the non-permissible values and simplify the following.

a)  $\frac{18x^3}{10xy}$  <sup>Term</sup>  $x \neq 0, y \neq 0$  <sup>Term</sup>

$$= \frac{9x^2}{5}$$

b)  $\frac{2m-6}{12-4m}$  <sup>Exp</sup>  $\frac{2m-6}{-4m+12}$  <sup>Exp</sup>

$$= \frac{-4m+12}{-4m+12} = 1$$

$-4m+12=0$   
 $-4m = -12$   
 $m = 3$

$$= \frac{-1}{2}$$

c)  $\frac{x-5}{7x^2-35x}$  <sup>Exp</sup>  $7x^2-35x=0$   
 $7x(x-5)=0$   
 $x \neq 0, 5$

$$= \frac{1}{7x}$$

d)  $\frac{3x^2-9x-30}{3x+6}$  <sup>Exp</sup>  $3x^2-9x-30=0$   
 $3(x^2-3x-10)=0$   
 $3(x-5)(x+2)=0$   
 $x \neq -2$

$$= x-5$$

$$\begin{array}{r} 20 \\ -5 \quad -4 \\ -9 \end{array}$$

e)  $\frac{m^2 - 9m + 20}{2m^2 - 32}$  <sup>Exp</sup> <sub>Exp</sub>

$$\frac{(m-5)(\cancel{m+4})}{2(m+4)(\cancel{m+4})}$$

$$= \boxed{\frac{m-5}{2(m+4)} \quad \text{or} \quad \frac{m-5}{2m+8}}$$

$$\begin{aligned} 2m^2 - 32 &= 0 \\ 2(m^2 - 16) &= 0 \\ 2(m+4)(m-4) &= 0 \\ \underline{m \neq -4, 4} \end{aligned}$$

f)  $\frac{2a^2 + 8a - 24}{4a^2 + 36a + 72}$  <sup>Exp</sup> <sub>Exp</sub>

$$\frac{2(a^2 + 4a - 12)}{4(a+6)(a+3)}$$

$$\frac{2(\cancel{a+6})(a-2)}{4(\cancel{a+6})(a+3)}$$

$$\boxed{\frac{1(a-2)}{2(a+3)} \quad \text{or} \quad \frac{a-2}{2a+6}}$$

$$\begin{aligned} 4a^2 + 36a + 72 &= 0 \\ 4(a^2 + 9a + 18) &= 0 \end{aligned}$$

$$\begin{array}{r} 18 \\ 6 \quad 3 \\ 9 \end{array}$$

$$4(a+6)(a+3) = 0$$

$$\underline{a \neq -6, -3}$$

$$\begin{array}{r} -12 \\ 6 \quad -2 \\ 4 \end{array}$$

Assignment: Simplifying Rational Expressions Assignment #4, 5, 7, 8, 9, 10, 11

4. Determine the nonpermissible values of the variable.

a)  $\frac{6}{8x-7}$     b)  $\frac{y}{10y+20}$     c)  $\frac{5a}{5-a}$     d)  $\frac{a^2+7a+12}{(a+4)(a+5)}$     e)  $\frac{12y^2-2}{y}$

f)  $\frac{1+16x^2}{1-16x^2}$     g)  $\frac{40p^3-4}{8q^3}$     h)  $\frac{3}{x^2+13x+12}$     i)  $\frac{d}{d^2-8d+16}$

5. Express in simplest form stating the nonpermissible values of the variable.

a)  $\frac{4ab}{16a}$     b)  $\frac{25x^3y^4}{5y^9}$     c)  $\frac{(a+3)(a-8)}{(a+1)(a-8)}$     d)  $\frac{(x+7)(x-2)}{x(x-2)(x+14)}$

e)  $\frac{y+9}{y^2-81}$     f)  $\frac{25y^2-36}{5y+6}$     g)  $\frac{64-9p^2}{(8-3p)(3+8p)}$     h)  $\frac{x^2-100}{(x+10)^2}$

6. The area of a soccer field is represented by  $a^2 - 12a + 32$  square metres.

a) Find a simplified expression for the length of the field if the width can be represented by  $a - 8$  metres.

b) Calculate the area of the field if  $a = 90$ .

7. Reduce to lowest terms stating the restrictions on the variable.

a)  $\frac{(t+3)^2}{(t+1)(t+3)}$     b)  $\frac{x^2-1}{x^2+2x+1}$     c)  $\frac{e^2+2e-35}{e^2+14e+49}$     d)  $\frac{m^2-2m-15}{m^2+12m+27}$

e)  $\frac{y^2+4y}{y^2-16}$     f)  $\frac{x^2+9x-22}{x^2+12x+11}$     g)  $\frac{a^2+11a+10}{a^2+8a-20}$     h)  $\frac{p^2+5p+6}{p^2-4}$

8. When simplified the rational expression  $\frac{a^2+a-2}{a^2-1}$  can be reduced to

- A.  $\frac{a-2}{-1}$   
B.  $\frac{a-2}{a-1}$   
C.  $\frac{a+2}{a+1}$   
D.  $\frac{a-2}{a+1}$

9.  $\frac{(x-y)^2}{x^2-y^2}$  is equivalent to

- A. 0  
B. 1  
C.  $\left(\frac{1}{x} - \frac{1}{y}\right)^2$   
D.  $\frac{x-y}{x+y}$

10. In the rational expression  $\frac{a-3}{a(a+7)}$  the nonpermissible value(s) of  $a$  are

- A. 3, -7
- B. 0, 3, -7
- C. 0, -7
- D. -7



11. The rational expressions  $\frac{x^2 + 13x + 40}{x^2 - 13x + 40}$  and  $\frac{64 + x^2}{64 - x^2}$  have one nonpermissible value in common.  
To the nearest tenth, this nonpermissible value is \_\_\_\_\_.

(Record your answer in the numerical response box from left to right)

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**Answer Key**

1. a)  $7(y-7)$  b)  $4(a^2+4)$  c)  $4(a-2)(a+2)$  d)  $-3c(1+9c)$  e)  $2(5x-3)(5x+3)$   
f)  $(10-t)(10+t)$  g)  $(a-2)(a+2)(a^2+4)$  h)  $3x(x-4)(x+4)(x^2+16)$

2. a)  $(x+7)(x+3)$  b)  $(y-2)^2$  c)  $(t-9)(t+8)$  d)  $b(b+8)(b-5)$   
e)  $(3a+1)(a-2)$  f)  $(4p+9)(2p+1)$  g)  $5(2p-1)(p+3)$  h)  $3(3x-2)^2$

3. b and c.

4. a)  $x \neq \frac{7}{8}$  b)  $y \neq -2$  c)  $a \neq 5$  d)  $a \neq -5, -4$  e)  $y \neq 0$   
f)  $x \neq \pm \frac{1}{4}$  g)  $q \neq 0$  h)  $x \neq -12, -1$  i)  $d \neq 4$

5. a)  $\frac{b}{4}, a \neq 0$  b)  $\frac{5x^3}{y^5}, y \neq 0$  c)  $\frac{a+3}{a+1}, a \neq -1, 8$  d)  $\frac{x+7}{x(x+14)}, x \neq -14, 0, 2$   
e)  $\frac{1}{y-9}, y \neq \pm 9$  f)  $5y-6, y \neq \frac{6}{5}$  g)  $\frac{8+3p}{3+8p}, p \neq \frac{3}{8}, \frac{8}{3}$  h)  $\frac{x-10}{x+10}, x \neq -10$

6. a)  $a-4$  metres b) 7052 square metres

7. a)  $\frac{t+3}{t+1}, t \neq -1, -3$  b)  $\frac{x-1}{x+1}, x \neq -1$  c)  $\frac{e-5}{e+7}, e \neq -7$  d)  $\frac{m-5}{m+9}, m \neq -9, -3$   
e)  $\frac{y}{y-4}, y \neq \pm 4$  f)  $\frac{x-2}{x+1}, x \neq -11, -1$  g)  $\frac{a+1}{a-2}, a \neq -10, 2$  h)  $\frac{p+3}{p-2}, p \neq \pm 2$

8. C 9. D 10. C 11. 

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