Chapter 12. Rational Expressions and Equations

Ex. 12.6

Answer 1CU.

Let the two rational expressions with a denominator of $x+2$ that have a sum of 1 are $\frac{x+8}{x+2}$ and $\frac{x-6}{x+2}$.

$$\begin{aligned}\frac{x+8}{x+2}+\frac{x-6}{x+2}&=\frac{x+8+x-6}{x+2}\\&=\frac{x+2}{x+2}\\&=1\end{aligned}$$

Answer 1PQ.

Consider the following polynomials.

$$\begin{aligned}\frac{a}{a+3}\div\frac{a+11}{a+3}&=\frac{a}{a+3}\cdot\frac{a+3}{a+11} && \text{Multiply by } \frac{a+3}{a+11}\text{, the reciprocal of } \frac{a+11}{a+3}.\\&=\frac{a}{\cancel{a+3}_{1}}\cdot\frac{\cancel{a+3}^{1}}{a+11} && \text{Divide by common factor, } (a+3).\\&=\frac{a}{a+11} && \text{Simplify.}\end{aligned}$$

Thus, the quotient is $\boxed{\frac{a}{a+11}}$.

Answer 2CU.

To add fractions with like denominators and to add rational expressions with like denominators, you add the numerators and then write the sum over the common denominator.

Answer 2PQ.

Consider the following polynomials.

$$\frac{4z+8}{z+3} \div (z+2)$$

$$= \frac{4z+8}{z+3} \cdot \frac{1}{z+2} \qquad \text{Multiply by } \frac{1}{z+2}\text{, the reciprocal of } (z+2).$$

$$= \frac{4(z+2)}{z+3} \cdot \frac{1}{z+2} \qquad \text{Factor.}$$

$$= \frac{4\,\cancel{(z+2)}^{1}}{z+3} \cdot \frac{1}{\cancel{z+2}_{1}} \qquad \text{Divide by common factors } (z+2).$$

$$= \frac{4}{z+3} \qquad \text{Simplify.}$$

Thus, the quotient is $\boxed{\frac{4}{z+3}}$.

Answer 3CU.

Two rational expressions whose sum is 0 are additive inverses, while two rational expressions whose difference is 0 are equivalent expressions.

$$\frac{1}{x} + \left(\frac{-1}{x}\right) = 0$$

$$\frac{1}{x} - \frac{1}{x} = 0$$

Answer 3PQ.

Consider the following polynomials.

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

$$= \frac{(2x-1)(x-2)}{(x-2)(x-3)} \cdot \frac{(x-3)(x-1)}{(2x-1)(x+5)} \qquad \text{Multiply by the raciprocal of } \frac{(2x-1)(x+5)}{(x-3)(x-1)}$$

$$= \frac{\cancel{(2x-1)}^{1}\,\cancel{(x-2)}^{1}}{\cancel{(x-2)}_{1}\,\cancel{(x-3)}_{1}} \cdot \frac{\cancel{(x-3)}^{1}(x-1)}{\cancel{(2x-1)}_{1}(x+5)}$$

Divide by common factors $(2x-1)(x-3)(x-2)$

$$= \frac{x-1}{x+5} \qquad \text{Simplify.}$$

Thus, the quotient is $\boxed{\frac{x-1}{x+5}}$.

Answer 4CU.

The difference of Russell is correct.

$$\frac{7x+2}{4x-3}-\frac{x-8}{3-4x}=\frac{7x+2}{4x-3}+\frac{x-8}{4x-3}$$
$$=\frac{7x+x+2-8}{4x-3}$$

$$=\frac{8x-6}{4x-3}$$
$$=\frac{2(4x-3)}{4x-3}$$
$$=2$$

Russell correctly combines like terms.

Answer 4PQ.

Consider the following rational expression.

$$(9xy^2-15xy+3)\div 3xy$$

$$=\frac{9xy^2-15xy+3}{3xy} \quad \text{Write as a rational expression.}$$

$$=\frac{9xy^2}{3xy}-\frac{15xy}{3xy}+\frac{3}{3xy} \quad \text{DIvide each term by } 3xy.$$

$$=\frac{\cancel{9xy^2}^{\,3y}}{\cancel{3xy}_{\,1}}-\frac{\cancel{15xy}^{\,5}}{\cancel{3xy}_{\,1}}+\frac{\cancel{3}^{\,1}}{\cancel{3xy}_{\,xy}} \quad \text{Simplify each term.}$$

$$=3y-5+\frac{1}{xy} \quad \text{Simplify.}$$

Thus, the quotient is $\boxed{3y-5+\frac{3}{3xy}}$.

Answer 5CU.

Consider the following addition.

$$\frac{a+2}{4}+\frac{a-2}{4}=\frac{a+2+a-2}{4} \quad \text{The common denominator is 4.}$$

$$=\frac{2a}{4} \quad \text{Simplify the numerators.}$$

$$=\frac{2\cdot a}{2\cdot 2} \quad \text{Factor.}$$

$$=\frac{\cancel{2}^{\,1}a}{\cancel{2}_{\,1}\cdot 2} \quad \text{Divide by the common factors, 2.}$$

$$=\frac{a}{2} \quad \text{Simplify.}$$

Thus, sum is $\boxed{\frac{a}{2}}$.

Answer 5PQ.

Consider the following rational expression.

$$\left(2x^2-7x-16\right)\div(2x+3)$$

Use long division process to divide a polynomial by a binomial.

$$\begin{array}{r|l} & \quad\quad\quad x-5 \\ 2x+3 & \ 2x^2-7x-16 \\ & (-)2x^2+3x \\ \hline & \quad\quad -10x-16 \\ & \quad (-)-10x-15 \\ \hline & \quad\quad\quad\quad -1 \end{array}$$

The quotient of $\left(2x^2-7x-16\right)\div(2x+3)$ is $x-5$ with a remainder -1, which can be written as $\boxed{x-5-\frac{1}{2x+3}}$.

Answer 6CU.

Consider the following addition.

$$\frac{3x}{x+1}+\frac{3}{x+1}=\frac{3x+3}{x+1} \quad \text{The common denominator is } (x+1).$$

$$=\frac{3(x+1)}{x+1} \quad \text{Factor.}$$

$$=\frac{3\,\cancel{(x+1)}^{1}}{\cancel{x+1}_{1}} \quad \text{Divide by the common factors, } (x+1).$$

$$=3 \quad \text{Simplify.}$$

Thus, sum is $\boxed{3}$.

Answer 6PQ.

Consider the following rational expression.

$$\frac{y^2-19y+9}{y-4}$$

Use long division process to divide a polynomial by a binomial.

$$\begin{array}{r|l} & y-15 \\ \hline y-4 & y^2-19y+9 \\ & \underline{(-)y^2-4y} \\ & -15y+9 \\ & \underline{(-)-15y+60} \\ & -51 \end{array}$$

The quotient of $\frac{y^2-19y+9}{y-4}$ is $y-15$ with a remainder -51, which can be written as $\boxed{y-15-\frac{51}{y-4}}$.

Answer 7CU.

Consider the following addition.

$$\begin{aligned} \frac{2-n}{n-1}+\frac{1}{n-1} &= \frac{2-n+1}{n-1} && \text{The common denominator is } (n-1). \\ &= \frac{3-n}{n-1} && \text{Simplify.} \end{aligned}$$

Thus, sum is $\boxed{\frac{3-n}{n-1}}$.

Answer 7PQ.

Consider the following addition.

$$\begin{aligned} \frac{2}{x+7}+\frac{5}{x+7} &= \frac{2+5}{x+7} && \text{The common denominator is } x+7. \\ &= \frac{7}{x+7} && \text{Add the numerators.} \end{aligned}$$

Thus, sum is $\boxed{\frac{7}{x+7}}$.

Answer 8CU.

Consider the following addition.

$$\frac{4t-1}{1-4t}+\frac{2t+3}{1-4t}=\frac{4t-1+2t+3}{1-4t} \quad \text{The common denominator is } (1-4t).$$

$$=\frac{6t+2}{1-4t} \quad \text{Simplify.}$$

Thus, sum is $\boxed{\frac{6t+2}{1-4t}}$.

Answer 8PQ.

Consider the following subtraction.

$$\frac{2m}{m+3}-\frac{-6}{m+3}=\frac{2m-(-6)}{m+3} \quad \text{The common denominator is } (m+3).$$

$$=\frac{2m+6}{m+3} \quad \text{Simplify.}$$

$$=\frac{2(m+3)}{m+3} \quad \text{Factor.}$$

$$=\frac{2\,\overset{1}{\cancel{(m+3)}}}{\underset{1}{\cancel{m+3}}} \quad \text{Divide by the common factor, } (m+3).$$

$$=2 \quad \text{Simplify.}$$

Thus, difference is $\boxed{2}$.

Answer 9CU.

Consider the following subtraction.

$$\frac{5a}{12}-\frac{7a}{12}=\frac{5a-7a}{12} \quad \text{The common denominator is 12.}$$

$$=\frac{-2a}{12} \quad \text{Subtract the numerator.}$$

$$=\frac{-1\cdot 2\cdot a}{2\cdot 2\cdot 3} \quad \text{Factor.}$$

$$=\frac{-1\cdot \overset{1}{\cancel{2}}\cdot a}{\underset{1}{\cancel{2}}\cdot 2\cdot 3} \quad \text{Divide by the common factors, 2.}$$

$$=-\frac{a}{6} \quad \text{Simplify.}$$

Thus, difference is $\boxed{-\frac{a}{6}}$.

Answer 9PQ.

Consider the following subtraction.

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

$$=\frac{(5x-1)-(2x-1)}{3x+2}$$ The common denominator is $(3x+2)$.

$$=\frac{(5x-1)+[-(2x-1)]}{3x+2}$$ The additive inverse of $(2x-1)$ is $-(2x-1)$.

$$=\frac{5x-1-2x+1}{3x+2}$$ Distributive property.

$$=\frac{3x}{3x+2}$$ Combine like terms.

Thus, difference is $\boxed{\frac{3x}{3x+2}}$.

Answer 10CU.

Consider the following subtraction.

$$\frac{7}{n-3}-\frac{4}{n-3}=\frac{7-4}{n-3}$$ The common denominator is $(n-3)$.

$$=\frac{3}{n-3}$$ Subtract the numerator.

Thus, difference is $\boxed{\frac{3}{n-3}}$.

Answer 11CU.

Consider the following subtraction.

$$\frac{3m}{m-2}-\frac{6}{2-m}=\frac{3m}{m-2}-\frac{6}{-(m-2)}$$ $2-m=-(m-2)$

$$=\frac{3m}{m-2}+\frac{6}{m-2}$$ Rewrite using like denominators.

$$=\frac{3m+6}{m-2}$$ The common denominator is $(m-2)$.

Thus, difference is $\boxed{\frac{3m+6}{m-2}}$.

Answer 12CU.

Consider the following subtraction.

$$\frac{x^2}{x-y}-\frac{y^2}{x-y}=\frac{x^2-y^2}{x-y}$$ The common denominator is $(x-y)$.

$$=\frac{(x-y)(x+y)}{x-y}$$ Factor.

$$=\frac{\overset{1}{\cancel{(x-y)}}(x+y)}{\underset{1}{\cancel{x-y}}}$$ Divide by the common factors, $(x-y)$.

$$=x+y$$ Subtract the numerator.

Thus, difference is $\boxed{x+y}$.

Answer 13CU.

The total numbers of students are 960.

One day, 45 were absent due to illness, 29 were participating in a wrestling tournament, 10 were excused to go to their doctors, and 12 were at a music competition.

To find the fraction of the students were absent from school on this day divide the number of absent students by total number of students.

$$\frac{45+29+10+12}{960}$$

$$=\frac{96}{960}$$

$$=\frac{1}{10}$$

Thus, the fraction is $\boxed{\frac{1}{10}}$.

Answer 14PA.

Consider the following addition.

$$\frac{m}{3}+\frac{2m}{3}=\frac{m+2m}{3}$$ The common denominator is 3.

$$=\frac{3m}{3}$$ Add the numerators.

$$=\frac{\overset{1}{\cancel{3}}m}{\underset{1}{\cancel{3}}}$$ Divide by the common factors, 3.

$$=m$$ Simplify.

Thus, sum is $\boxed{m}$.

Answer 15PA.

Consider the following addition.

$$\frac{12z}{7}+\frac{-5z}{7}=\frac{12z+(-5z)}{7}$$ The common denominator is 7.

$$=\frac{12z-5z}{7}$$ Multiply.

$$=\frac{7z}{7}$$ Subtract the numerators.

$$=\frac{\cancel{7}^{1}z}{\cancel{7}_{1}}$$ Divide by the common factors, 7.

$$=z$$ Simplify.

Thus, sum is $\boxed{z}$.

Answer 16PA.

Consider the following addition.

$$\frac{x+3}{5}+\frac{x+2}{5}=\frac{x+3+x+2}{5}$$ The common denominator is 5.

$$=\frac{2x+5}{5}$$ Add the numerators.

Thus, sum is $\boxed{\frac{2x+5}{5}}$.

Answer 17PA.

Consider the following addition.

$$\frac{n-7}{2}+\frac{n+5}{2}=\frac{n-7+n+5}{2}$$ The common denominator is 2.

$$=\frac{2n-2}{2}$$ Simplify.

$$=\frac{2(n-1)}{2}$$ Factor.

$$=\frac{\cancel{2}^{1}(n-1)}{\cancel{2}_{1}}$$ Divide by the common factors, 2.

$$=n-1$$ Simplify.

Thus, sum is $\boxed{n-1}$.

Answer 18PA.

Consider the following addition.

$$\frac{2y}{y+3}+\frac{6}{y+3}=\frac{2y+6}{y+3}$$ The common denominator is $(y+3)$.

$$=\frac{2(y+3)}{y+3}$$ Factor.

$$=\frac{2\,\overset{1}{\cancel{(y+3)}}}{\underset{1}{\cancel{y+3}}}$$ Divide by the common factors, $(y+3)$.

$$=2$$ Simplify.

Thus, sum is $\boxed{2}$.

Answer 19PA.

Consider the following addition.

$$\frac{3r}{r+5}+\frac{15}{r+5}=\frac{3r+15}{r+5}$$ The common denominator is $(r+5)$.

$$=\frac{3(r+5)}{r+5}$$ Factor.

$$=\frac{3\,\overset{1}{\cancel{(r+5)}}}{\underset{1}{\cancel{r+5}}}$$ Divide by the common factors, $(r+5)$.

$$=3$$ Simplify.

Thus, sum is $\boxed{3}$.

Answer 20PA.

Consider the following addition.

$$\frac{k-5}{k-1}+\frac{4}{k-1}=\frac{k-5+4}{k-1}$$ The common denominator is $(k-1)$.

$$=\frac{k-1}{k-1}$$ Simplify the numerator.

$$=\frac{\overset{1}{\cancel{k-1}}}{\underset{1}{\cancel{k-1}}}$$ Divide by the common factors, $(k-1)$.

$$=1$$ Simplify.

Thus, sum is $\boxed{1}$.

Answer 21PA.

Consider the following addition.

$$\frac{n-2}{n+3}+\frac{-1}{n+3}=\frac{n-2+(-1)}{n+3}$$ The common denominator is $(n+3)$.

$$=\frac{n-2-1}{n+3}$$ Multiply.

$$=\frac{n-3}{n+3}$$ Simplify.

Thus, sum is $\boxed{\frac{n-3}{n+3}}$.

Answer 22PA.

Consider the following addition.

$$\frac{4x-5}{x-2}+\frac{x+3}{x-2}=\frac{4x-5+x+3}{x-2}$$ The common denominator is $(x-2)$.

$$=\frac{5x-2}{x-2}$$ Simplify.

Thus, sum is $\boxed{\frac{5x-2}{x-2}}$.

Answer 23PA.

Consider the following addition.

$$\frac{2a+3}{a-4}+\frac{a-2}{a-4}=\frac{2a+3+a-2}{a-4}$$ The common denominator is $(a-4)$.

$$=\frac{3a+1}{a-4}$$ Simplify.

Thus, sum is $\boxed{\frac{3a+1}{a-4}}$.

Answer 24PA.

Consider the following addition.

$$\frac{5s+1}{2s+1}+\frac{3s-2}{2s+1}=\frac{5s+1+3s-2}{2s+1}$$ The common denominator is $(2s+1)$.

$$=\frac{8s-1}{2s+1}$$ Simplify.

Thus, sum is $\boxed{\frac{8s-1}{2s+1}}$.

Answer 25PA.

Consider the following addition.

$$\frac{9b+3}{2b+6}+\frac{5b+4}{2b+6}=\frac{9b+3+5b+4}{2b+6}$$ The common denominator is $(2b+6)$.

$$=\frac{14b+7}{2b+6}$$ Simplify.

Thus, sum is $\boxed{\frac{14b+7}{2b+6}}$.

Answer 26PA.

The denominator $2-3x$ is the same as $-(-2+3x)$ or $-(3x-2)$. Rewrite the second expression so that it has the same denominator as the first.

$$\frac{12x-7}{3x-2}+\frac{9x-5}{2-3x}$$

$$=\frac{12x-7}{3x-2}+\frac{9x-5}{-(3x-2)}$$ $2-3x=-(3x-2)$

$$=\frac{12x-7}{3x-2}-\frac{9x-5}{3x-2}$$ Rewrite using like denominators.

$$=\frac{(12x-7)-(9x-5)}{3x-2}$$ The common denominator is $(3x-2)$.

$$=\frac{(12x-7)+[-(9x-5)]}{3x-2}$$ The additive inverse of $(9x-5)$ is $-(9x-5)$.

$$=\frac{12x-7-9x+5}{3x-2}$$ Distributive property.

$$=\frac{3x-2}{3x-2}$$ Combine like terms.

$$=\frac{\cancel{3x-2}^{1}}{\cancel{3x-2}_{1}}$$ Divide by the common factors, $(3x-2)$.

$$=1$$ Simplify.

Thus, sum is $\boxed{1}$.

Answer 27PA.

Consider the following addition.

$$\frac{11x-5}{2x+5}+\frac{11x+12}{2x+5}$$

$$=\frac{11x-5+11x+12}{2x+5}$$ The common denominator is $(2x+5)$.

$$=\frac{22x+7}{2x+5}$$ Combine like terms.

Thus, sum is $\boxed{\frac{22x+7}{2x+5}}$.

Answer 28PA.

Consider the following subtraction.

$$\frac{5x}{7}-\frac{3x}{7}=\frac{5x-3x}{7} \quad \text{The common denominator is 7.}$$

$$=\frac{2x}{7} \quad \text{Subtract the numerator.}$$

Thus, difference is $\boxed{\frac{2x}{7}}$.

Answer 29PA.

Consider the following subtraction.

$$\frac{4n}{3}-\frac{2n}{3}=\frac{4n-2n}{3} \quad \text{The common denominator is 3.}$$

$$=\frac{2n}{3} \quad \text{Subtract the numerator.}$$

Thus, difference is $\boxed{\frac{2n}{3}}$.

Answer 30PA.

Consider the following subtraction.

$$\frac{x+4}{5}-\frac{x+2}{5}=\frac{(x+4)-(x+2)}{5} \quad \text{The common denominator is 5.}$$

$$=\frac{(x+4)+[-(x+2)]}{5} \quad \text{The additive inverse of } (x+2) \text{ is } -(x+2).$$

$$=\frac{x+4-x-2}{5} \quad \text{Distributive property.}$$

$$=\frac{2}{5} \quad \text{Simplify.}$$

Thus, difference is $\boxed{\frac{2}{5}}$.

Answer 31PA.

Consider the following subtraction.

$$\frac{a+5}{6}-\frac{a+3}{6}$$

$$=\frac{(a+5)-(a+3)}{6} \quad \text{The common denominator is 6.}$$

$$=\frac{(a+5)+[-(a+3)]}{6} \quad \text{The additive inverse of } (a+3) \text{ is } -(a+3).$$

$$=\frac{a+5-a-3}{6} \quad \text{Distributive property.}$$

$$=\frac{2}{6} \quad \text{Simplify.}$$

$$=\frac{\overset{1}{\cancel{2}}}{\underset{3}{\cancel{6}}} \quad \text{Divide by the common factors, 2.}$$

$$=\frac{1}{3}$$

Thus, difference is $\boxed{\frac{1}{3}}$.

Answer 32PA.

Consider the following subtraction.

$$\frac{2}{x+7}-\frac{-5}{x+7}=\frac{2-(-5)}{x+7} \quad \text{The common denominator is } (x+7).$$

$$=\frac{2+5}{x+7} \quad \text{Multiply.}$$

$$=\frac{7}{x+7} \quad \text{Add the numerator.}$$

Thus, difference is $\boxed{\frac{7}{x+7}}$.

Answer 33PA.

Consider the following subtraction.

$$\frac{4}{z-2}-\frac{-6}{z-2}=\frac{4-(-6)}{z-2} \quad \text{The common denominator is } (z-2).$$

$$=\frac{4+6}{z-2} \quad \text{Multiply.}$$

$$=\frac{10}{z-2} \quad \text{Add the numerator.}$$

Thus, difference is $\boxed{\frac{10}{z-2}}$.

Answer 34PA.

Consider the following subtraction.

$$\frac{5}{3x-5}-\frac{3x}{3x-5}=\frac{5-3x}{3x-5} \quad \text{The common denominator is } (3x-5).$$

$$=\frac{-(-5+3x)}{3x-5} \quad \text{Rewrite } 5-3x \text{ as } -(-5+3x).$$

$$=-\frac{3x-5}{3x-5}$$

$$=-\frac{\cancel{3x-5}^{1}}{\cancel{3x-5}_{1}} \quad \text{Divide by the common factors, } (3x-5).$$

$$=-1 \quad \text{Simplify.}$$

Thus, difference is $\boxed{-1}$.

Answer 35PA.

Consider the following subtraction.

$$\frac{4}{7m-2}-\frac{7m}{7m-2}$$

$$=\frac{4-7m}{7m-2} \quad \text{The common denominator is } (7m-2).$$

Thus, difference is $\boxed{\frac{4-7m}{7m-2}}$.

Answer 36PA.

The denominator $2-x$ is the same as $-(-2+x)$ or $-(x-2)$. Rewrite the second expression so that it has the same denominator as the first.

$$\frac{2x}{x-2}-\frac{2x}{2-x}=\frac{2x}{x-2}-\frac{2x}{-(x-2)} \qquad 2-x=-(x-2)$$

$$=\frac{2x}{x-2}+\frac{2x}{x-2} \qquad \text{Rewrite using like denominators.}$$

$$=\frac{2x+2x}{x-2} \qquad \text{The common denominator is } (x-2).$$

$$=\frac{4x}{x-2} \qquad \text{Simplify.}$$

Thus, difference is $\boxed{\frac{4x}{x-2}}$.

Answer 37PA.

The denominator $3-y$ is the same as $-(-3+y)$ or $-(y-3)$. Rewrite the second expression so that it has the same denominator as the first.

$$\frac{5y}{y-3}-\frac{5y}{3-y}=\frac{5y}{y-3}-\frac{5y}{-(y-3)} \qquad 3-y=-(y-3)$$

$$=\frac{5y}{y-3}+\frac{5y}{y-3} \qquad \text{Rewrite using like denominators.}$$

$$=\frac{5y+5y}{y-3} \qquad \text{The common denominator is } (y-3).$$

$$=\frac{10y}{y-3} \qquad \text{Simplify.}$$

Thus, difference is $\boxed{\frac{10y}{y-3}}$.

Answer 38PA.

Consider the following subtraction.

$$\frac{8}{3t-4}-\frac{6t}{3t-4}=\frac{8-6t}{3t-4} \qquad \text{The common denominator is } (3t-4).$$

$$=\frac{-2(3t-4)}{3t-4} \qquad \text{Factor.}$$

$$=\frac{-2\,\cancel{(3t-4)}^{1}}{\cancel{3t-4}_{1}} \qquad \text{Divide by the common factors, } (3t-4).$$

$$=-2 \qquad \text{Simplify.}$$

Thus, difference is $\boxed{-2}$.

Answer 39PA.

Consider the following subtraction.

$$\frac{15x}{5x+1}-\frac{-3}{5x+1}=\frac{15x-(-3)}{5x+1}$$ The common denominator is $(5x+1)$.

$$=\frac{15x+3}{5x+1}$$ Simplify.

$$=\frac{3(5x+1)}{5x+1}$$ Factor.

$$=\frac{3\,\cancel{(5x+1)}^{1}}{\cancel{5x+1}_{1}}$$ Divide by the common factors, $(5x+1)$.

$$=3$$ Simplify.

Thus, difference is $\boxed{3}$.

Answer 40PA.

The denominator $6-2a$ is the same as $-(-6+2a)$ or $-(2a-6)$. Rewrite the second expression so that it has the same denominator as the first.

$$\frac{10a-12}{2a-6}-\frac{6a}{6-2a}$$

$$=\frac{10a-12}{2a-6}-\frac{6a}{-(2a-6)}$$ $6-2a=-(2a-6)$

$$=\frac{10a-12}{2a-6}+\frac{6a}{2a-6}$$ Rewrite using like denominators.

$$=\frac{(10a-12)+(6a)}{2a-6}$$ The common denominator is $(2a-6)$.

$$=\frac{10a-12+6a}{2a-6}$$

$$=\frac{16a-12}{2a-6}$$ Combine like terms.

$$=\frac{2(8a-6)}{2(a-3)}$$ Factor.

$$=\frac{8a-6}{a-3}$$ Simplify

Thus, difference is $\boxed{\frac{8a-6}{a-3}}$.

Answer 41PA.

Consider the following subtraction.

$$\frac{b-15}{2b+12}-\frac{-3b+8}{2b+12}$$

$$=\frac{(b-15)-(-3b+8)}{2b+12}$$ The common denominator is $(2b+12)$.

$$=\frac{(b-15)+[-(-3b+8)]}{2b+12}$$ The additive inverse of $(-3b+8)$ is $-(-3b+8)$.

$$=\frac{b-15+3b-8}{2b+12}$$ Distribute the negative.

$$=\frac{4b-23}{2b+12}$$ Simplify.

Thus, difference is $\boxed{\frac{4b-23}{2b+12}}$.

Answer 42PA.

The United States population in 1998 is described in the table.

Age	Number of people
0-19	77,525,000
20-39	79,112,000
40-59	68,699,000
60-79	35,786,000
80-99	8,634,000
100+	61,000

To find the fraction of the population that is 80 years or older divide population that is 80 years or older by total population:

$$\frac{8,634,000+61,000}{77,525,000+79,112,000+68,699,00+35,786,000+8,634,000+61,000}$$

$$=\frac{8,696,000}{269,817,000}$$

$$=\frac{8,696}{269,817}$$

Thus, the fraction is $\frac{8,696}{269,817}$.

Answer 47PA.

Use the following information. Each figure has a perimeter of x units.

Consider the above figure a.

Find the area of the square, where $s = \frac{x}{4}$.

$A = s^2$	Formula.
$= \left(\frac{x}{4}\right)^2$	Substitute.
$= \frac{x^2}{16}$	Simplify.

Now find the ratio of the area of figure a.

$\frac{\text{Area}}{\text{Perimeter}} = \frac{\frac{x^2}{16}}{x}$	Substitute.
$= \frac{x^2}{16} \div x$	Divide.
$= \frac{x^2}{16} \cdot \frac{1}{x}$	multiply by the reciprocal of x.
$= \frac{x}{16}$	Multiply

Thus, the ratio is $\boxed{\frac{x}{16}}$.

Answer 48PA.

Use the following information. Each figure has a perimeter of x units.

Consider the above figure a.

Find the area of the square, where $s = \frac{x}{4}$.

$$A = s^2 \quad \text{Formula.}$$
$$= \left(\frac{x}{4}\right)^2 \quad \text{Substitute.}$$
$$= \frac{x^2}{16} \quad \text{Simplify.}$$

Now find the ratio of the area of figure a.

$$\frac{\text{Area}}{\text{Perimeter}} = \frac{\frac{x^2}{16}}{x} \quad \text{Substitute.}$$
$$= \frac{x^2}{16} \div x \quad \text{Divide.}$$
$$= \frac{x^2}{16} \cdot \frac{1}{x} \quad \text{multiply by the reciprocal of } x.$$
$$= \frac{x}{16} \quad \text{Multiply}$$

Thus, the ratio is $\frac{x}{16}$.

Consider the above figure b.

Find the area of the rectangle, where $l = \frac{x}{3}$, and $b = \frac{x}{6}$.

$$A = lb \quad \text{Formula.}$$
$$= \frac{x}{3} \cdot \frac{x}{6} \quad \text{Substitute.}$$
$$= \frac{x^2}{18} \quad \text{Simplify.}$$

Now find the ratio of the area of figure b.

$$\frac{\text{Area}}{\text{Perimeter}} = \frac{\frac{x^2}{18}}{x} \quad \text{Substitute.}$$
$$= \frac{x^2}{18} \div x \quad \text{Divide.}$$
$$= \frac{x^2}{18} \cdot \frac{1}{x} \quad \text{multiply by the reciprocal of } x.$$
$$= \frac{x}{18} \quad \text{Multiply}$$

Thus, the ratio is $\frac{x}{18}$.

Consider the above figure c.

Find the area of the triangle, where $b=\frac{3x}{12}$,and $h=\frac{4x}{12}$.

$$\begin{aligned} A &= \frac{1}{2}bh && \text{Formula.} \\ &= \frac{1}{2}\cdot\frac{3x}{12}\cdot\frac{4x}{12} && \text{Substitute.} \\ &= \frac{x^2}{24} && \text{Simplify.} \end{aligned}$$

Now find the ratio of the area of figure c.

$$\begin{aligned} \frac{\text{Area}}{\text{Perimeter}} &= \frac{\frac{x^2}{24}}{x} && \text{Substitute.} \\ &= \frac{x^2}{24}\div x && \text{Divide.} \\ &= \frac{x^2}{24}\cdot\frac{1}{x} && \text{multiply by the reciprocal of } x. \\ &= \frac{x}{24} && \text{Multiply} \end{aligned}$$

Thus, the ratio is $\frac{x}{24}$.

The figure a. has the greatest ratio.

Answer 49PA.

Simplify the following rational number:

Option a

$$\frac{3}{2-x}=-\frac{3}{x-2}$$

Option b

$$\frac{-3}{x-2}=-\frac{3}{x-2}$$

Option c

$$-\frac{3}{2-x}=\frac{3}{x-2}$$

Option d

$$-\frac{3}{x-2}=-\frac{3}{x-2}$$

Thus, the option c is not equivalent to the others.

Answer 51PA.

Consider the following addition.

$$\frac{k+2}{k-7}+\frac{-3}{k-7}=\frac{(k+2)+(-3)}{k-7}$$ The common denominator is $(k-7)$.

$$=\frac{k+2-3}{k-7}$$ Multiply.

$$=\frac{k-1}{k-7}$$ Subtract the numerators.

Thus, sum is $\frac{k-1}{k-7}$.

Therefore, correct answer is option $\boxed{\text{A}}$.

Answer 52PA.

Consider the following figure.

An expression for the perimeter of rectangle ABCD:

$$P=2(l+b)$$ Formula.

$$=2\left(\frac{9r}{2r+6s}+\frac{5r}{2r+6s}\right)$$ Substitute.

$$=2\left(\frac{9r+5r}{2r+6s}\right)$$ Add.

$$=\frac{2\cdot 14r}{2(r+3s)}$$ Simplify.

$$=\frac{14r}{r+3s}$$ Factor out 2.

Thus, the correct option is $\boxed{B.\ \frac{14r}{r+3s}}$.

Answer 53MYS.

Consider the following rational expression.

$$\frac{x^3-7x+6}{x-2}=\frac{x^3+0x^2-7x+6}{x-2}$$

$$\begin{array}{r|l} & x^2+2x-3 \\ x-2 & x^3+0x^2-7x+6 \\ & \underline{(-1)x^3-2x^2} \\ & 2x^2-7x \\ & \underline{(-1)2x^2-4x} \\ & -3x+6 \\ & \underline{(-)-3x+6} \\ & 0 \end{array}$$

Thus, the quotient is $\boxed{x^2+2x-3}$.

Answer 54MYS.

Consider the following rational expression.

$$\frac{56x^3+32x^2-63x-36}{7x+4}$$

$$\begin{array}{r}
8x^2-9 \\
7x+4\overline{)\;56x^3+32x^2-63x-36} \\
\underline{(-)56x^3+32x^2} \\
-63x-36 \\
\underline{(-)-63x-36} \\
0
\end{array}$$

Thus, the quotient is $\boxed{8x^2-9}$.

Answer 55MYS.

Consider the following monomials.

$$\frac{b^2-9}{4b} \div (b-3)$$

$$= \frac{b^2-9}{4b} \cdot \frac{1}{b-3} \qquad \text{Multiply by } \frac{1}{b-3}, \text{ the reciprocal of } (b-3).$$

$$= \frac{(b-3)(b+3)}{4b} \cdot \frac{1}{b-3} \qquad \text{Factor.}$$

$$= \frac{\overset{1}{\cancel{(b-3)}}(b+3)}{4b} \cdot \frac{1}{\underset{1}{\cancel{b-3}}} \qquad \text{Divide by common factor } (b-3).$$

$$= \frac{b+3}{4b} \qquad \text{Simplify.}$$

Thus, the quotient is $\boxed{\frac{b+3}{4b}}$.

Answer 56MYS.

Consider the following monomials.

$$\frac{x}{x+2} \div \frac{x^2}{x^2+5x+6}$$

$$= \frac{x}{x+2} \cdot \frac{x^2+5x+6}{x^2} \quad \text{Multiply by } \frac{x^2+5x+6}{x^2}\text{, the reciprocal of } \frac{x^2}{x^2+5x+6}.$$

$$= \frac{x}{x+2} \cdot \frac{(x+2)(x+3)}{x \cdot x} \quad \text{Factor.}$$

$$= \frac{\cancel{x}^{1}}{\cancel{x+2}_{1}} \cdot \frac{\cancel{(x+2)}^{1}(x+3)}{\cancel{x}_{1} \cdot x} \quad \text{Divide by common factors } x(x+2).$$

$$= \frac{x+3}{x} \quad \text{Simplify.}$$

Thus, the quotient is $\boxed{\frac{x+3}{x}}$.

Answer 57MYS.

Consider the following polynomial.

$$a^2+9a+14$$

$$= a^2+7a+2a+14 \quad \text{Write } 9a \text{ as } 7a+2a.$$

$$= a(a+7)+2(a+7) \quad \left[\begin{array}{l}\text{Factor out the GCF } a \text{ in first two} \\ \text{terms and 2 from last two terms.}\end{array}\right]$$

$$= (a+7)(a+2) \quad \text{Factor out the GCF } (a+7).$$

Thus, the factor is $\boxed{(a+7)(a+2)}$.

Answer 58MYS.

Consider the following polynomial.

$$p^2+p-30$$

$$= p^2+6p-5p-30 \quad \text{Rewrite } p \text{ as } 6p-5p.$$

$$= p(p+6)-5(p+6) \quad \left[\begin{array}{l}\text{Factor out the GCF } p \text{ in first two} \\ \text{terms and } -5 \text{ from last two terms.}\end{array}\right]$$

$$= (p+6)(p-5) \quad \text{Factor out the GCF } (p+6).$$

Thus, the factor is $\boxed{(p+6)(p-5)}$.

Answer 59MYS.

Consider the following polynomial.

$$y^2-11yz+28z^2$$

$$=y^2-7yz-4yz+28y^2 \quad \text{Rewrite } -11xy \text{ as } -7yz-4yz.$$

$$=y(y-7z)-4z(y-7z) \quad \left[\begin{array}{l}\text{Factor out the GCF } y \text{ in first two}\\ \text{terms and } -4z \text{ from last two terms.}\end{array}\right]$$

$$=(y-7z)(y-4z) \quad \text{Factor out the GCF } (y-7z).$$

Thus, the factor is $\boxed{(y-4z)(y-7z)}$.

Answer 60MYS.

Consider the following polynomial.

$$(3x^2-4x)-(7-9x)$$

$$=(3x^2-4x)+[-(7-9x)] \quad \text{The additive inverse of } (7-9x) \text{ is } -(7-9x).$$

$$=3x^2-4x-7+9x \quad \text{Distribute the negative.}$$

$$=3x^2+5x-7 \quad \text{Combine like terms.}$$

Thus, the answer is $\boxed{3x^2+5x-7}$.

Answer 61MYS.

Consider the following polynomial.

$$(5x^2-6x+14)+(2x^2+3x+8)$$

$$=(5x^2+2x^2)+(-6x+3x)+(14+8) \quad \text{Group like terms.}$$

$$=7x^2-3x+22 \quad \text{Combine like terms.}$$

Thus, the answer is $\boxed{7x^2-3x+22}$.

Answer 63MYS.

Consider the following numbers.

$$4,9,12$$

Find the prime factors of each number.

$$4=2\cdot2$$
$$9=3\cdot3$$
$$12=2\cdot2\cdot3$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$4=2\cdot2$$
$$9=3\cdot3$$
$$12=2\cdot2\cdot3$$
$$\text{LCM}=2\cdot2\cdot3\cdot3=36$$

Therefore, the LCM is $\boxed{36}$.

Answer 64MYS.

Consider the following expressions.

$$7, 21, 5$$

Find the prime factors of each number.

$$\begin{aligned} 7 &= 7 \\ 21 &= 3 \cdot 7 \\ 5 &= 5 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 7 &= 7 \\ 21 &= 3 \cdot 7 \\ 5 &= 5 \\ \text{LCM} &= 3 \cdot 5 \cdot 7 = 105 \end{aligned}$$

Therefore, the LCM is $\boxed{105}$.

Answer 65MYS.

Consider the following expressions.

$$6, 12, 24$$

Find the prime factors of each number.

$$\begin{aligned} 6 &= 2 \cdot 3 \\ 12 &= 2 \cdot 2 \cdot 3 \\ 24 &= 2 \cdot 2 \cdot 2 \cdot 3 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 6 &= 2 \cdot 3 \\ 12 &= 2 \cdot 2 \cdot 3 \\ 24 &= 2 \cdot 2 \cdot 2 \cdot 3 \\ \text{LCM} &= 2 \cdot 2 \cdot 2 \cdot 3 = 24 \end{aligned}$$

Therefore, the LCM is $\boxed{24}$.

Answer 66MYS.

Consider the following expressions.

$$45, 10, 6$$

Find the prime factors of each number.

$$\begin{aligned} 45 &= 3 \cdot 3 \cdot 5 \\ 10 &= 2 \cdot 5 \\ 6 &= 2 \cdot 3 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 45 &= 3 \cdot 3 \cdot 5 \\ 10 &= 2 \cdot 5 \\ 6 &= 2 \cdot 3 \\ \text{LCM} &= 2 \cdot 3 \cdot 3 \cdot 5 = 90 \end{aligned}$$

Therefore, the LCM is $\boxed{90}$.

Answer 67MYS.

Consider the following expressions.

$$5,6,15$$

Find the prime factors of each number.

$$\begin{aligned} 5 &= 5 \\ 6 &= 2\cdot 3 \\ 15 &= 3\cdot 5 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 5 &= 5 \\ 6 &= 2\cdot 3 \\ 15 &= 3\cdot 5 \\ \text{LCM} &= 2\cdot 3\cdot 5 = 30 \end{aligned}$$

Therefore, the LCM is $\boxed{30}$.

Answer 68MYS.

Consider the following expressions.

$$8,9,12$$

Find the prime factors of each number.

$$\begin{aligned} 8 &= 2\cdot 2\cdot 2 \\ 9 &= 3\cdot 3 \\ 12 &= 2\cdot 2\cdot 3 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 8 &= 2\cdot 2\cdot 2 \\ 9 &= 3\cdot 3 \\ 12 &= 2\cdot 2\cdot 3 \\ \text{LCM} &= 2\cdot 2\cdot 2\cdot 3\cdot 3 = 72 \end{aligned}$$

Therefore, the LCM is $\boxed{72}$.

Answer 69MYS.

Consider the following expressions.

$$16,20,25$$

Find the prime factors of each number.

$$\begin{aligned} 16 &= 2\cdot 2\cdot 2\cdot 2 \\ 20 &= 2\cdot 2\cdot 5 \\ 25 &= 5\cdot 5 \end{aligned}$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$\begin{aligned} 16 &= 2\cdot 2\cdot 2\cdot 2 \\ 20 &= 2\cdot 2\cdot 5 \\ 25 &= 5\cdot 5 \\ \text{LCM} &= 2\cdot 2\cdot 2\cdot 2\cdot 5\cdot 5 = 400 \end{aligned}$$

Therefore, the LCM is $\boxed{400}$.

Answer 70MYS.

Consider the following expressions.

$$36, 48, 60$$

Find the prime factors of each number.

$$36 = 2 \cdot 2 \cdot 3 \cdot 3$$
$$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$$
$$60 = 2 \cdot 2 \cdot 3 \cdot 5$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$36 = 2 \cdot 2 \cdot 3 \cdot 3$$
$$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$$
$$60 = 2 \cdot 2 \cdot 3 \cdot 5$$
$$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 720$$

Therefore, the LCM is $\boxed{720}$.

Answer 71MYS.

Consider the following expressions.

$$9, 16, 24$$

Find the prime factors of each number.

$$9 = 3 \cdot 3$$
$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$

Use each prime factor the greatest number of times it appears in any of the factorization.

$$9 = 3 \cdot 3$$
$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 144$$

Therefore, the LCM is $\boxed{144}$.