
MULTIPLYING AND DIVIDING FRACTIONS

EXAMPLE 1: $\frac{a^4k^5}{u^2b^2} \cdot \frac{a^3k^4}{u^2b}$

$$= \frac{a^4k^5a^3k^4}{u^2b^2u^2b} \quad \text{(multiply tops and multiply bottoms)}$$

$$= \frac{a^4a^3k^5k^4}{u^2u^2b^2b} \quad \text{(rearrange the factors, top and bottom)}$$

$$= \boxed{\frac{a^7k^9}{u^4b^3}} \quad \text{(simplify by adding exponents)}$$

EXAMPLE 2: $\frac{k^4u^6}{ws^2} \cdot \frac{ws^4}{k^6u}$

$$= \frac{k^4u^6ws^4}{ws^2k^6u} \quad \text{(multiply tops and multiply bottoms)}$$

$$= \boxed{\frac{s^2u^5}{k^2}} \quad \text{(reduce the fraction)}$$

Alternate solution, with factoring and cross-canceling:

$$\frac{k^4u^6}{ws^2} \cdot \frac{ws^4}{k^6u}$$

$$= \frac{k^4u^5u}{ws^2} \cdot \frac{ws^2s^2}{k^4k^2u}$$

$$= \frac{k^4 u^5 \cancel{u}}{\cancel{u} s^2} \cdot \frac{\cancel{u} s^2 \cancel{s^2}}{k^4 k^2 \cancel{u}}$$

$$= \boxed{\frac{u^5 s^2}{k^2}}$$

EXAMPLE 3: $\frac{x^2 y}{z^2} \div \frac{y^4}{x^6 z^5}$

$$= \frac{x^2 y}{z^2} \cdot \frac{x^6 z^5}{y^4} \quad (\text{multiply by the reciprocal})$$

$$= \boxed{\frac{x^8 z^3}{y^3}} \quad (\text{cross-cancel } z\text{'s and } y\text{'s})$$

EXAMPLE 4: **Multiply:** $\frac{x^2 - 9}{x^2 - 6x + 9} \cdot \frac{x + 2}{x^2 + 5x + 6}$

Solution:

$$\frac{x^2 - 9}{x^2 - 6x + 9} \cdot \frac{x + 2}{x^2 + 5x + 6} \quad (\text{the given problem})$$

$$= \frac{(x + 3)(x - 3)}{(x - 3)(x - 3)} \cdot \frac{x + 2}{(x + 2)(x + 3)} \quad (\text{factor everything})$$

$$= \frac{\cancel{(x + 3)}(x - 3)}{(x - 3)\cancel{(x - 3)}} \cdot \frac{x + 2}{\cancel{(x + 2)}\cancel{(x + 3)}} \quad (\text{cancel})$$

$$= \boxed{\frac{1}{x - 3}} \quad (x - 3 \text{ is on the bottom})$$

EXAMPLE 5: Divide: $\frac{x+10}{x^2+6x-7} \div \frac{x-12}{x^2-13x+12}$

Solution:

$$\begin{aligned}
 & \frac{x+10}{x^2+6x-7} \div \frac{x-12}{x^2-13x+12} && \text{(the given problem)} \\
 = & \frac{x+10}{x^2+6x-7} \times \frac{x^2-13x+12}{x-12} && \text{(invert and multiply)} \\
 = & \frac{x+10}{(x+7)(x-1)} \times \frac{(x-1)(x-12)}{x-12} && \text{(factor everything)} \\
 = & \frac{x+10}{(x+7)\cancel{(x-1)}} \times \frac{\cancel{(x-1)}\cancel{(x-12)}}{\cancel{x-12}} && \text{(cancel)} \\
 = & \boxed{\frac{x+10}{x+7}}
 \end{aligned}$$

Homework

1. Multiply or divide:

$$\begin{array}{lll}
 \text{a. } \frac{x^2k}{t^4u^4} \div \frac{t^4u^5}{x^4k^3} & \text{b. } \frac{r^6a^6}{v^5u} \div \frac{r^4a^4}{vu^6} & \text{c. } \frac{w^2r^5}{k^6x} \div \frac{kx^6}{w^2r^5} \\
 \text{d. } \frac{r^5z^5}{b^2n^4} \cdot \frac{b^6n}{r^6z^4} & \text{e. } \frac{u^4w}{v^3m^2} \div \frac{uw^6}{v^6m} & \text{f. } \frac{ku^2}{v^6w^3} \cdot \frac{v^6w^5}{k^4u^3}
 \end{array}$$

2. Multiply or divide:

$$\begin{array}{ll}
 \text{a. } \frac{c-2}{c^2} \cdot \frac{c^2+4c}{c+4} & \text{b. } \frac{m}{m^2-2m-35} \cdot \frac{m^2-m-42}{m+6} \\
 \text{c. } \frac{c-2}{c^2} \div \frac{c-3}{c^2-4c} & \text{d. } \frac{v}{v^2+4v-21} \div \frac{v+10}{v^2-2v-63}
 \end{array}$$

$$\text{e. } \frac{q+6}{q^2+6q} \div \frac{q}{q^2+6q} \qquad \text{f. } \frac{v-1}{v^2-v-6} \cdot \frac{v^2-2v-3}{v+1}$$

3. Multiply or divide:

$$\text{a. } \frac{m-6}{m^2-21m+108} \div \frac{m+5}{m^2-4m-45}$$

$$\text{b. } \frac{c+7}{c^2-18c+80} \cdot \frac{c^2-6c-40}{c+4}$$

$$\text{c. } \frac{z-1}{z^2-15z+44} \cdot \frac{z^2+2z-24}{z+6}$$

$$\text{d. } \frac{z+4}{z^2+8z+7} \div \frac{z-4}{z^2-3z-4}$$

$$\text{e. } \frac{m+8}{m^2+22m+120} \div \frac{m+3}{m^2+18m+80}$$

$$\text{f. } \frac{u-8}{u^2-6u-7} \div \frac{u-10}{u^2-9u-10}$$

Solutions

1. a. $\frac{x^6 k^4}{t^8 u^9}$

b. $\frac{r^2 a^2 u^5}{v^4}$

c. $\frac{w^4 r^{10}}{k^7 x^7}$

d. $\frac{z b^4}{r n^3}$

e. $\frac{u^3 v^3}{w^5 m}$

f. $\frac{w^2}{k^3 u}$

2. a. $\frac{c-2}{c}$

b. $\frac{m}{m+5}$

c. $\frac{c^2-6c+8}{c^2-3c}$

d. $\frac{v^2-9v}{v^2+7v-30}$

e. $\frac{q+6}{q}$

f. $\frac{v-1}{v+2}$

3. a. $\frac{m-6}{m-12}$

b. $\frac{c+7}{c-8}$

c. $\frac{z-1}{z-11}$

d. $\frac{z+4}{z+7}$

e. $\frac{m^2+16m+64}{m^2+15m+36}$

f. $\frac{u-8}{u-7}$

**“Education is the power to think clearly,
the power to act well in the world’s work,
and the power to appreciate life.”**

— *Brigham Young*