Multiplying and Dividing

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Multiplying and Dividing Rationals

1. We always have to state the restrictions.
   - ➢ Dividing by zero is never allowed.
   - ➢ Sometimes this can be hard to see. For example, x^2+x-6 does not immediately look like it has zeroes of -3 and 2.
2. Factor all numerators and denominators.
   - ➢ This is so you can cancel terms. This will often be the case.
3. State the answer as one rational.

Let's start with multiplication:

$$\frac{x^2+x-6}{x^2+2x-15} \cdot \frac{x-3}{x-2}$$

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

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

$x \neq 3, -5, 2$

x^2+x-6 $\quad ab=-6$, $a+b=1$

$(x^2-2x)+(3x-6)$ $\quad 3, -2$

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

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

$x^2+2x-15$ $\quad ab=-15$, $a+b=2$

$(x^2-3x)+(5x-15)$ $\quad -3, 5$

$x(x-3)+5(x-3)$

$(x-3)(x+5)$

$$\frac{x^2+7x+12}{x^2+2x-15} \bullet \frac{x^2-5x+6}{x^2-16}$$

$x^2+7x+12$ $\quad ab=12$, $a+b=7$, $4, 3$

$(x^2+4x)+(3x+12)$

$x(x+4)+3(x+4)$

$(x+4)(x+3)$

$x^2+2x-15$

$(x-3)(x+5)$

x^2-5x+6 $\quad ab=6$, $a+b=-5$, $-3,-2$

$(x^2-3x)-(2x-6)$

$x(x-3)-2(x-3)$

$(x-3)(x-2)$

$a^2-b^2 \rightarrow (x+4)(x-4)$

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

restrictions: $x \neq 3, -5, \pm 4$

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

We love quadratics, we love factoring and we love fractions!

This should be the best chapter ever!

When we divide a couple things need to be remembered.

1. We invert and multiply when we have a fraction divided by a fraction.
   - ➢ This is sometimes called "multiply by the inverse".
   - ➢ I've heard others (only in this room) call it "kiss and flip".
2. You can not cancel terms until this is done.
3. We will end up with one more non permissible term.

$$\frac{\frac{x^2-x-20}{x^2-6x}}{\frac{x^2+9x+20}{x^2-12x+36}}$$

→ If any one of these are zero ...

$$x \cdot \frac{1}{2} = \frac{x}{2}$$

① ↓ ② ↑ ③ ④

$$\frac{x^2-x-20}{x^2-6x} \div \frac{x^2+9x+20}{x^2-12x+36}$$

1) $(x-5)(x+4)$
2) $(x+5)(x+4)$ ←
3) $x(x-6)$
4) $(x-6)(x-6)$
$(x-6)^2$

State the restrictions
→ 6, -5, -4

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

$$\frac{(x-5)(x-6)}{x(x+5)} \leftarrow$$

$$\frac{x^2+15x+56}{x^2-3x-54} \div \frac{x^2+6x-16}{x^2+4x-12}$$

hint: $\frac{x+7}{x-9}$

Homework: pg: 327
#1,2,4,7,8abc,10,15,16