

Examples of rational numbers: a) $\frac{3}{5}$ b) $-8 = \frac{-8}{1}$ c) $0.13 = \frac{13}{100}$

Examples of rational expressions: a) $\frac{3+x}{5-x}$ b) $\frac{x^2-2x}{x^2}$ c) $\frac{3x}{9-x^2}$
 d) $\frac{1}{xy}$ e) $\frac{3x}{x^2+4}$ f) $\frac{-2x^2}{x^2+4x-5}$

RESTRICTIONS

Because the denominator cannot equal 0, we must **restrict** values of x so that the denominator does not equal 0.

Restrict the following rational expressions:

a) $\frac{3+x}{5-x}$ $5-x \neq 0$
 $\boxed{5 \neq x}$
 Restriction: $x \neq 5$

d) $\frac{1}{xy}$ $x \cdot y \neq 0$ Restrictions
 $x \neq 0$ or $y \neq 0$

b) $\frac{x^2-2x}{x^2}$ $\sqrt{x^2 \neq 0}$
 $x \neq 0$

e) $\frac{3x}{x^2+4}$ $x^2+4 \neq 0$
 $\sqrt{x^2} = \sqrt{-4}$ cannot square root.
 NO restrictions because no matter what you sub for "x" it'll be either 0 or a positive number.

c) $\frac{3x}{9-x^2}$ $9-x^2 \neq 0$
 $\sqrt{9} \neq \sqrt{x^2}$
 $3 \neq x$ or $-3 \neq x$ } $\{x \neq -3, 3\}$

f) $\frac{-2x^2}{x^2+4x-5}$ $x^2+4x-5 \neq 0$ $\frac{x}{-5} \mid \frac{x}{+4} \mid \frac{x}{-5}$
 $(x-1)(x+5) \neq 0$
 $x-1 \neq 0$ $x+5 \neq 0$
 $x \neq 1$ $x \neq -5$
 $\{x \neq -5, 1\}$

SIMPLIFYING RATIONAL EXPRESSIONS

- 1) Common factor or factor the expressions both in the numerator and denominator.
- 2) State restrictions.
- 3) Cancel out the same terms
- 4) State restrictions one more time.

Ex1. $\frac{x^2 - 2x}{x^2} = \frac{\cancel{x}(x-2)}{\cancel{x} \cdot x}$ Restriction ① $x \neq 0$

$$= \frac{(x-2)}{x}$$

Restriction ② $x \neq 0$

Ex2. $\frac{x^2 - 9}{x^2 - 2x - 15} = \frac{(x-3)\cancel{(x+3)}}{\cancel{(x+3)}(x-5)}$ Restriction ① $x \neq -3, x \neq 5$

$$= \frac{x-3}{x-5}$$

Restriction ② $\{x \neq -3, 5\}$

Ex3. $\frac{x^2 + 7x - 8}{2 - 2x} = \frac{\overset{-1}{\cancel{(x-1)}}(x+8)}{2\cancel{(1-x)}}$ Restriction ① $x \neq 1$

Note $x-1$ is $-1 \cdot (1-x)$

$$= \frac{x+8}{2}$$

Restriction ② $x \neq 1$