

Multiplying & Dividing Rational Expressions

Question? Do you need common denominators when you multiply or divide fractions?

Recap of "simplifying" fractions before we move on to \cdot and \div

Simplify the following.

1) $\frac{11x^2y^6}{33x^3y^3}$

$$\frac{y^3}{3x}$$

reduce the fraction, subtract the exponents

2) $\frac{2x^2 - 13x - 7}{2x - 14}$

hint: when in doubt...factor it out!

$$\frac{(2x+1)(\cancel{x-7})}{2(\cancel{x-7})} = \frac{2x+1}{2}$$

Which one of the following requires that you **cross multiply**?

3) $\frac{x-2}{5} = \frac{10}{x+3}$

4) $\frac{x-2}{5} \cdot \frac{10}{x+3}$

What can you do to #4 that involves the word **cross**? **cancel**

4) $\frac{x-2}{\cancel{5}} \cdot \frac{\cancel{10}}{x+3} = \frac{x-2}{1} \cdot \frac{2}{x+3} = \frac{2(x-2)}{x+3}$

Examples: (simplify the following multiplication problems by cross cancelling first)

5) $\frac{2}{3} \cdot \frac{4a}{9b^3} \cdot \frac{12b^5}{10a^2} = \frac{2}{3} \cdot \frac{4b^2}{5a} = \frac{8b^2}{15a}$

6) $\frac{3}{xy^9} \cdot \frac{(5xy^4)^3}{9} = \frac{1}{xy^9} \cdot \frac{125x^3y^{12}}{9} = \frac{1}{1} \cdot \frac{125x^2y^3}{3} = \frac{125x^2y^9}{3}$

Examples: (simplify the following mult. problems by **factoring**, then cancelling)

7) $\frac{b}{b^2+3b-28} \cdot \frac{(b+7)(b-7)}{16} = \frac{b(b-7)}{4(b-4)}$

8) $\frac{3(3-y)}{9-3y} \cdot \frac{4(3+d)}{12+4d} = \frac{-3(y-3)}{(d+8)(d+3)} \cdot \frac{4(3+d)}{y-3} = \frac{-12}{d+8}$

change to $-3(y-3)$



When dividing fractions, you need to reciprocate (flip) the second fraction, then change to multiplication.

Examples: (simplify the following division problems)

9) $\frac{12}{m^2n^3} \div \left(\frac{6m}{n^4}\right)^2$

$$= \frac{12}{m^2n^3} \div \frac{36m^2}{n^8} = \frac{\cancel{12}}{m^2n^3} \cdot \frac{\cancel{n^8}}{\cancel{36}m^2}$$

$$= \frac{1}{m^2} \cdot \frac{n^5}{3m^2} = \frac{n^5}{3m^4}$$

10) $\frac{w-7}{z^7} \div \frac{7-w}{z^4}$

$$= \frac{w-7}{z^7} \cdot \frac{z^4}{7-w} = \frac{\cancel{w-7}}{z^3} \cdot \frac{\cancel{z^4}}{-1(\cancel{w-7})}$$

$$= \frac{1}{-z^3} \text{ or } -\frac{1}{z^3}$$

11) $\frac{x^3+8}{x^2-9} \div \frac{x^2+7x+10}{x^2+2x-15}$

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

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

12) $\frac{1}{10-h} \cdot \frac{3h}{h^2-7h+12} \div \frac{6}{h^2-13h+30}$

$$= \frac{1}{-1(h-10)} \cdot \frac{\cancel{3}h}{(h-3)(h-4)} \cdot \frac{(h-3)(h-10)}{\cancel{6}_2}$$

$$= \frac{h}{-2(h-4)} \text{ or } -\frac{h}{2(h-4)}$$

no need to multiply any of these final answers out