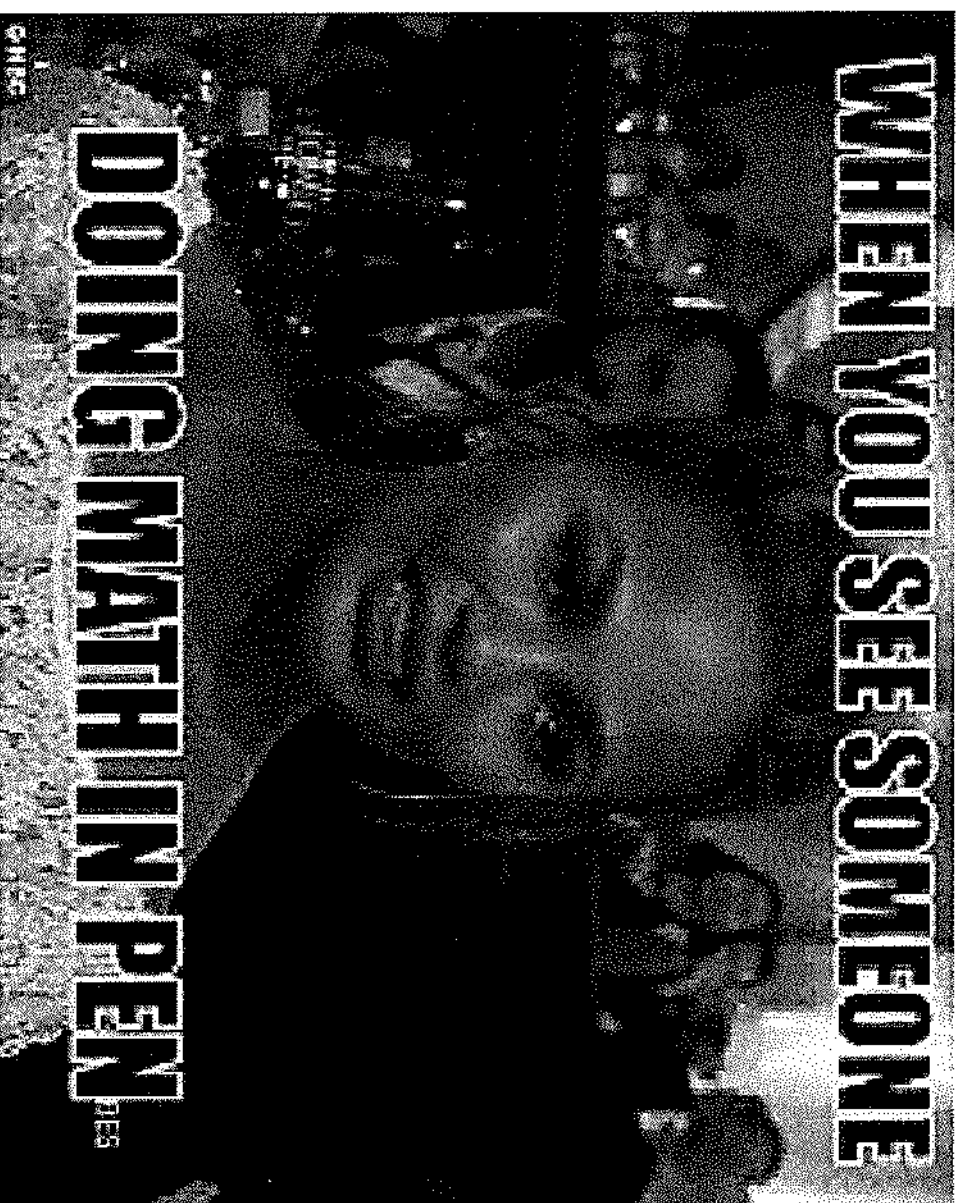


Notes

Simplifying Rational Expressions

Multiplying/Dividing Rational Expressions



ex: True or False?

a) $\frac{x}{x+3} = \frac{1}{3}$ **False**, can not cancel out the "x"

b) $\frac{x+4}{x-8} = -\frac{1}{2}$ **False**, can not cancel out the "x"

c) $\frac{1}{x(x+1)} = \frac{1}{x+1}$ **true**
multiplication

Rational Expressions

A rational expression has the form

$$\frac{f(x)}{g(x)} \quad \text{where}$$

$f(x)$ and $g(x)$ polynomials and $g(x) \neq 0$.

A rational expression is in simplified form when its numerator and denominator have NO common factors.

ex: Simplify.

a) $\frac{50a}{25a^2 - 25a}$

$$\frac{250a}{25a(a-1)}$$

$$\boxed{\frac{2}{a-1}}$$

① factor completely

② reduce

③ answer

"Before cancelling"

Restrictions (denominator) :

$$25a(a-1) = 0$$

/

$$a = 0 \quad a - 1 = 0$$

$$a = 1$$

$$\boxed{a \neq 0 \quad a \neq 1}$$

ex: Simplify.

$$b) \frac{56x + 16}{64}$$

$$\frac{8(7x + 2)}{8 \cancel{64}}$$

$$\boxed{\frac{7x + 2}{8}}$$

no restrictions

b/c no variable

in denominator

ex: Simplify.

$$c) \frac{10x^2 + 16x}{6x^2 + 8x}$$

$$\frac{2x(5x+8)}{2x(3x+4)}$$

$5x+8$
$3x+4$

Restrictions:

$$2x(3x+4) = 0$$

$$/ \quad 3x+4=0$$

$$2x=0 \quad 3x=-4$$

$$x=0$$

$$x = -\frac{4}{3}$$

$x \neq 0, x \neq -\frac{4}{3}$

ex: Simplify.

d) $\frac{3x + 18}{x^2 - 36}$

pos

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

$$\boxed{\frac{3}{x-6}}$$

ex: Simplify.

$$e) \frac{2x^2 - 6x - 36}{4x^2 - 16x + 12}$$

$$\frac{2(x^2 - 3x - 18)}{4(x^2 - 4x + 3)}$$

$$\frac{2(x+3)(x-6)}{2^2(x-3)(x-1)}$$

$$\frac{(x+3)(x-6)}{2(x-3)(x-1)}$$

e)

$$\frac{2m^2 - 2m - 12}{7m^2 - 16m - 15}$$

$$\frac{2(n^2 - n - 6)}{7n^2 - 16n - 15}$$

$$\frac{2(n+2)(n-3)}{(7n+5)(n-3)}$$

$$\frac{2(n+2)}{7n+5}$$

$$\frac{3 \cancel{15} \times \cancel{7}}{\cancel{10} \times 5}$$

$$\frac{35}{3 \sqrt{105}}$$

$$5 \sqrt{105}$$

$$n^2 - n - 6$$

$$+2 \quad -3$$

$$7n^2 - 16n - 15$$

$$(7n+5)(n-3)$$



$$-105$$

$$\frac{7n}{+5} \quad \frac{7n}{-21}$$

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

ex: Simplify.

$$f) \frac{2x^2 + 10x}{3x^2 + 16x + 5}$$



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

$$\boxed{\frac{2x}{3x+1}}$$

$$+ 15 \left(\frac{3x}{+1} \right)$$

$$+ \frac{3x}{+15} \left(\frac{1x}{+5} \right)$$

ex: Simplify.

$$g) \frac{5x^3 + 20x^2 + 15x}{x^3 - 6x^2 - 9x + 54}$$

$$\frac{5x(x^2 + 4x + 3)}{x^2(x - 6) - 9(x - 6)}$$

$$\frac{5x(x+1)\cancel{(x+3)}}{(x-6)\cancel{(x+3)}(x-3)}$$

$$\boxed{\frac{5x(x+1)}{(x-6)(x-3)}}$$

ex: Simplify.

$$h) \frac{x^2 - 4}{x^3 - 8}$$

DOs

diff. of cubes \Rightarrow SOAP
(rule)

$$a = x$$

$$b = 2$$

$$a^2 = x^2$$

$$ab = 2x$$

$$b^2 = 4$$

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

$$\frac{\cancel{(x-2)}(x^2+2x+4)}{s \quad 2 \quad \text{AP}}$$

$$\left[\frac{x+2}{x^2+2x+4} \right]$$

$$\begin{array}{r} \cancel{4} \\ 1 \quad \cancel{4} \\ 2 \quad \cancel{4} \end{array}$$

REVIEW: Perform the indicated operation.

a) $\frac{1}{2} \cdot \frac{4}{5}$
 ~~$\frac{1}{2} \cdot \frac{4}{5}$~~

$$\boxed{\frac{2}{5}}$$

① Reduce

② "Multiply across"

Numerators →
denominators →

REVIEW: Perform the indicated operation.

$$b) \frac{1}{2} \div \frac{4}{5}$$

↓

$$\frac{1}{2} \cdot \frac{5}{4}$$

*nothing
reduces
here.*

$$\boxed{\frac{5}{8}}$$

① "Stay - change - flip"
Keep

② reduce

③ "multiply across"

The rules for multiplying, dividing, adding and subtracting fractions are the SAME for rational expressions!

Multiplying

① Factor completely

② Reduce

③ Answer

ex: Perform the indicated operation. Express your answer in simplest form.

a) $\frac{x^2 - 6x - 16}{x^2 - 16x + 24} \cdot \frac{x - 8}{x^2 + 5x + 6}$ mult.

Prime

$$\frac{(x-8)(\cancel{x+2})}{(x^2-16x+24)} \cdot \frac{(x-8)}{(\cancel{x+2})(x+3)}$$

$$\frac{(x-8)^2}{(x+3)(x^2-16x+24)}$$

$$\begin{array}{r} +24 \\ \hline 1 \quad 24 \\ 2 \quad 12 \\ 4 \quad 6 \\ 3 \quad 8 \end{array}$$

$$\begin{array}{r} +6 \\ -1 + 6 \\ +2 + 3 \end{array} \bigg) x$$

ex: Perform the indicated operation. Express your answer in simplest form. mult.

$$b) \frac{x^2 - 5x - 36}{x^2 - 49} \cdot \left(\frac{x^2 - 11x + 28}{1} \right)$$

$$\begin{array}{l} -36 \leftarrow \\ +4 \quad -9 \end{array}$$

$$\frac{(x+4)(x-9)}{(x+7)(x-7)} \cdot \frac{(x-4)(x-7)}{1}$$

$$\begin{array}{l} +28 \leftarrow \\ -4 \quad -7 \end{array}$$

$$\left[\frac{(x+4)(x-9)(x-4)}{x+7} \right]$$

ex: Perform the indicated operation. Express your answer in simplest form.

$$c) \frac{8x-20}{x^2+2x-35} \div \frac{4x^2-16}{x^2-7x+10}$$

Keep change flip

$$\frac{8x-20}{x^2+2x-35} \cdot \frac{x^2-7x+10}{4x^2-16}$$

$$4x^2-16$$

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

Das

$$\frac{4(2x-5)}{(x+7)(x-5)} \cdot \frac{(x-5)(x-2)}{4(x+2)(x-2)}$$

$$\frac{2x-5}{(x+7)(x+2)}$$

Restrictions:
 $x \neq -7, 5, 2, -2$

from anything that was ever a denominator.

ex: Perform the indicated operation. Express your answer in simplest form.

$$d) \frac{x^3 - 3x^2 - 9x + 27}{3x^2 + 10x + 8} \div \frac{x^2 - 6x + 9}{3x^2 + x - 4}$$

$$\frac{\cancel{(x-3)}(x+3)\cancel{(x-3)}}{\cancel{(3x+4)}(x+2)} \cdot \frac{\cancel{(3x+4)}(x-1)}{\cancel{(x-3)}(x-5)}$$

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

See next

page →

for factoring

help

$$x^3 - 3x^2 - 9x + 27$$

$$x^2(x-3) - 9(x-3)$$

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