

Fractions and Rational Expressions

Algebraic Rules for Fractions and Rational Expressions

a, b, c, d may be numbers or variable expressions.

Adding and Subtracting
requires

a Common Denominator

$$\frac{a}{b} + \frac{c}{b} = \frac{a + c}{b}$$

$$\frac{a}{b} + \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{d} + \frac{c}{d} \cdot \frac{b}{b} = \frac{ad + cd}{bd}$$

Multiplying
just multiply tops/bottoms

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$$

Dividing - "flip" bottom

$$\frac{a/b}{c/d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{a \cdot d}{b \cdot c}$$

Reducing Fractions
cancel common terms

$$\frac{a \cdot c}{b \cdot c} = \frac{a}{b}$$

$$\frac{a \cdot c + b \cdot c}{d \cdot c} = \frac{a + b}{d}$$

$$\frac{a \cdot c}{b \cdot c + d \cdot c} = \frac{a}{b + d}$$

Handout: Fractions and Rational Expressions

Simplify and Reduce the following Fractions/Rational Expressions

a) $\frac{48}{8}$

b) $\frac{21}{24}$

c) $\frac{88}{80}$

d) $\frac{76}{40}$

e) $\frac{19 + 7}{7 + 6}$

f) $\frac{284 + 4}{271 + 1}$

g) $\frac{21x - 21}{35x + 14}$

h) $\frac{6x + 27}{9x - 21}$

i) $\frac{48x^3 - 84x^2}{42x^3 - 90x^2}$

j) $\frac{54x^2 - 114x}{78x^2 + 6x}$

k) $\frac{56x - 49}{96x - 84}$

l) $\frac{14x + 10}{105x + 75}$

Convert the Improper Fractions to Mixed Numbers

a) $\frac{42}{19}$

b) $\frac{23}{19}$

c) $\frac{44}{21}$

d) $\frac{43}{13}$

e) $\frac{53}{9}$

f) $\frac{35}{17}$

Answers a) 6; b) $\frac{7}{8}$; c) $\frac{11}{10}$; d) $\frac{19}{10}$; e) 2; f) $\frac{18}{17}$; g) $\frac{3(x-1)}{5x+2}$; h) $\frac{2x+9}{3x-7}$; i) $\frac{14-8x}{15-7x}$; j) $\frac{9x-19}{13x+1}$; k) $\frac{7}{12}$; l) $\frac{2}{15}$;
a) $2\frac{4}{19}$; b) $1\frac{4}{19}$; c) $2\frac{2}{21}$; d) $3\frac{4}{13}$; e) $5\frac{8}{9}$; f) $2\frac{1}{17}$;

Adding and Subtracting

$$\text{a) } \frac{5}{23} + \frac{6}{17}$$

$$\text{b) } \frac{6}{7} + \frac{8}{23}$$

$$\text{c) } \frac{12}{23} - \frac{15}{13}$$

$$\text{d) } \frac{8}{3} - \frac{13}{19}$$

$$\text{e) } \frac{15}{4} + \frac{17}{4} - \frac{290}{40}$$

$$\text{f) } \frac{10}{7} + 1 - \frac{60}{35}$$

$$\text{g) } \frac{4}{5} + \frac{3}{1+x}$$

$$\text{h) } \frac{5}{7} + \frac{4}{2+x}$$

$$\text{i) } \frac{2}{x+5} + \frac{1}{-3+x}$$

$$\text{j) } \frac{1}{x+4} + \frac{5}{6+x}$$

Multiplying

$$\text{a) } \left(\frac{1}{11} + \frac{1}{7}\right) \cdot \left(\frac{1}{7} - \frac{1}{11}\right)$$

$$\text{b) } \left(\frac{3}{5} + \frac{3}{11}\right) \cdot \left(\frac{6}{11} - \frac{3}{5}\right)$$

$$\text{c) } \left(x + \frac{3}{2}\right) \cdot \left(\frac{5}{2} - x\right)$$

$$\text{d) } \left(x + \frac{7}{3}\right) \cdot \left(\frac{7}{3} - x\right)$$

Answers a) $\frac{223}{391}$; b) $\frac{194}{161}$; c) $-\frac{189}{299}$; d) $\frac{113}{57}$; e) $\frac{3}{4}$; f) $\frac{5}{7}$; g) $\frac{4x+19}{5(x+1)}$; h) $\frac{5x+38}{7(x+2)}$;

$$\text{i) } \frac{3x-1}{(x-3)(x+5)} = \frac{3x-1}{x^2+2x-15}; \text{ j) } \frac{2(3x+13)}{(x+4)(x+6)} = \frac{6x+26}{x^2+10x+24};$$

Answers a) $\frac{72}{5929}$; b) $-\frac{144}{3025}$; c) $-x^2 + x + \frac{15}{4}$; d) $\frac{49}{9} - x^2$;

More Complicated Fractions

$$\text{a) } \frac{3}{7} + \frac{5}{1 + \frac{3}{4}}$$

$$\text{b) } \frac{2}{5} + \frac{3}{5 + \frac{5}{4}}$$

$$\text{c) } \frac{4}{7} + \frac{1}{2 + \frac{2}{x+4}}$$

$$\text{d) } \frac{5}{4} + \frac{3}{5 + \frac{2}{x+7}}$$

$$\text{e) } \frac{1 + \frac{3}{2}}{\frac{10}{3} + 6}$$

$$\text{f) } \frac{8 + \frac{5}{12}}{\frac{4}{5} + 7}$$

$$\text{g) } \frac{6 + \frac{3}{x}}{\frac{4}{x} + 7}$$

$$\text{h) } \frac{5 + \frac{5}{x}}{\frac{4}{x} + 3}$$

Don't forget to reduce the fractions.

$$\text{a) } \frac{3}{5} - \frac{5}{11} + \frac{3}{55}$$

$$\text{b) } \frac{5}{7} - \frac{8}{11} + \frac{100}{77}$$

$$\text{c) } \frac{4}{z+3} + \frac{5}{z-11} + \frac{z^2 - 18z + 7}{(z-11)(z+3)}$$

$$\text{d) } \frac{1}{z+11} + \frac{8}{z-7} + \frac{z^2 - 12z - 109}{(z-7)(z+11)}$$

Answers a) $\frac{23}{7}$; b) $\frac{22}{25}$; c) $\frac{15x+68}{14(x+5)}$; d) $\frac{37x+269}{4(5x+37)}$; e) $\frac{15}{56}$; f) $\frac{505}{468}$; g) $\frac{3(2x+1)}{7x+4}$; h) $\frac{5(x+1)}{3x+4}$;

Answers a) $\frac{1}{5}$; b) $\frac{9}{7}$; c) $\frac{z+2}{z+3}$; d) $\frac{z+4}{z+11}$;