Review of Fractions

A fraction is said to be **reduced to lowest terms** or **simplified** if one is the only common factor of the numerator (top #) and the denominator (bottom #). If the numerator and denominator have common factors other than one, you must then divide out these common factors. Write the common factors over each other and use the fact that any nonzero number divided by itself is one.

Ex. A Simplify $\frac{42}{77}$.

Solution:
Since 42 and 77 have a common factor of 7, the problem becomes:

$$\frac{42}{77} = \frac{7 \cdot 6}{7 \cdot 11} = 1 \cdot \frac{6}{11} = \boxed{\frac{6}{11}}$$

Ex. B Simplify $\frac{84}{96}$.

Solution:
Since 84 and 96 have a common factor of 4, the problem becomes:

$$\frac{84}{96} = \frac{4 \cdot 21}{4 \cdot 24} = 1 \cdot \frac{21}{24} = \frac{21}{24}.$$

But 21 and 24 have a common factor of 3, so we can go further:

$$\frac{21}{24} = \frac{3 \cdot 7}{3 \cdot 8} = 1 \cdot \frac{7}{8} = \boxed{\frac{7}{8}}$$

Ex. C Simplify $\frac{175}{225}$.

Solution:
Since 175 and 225 have a common factor of 25, we get:

$$\frac{175}{225} = \frac{25 \cdot 7}{25 \cdot 9} = 1 \cdot \frac{7}{9} = \boxed{\frac{7}{9}}$$

Ex. D Simplify $\frac{405}{72}$.

Solution:
Since 405 and 72 have a common factor of 9, we can write:

$$\frac{405}{72} = \frac{9 \cdot 45}{9 \cdot 8} = 1 \cdot \frac{45}{8} = \boxed{\frac{45}{8}}$$

Ex. E Simplify $\frac{272}{1156}$.

Solution:
Since 272 and 1156 have 4 as a common factor, we can write:

$$\frac{272}{1156} = \frac{4 \cdot 68}{4 \cdot 289} = 1 \cdot \frac{68}{289} = \frac{68}{289}.$$

If we examine 68, it can be written as $4 \cdot 17$ and although 289 is not divisible by 4, it is divisible by 17. So, problem becomes:

$$\frac{68}{289} = \frac{17 \cdot 4}{17 \cdot 17} = 1 \cdot \frac{4}{17} = \boxed{\frac{4}{17}}$$

Simplify the following:

1) $\frac{36}{45}$ 2) $\frac{108}{120}$ 3) $\frac{66}{72}$

4) $\frac{25}{35}$ 5) $\frac{187}{198}$ 6) $\frac{48}{30}$

7) $\frac{84}{98}$ 8) $\frac{153}{102}$ 9) $\frac{91}{65}$

10) $\frac{450}{750}$ 11) $\frac{23}{39}$ 12) $\frac{127}{762}$

Answers:

1) $\frac{4}{5}$ 2) $\frac{9}{10}$ 3) $\frac{11}{12}$

4) $\frac{5}{7}$ 5) $\frac{17}{18}$ 6) $\frac{8}{5}$

7) $\frac{6}{7}$ 8) $\frac{3}{2}$ 9) $\frac{7}{5}$

10) $\frac{3}{5}$ 11) $\frac{23}{39}$ 12) $\frac{1}{6}$

If the numerator of a fraction is less than the denominator, then the fraction is called a **proper fraction.** Otherwise, the fraction is called an **improper fraction.** A **mixed number** is a whole number plus a proper fraction.

Ex. F

a) $\frac{6}{7}$, $\frac{7}{9}$, $\frac{3}{5}$, $\frac{23}{39}$, and $\frac{1}{6}$ are examples of proper fractions.

b) $\frac{3}{2}$, $\frac{8}{5}$, $\frac{45}{8}$, $\frac{53}{27}$, and $\frac{9}{9}$ are examples of improper fractions.

c) $5\frac{1}{6}$ and $4\frac{7}{9}$ are examples of mixed numbers whereas $8\frac{8}{5}$ is not a mixed number.

To convert an improper fraction to a mixed number, divide the numerator by the denominator. The quotient will be the whole number part of the mixed number while the remainder over the denominator will be the proper fraction part of the mixed number.

Improper Fraction: $\frac{\text{Numerator}}{\text{Denominator}}$

$$\text{Denominator} \overline{)\text{Numerator}}^{\text{Whole}}_{\underline{\quad " \quad "\quad}}_{\text{Remainder}}$$
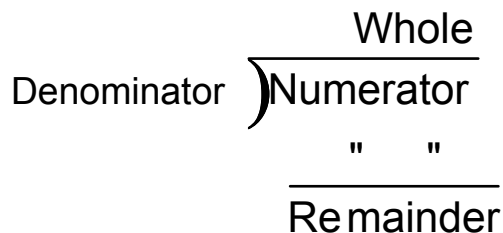
Mixed Number: Whole $\frac{\text{Remainder}}{\text{Denominator}}$

Ex. G Write $\frac{43}{8}$ as a mixed number.

Solution:
Take the numerator divided by the denominator and write the answer:

$$\begin{array}{r} 5 \\ 8\overline{)43} \\ -40 \\ \hline 3 \end{array}$$

So, we get $\boxed{5\ \frac{3}{8}}$

Ex. H Write $\frac{95}{27}$ as a mixed number.

Solution:
Take the numerator divided by the denominator and write the answer:

$$\begin{array}{r} 3 \\ 27\overline{)95} \\ -81 \\ \hline 14 \end{array}$$

So, we get $\boxed{3\ \frac{14}{27}}$

Ex. I Write $\frac{91}{13}$ as a mixed number.

Solution:
Take the numerator divided by the denominator and write the answer:

$$\begin{array}{r} 7 \\ 13\overline{)91} \\ -91 \\ \hline 0 \end{array}$$

So, we get $\boxed{7}$

Since the remainder is 0, we write 7 as our answer.

To convert a mixed number to an improper fraction, multiply the whole number by the denominator and add the result to the numerator. Put the answer you get over the denominator.

Mixed Number: Whole $\frac{Numerator}{Denominator}$

Improper Fraction:
$$\frac{Whole \bullet Denominator + Numerator}{Denominator}$$

Ex. J Write $3\frac{4}{5}$ as an improper fraction.
Solution:
Multiply the whole number by the denominator and add the result to the numerator:
$$3\frac{4}{5} = \frac{3 \bullet 5 + 4}{5} = \frac{15 + 4}{5} = \boxed{\frac{19}{5}}$$

Ex. K Write $2\frac{3}{7}$ as an improper fraction.
Solution:
Multiply the whole number by the denominator and add the result to the numerator:
$$2\frac{3}{7} = \frac{2 \bullet 7 + 3}{7} = \frac{14 + 3}{7} = \boxed{\frac{17}{7}}$$

Ex. L Write $8\frac{6}{13}$ as an improper fraction.
Solution:
Multiply the whole number by the denominator and add the result to the numerator:
$$8\frac{6}{13} = \frac{8 \bullet 13 + 6}{13} = \frac{104 + 6}{13} = \boxed{\frac{110}{13}}$$

Ex. M Write 9 as an improper fraction.
Solution:
Anytime you are working with a whole number, you can rewrite it as an improper fraction just by putting the number over 1.
$$9 = \boxed{\frac{9}{1}}$$

Write the following as a mixed number:

11) $\frac{66}{5}$ 12) $\frac{93}{8}$

13) $\frac{78}{7}$ 14) $\frac{51}{4}$

15) $\frac{175}{14}$ 16) $\frac{95}{9}$

Write the following as an improper fraction:

17) $8\frac{5}{7}$ 18) $6\frac{6}{11}$

19) $3\frac{7}{9}$ 20) $8\frac{3}{4}$

21) $7\frac{11}{20}$ 22) $23\frac{2}{5}$

Answers:

11) $13\frac{1}{5}$ 12) $11\frac{5}{8}$

13) $11\frac{1}{7}$ 14) $12\frac{3}{4}$

15) $12\frac{1}{2}$ 16) $10\frac{5}{9}$

17) $\frac{61}{7}$ 18) $\frac{72}{11}$

19) $\frac{34}{9}$ 20) $\frac{35}{4}$

21) $\frac{151}{20}$ 22) $\frac{117}{5}$

To multiply two fractions, if the numerators and denominators have common factors other than 1, reduce first. When reducing, you can cross out the common factors since they reduce to one. After reducing, multiply the numerators together and multiply the denominators together.

Ex. N Multiply: $\frac{7}{11} \cdot \frac{4}{3}$.

Solution:
One is the only common factor of the numerator and denominator so multiply the numerators to and multiply the denominators:

$$\frac{7}{11} \cdot \frac{4}{3} = \frac{7 \cdot 4}{11 \cdot 3} = \boxed{\frac{28}{33}}$$

Ex. O Find the product of $\frac{5}{8}$ & $\frac{4}{9}$.

Solution:
Reduce first and then multiply:

$$\frac{5}{8} \cdot \frac{4}{9} = \frac{5}{2 \cdot 4} \cdot \frac{4 \cdot 1}{9} = \frac{5}{2 \cdot \cancel{4}} \cdot \frac{\cancel{4} \cdot 1}{9}$$

$$= \frac{5 \cdot 1}{2 \cdot 9} = \boxed{\frac{5}{18}}$$

Ex. P Find $\frac{12}{35} \cdot \frac{25}{18} \cdot \frac{28}{45}$.

Solution:
Reduce first and then multiply:

$$\frac{12}{35} \cdot \frac{25}{18} \cdot \frac{28}{45} = \frac{2 \cdot 6}{7 \cdot 5} \cdot \frac{5 \cdot 5}{6 \cdot 3} \cdot \frac{28}{45}$$

$$= \frac{2 \cdot \cancel{6}}{7 \cdot \cancel{5}} \cdot \frac{\cancel{5} \cdot 5}{\cancel{6} \cdot 3} \cdot \frac{28}{45} = \frac{2 \cdot 5}{7 \cdot 3} \cdot \frac{28}{45}$$

$$= \frac{2 \cdot 5}{7 \cdot 3} \cdot \frac{7 \cdot 4}{5 \cdot 9} = \frac{2 \cdot \cancel{5}}{\cancel{7} \cdot 3} \cdot \frac{\cancel{7} \cdot 4}{\cancel{5} \cdot 9}$$

$$= \frac{2 \cdot 4}{3 \cdot 9} = \boxed{\frac{8}{27}}$$

When multiplying mixed numbers, first change them into improper fractions and then you can multiply them as before.

Ex. Q Multiply: $3\frac{1}{5} \cdot 7\frac{3}{4}$.

Solution:
Change the mixed numbers into improper fractions, reduce, and multiply:

$$3\frac{1}{5} \cdot 7\frac{3}{4} = \frac{3 \cdot 5 + 1}{5} \cdot \frac{7 \cdot 4 + 3}{4}$$

$$= \frac{16}{5} \cdot \frac{31}{4} = \frac{4 \cdot 4}{5} \cdot \frac{31}{4 \cdot 1} = \frac{4 \cdot \cancel{4}}{5} \cdot \frac{31}{\cancel{4} \cdot 1}$$

$$= \frac{4 \cdot 31}{5 \cdot 1} = \boxed{\frac{124}{5} \text{ or } 24\frac{4}{5}}$$

Ex. R Find $(3\frac{2}{5})(2\frac{6}{17})(11)$.

Solution:
Change the mixed numbers into improper fractions, reduce, and multiply:

$$3\frac{2}{5} \cdot 2\frac{6}{17} \cdot 11 = \frac{3 \cdot 5 + 2}{5} \cdot \frac{2 \cdot 17 + 6}{17} \cdot \frac{11}{1}$$

$$= \frac{17}{5} \cdot \frac{40}{17} \cdot \frac{11}{1} = \frac{1 \cdot 17}{5} \cdot \frac{5 \cdot 8}{17 \cdot 1} \cdot \frac{11}{1}$$

$$= \frac{1 \cdot \cancel{17}}{\cancel{5}} \cdot \frac{\cancel{5} \cdot 8}{\cancel{17} \cdot 1} \cdot \frac{11}{1} = \frac{1 \cdot 8 \cdot 11}{1 \cdot 1} = \frac{88}{1}$$

$$= \boxed{88}$$

Perform the indicated operation:

23) $\left(\frac{7}{8}\right)\left(\frac{20}{21}\right)$

24) $7\frac{1}{2} \cdot 3\frac{8}{9}$

25) $9 \cdot \frac{64}{15} \cdot \frac{7}{48}$

26) $(3\frac{11}{18})(4\frac{4}{13})$

27) $\frac{27}{16} \cdot \frac{40}{21} \cdot \frac{14}{33}$

28) $17 \cdot 6\frac{3}{4} \cdot \frac{3}{5}$

29) $7\frac{1}{3} \times 3\frac{6}{11}$

30) $\frac{15}{28} \cdot \frac{21}{45} \cdot \frac{16}{9}$

Answers:

23) $\frac{5}{6}$ 24) $\frac{175}{6}$ or $29\frac{1}{6}$

25) $5\frac{3}{5}$ 26) $15\frac{5}{9}$

27) $\frac{15}{11}$ or $1\frac{4}{11}$ 28) $\frac{1377}{20}$ or $68\frac{17}{20}$

29) 26 30) $\frac{4}{9}$

When dividing fractions, change the operation to multiplication and invert the fraction to the right of the operation. Then multiply as before. If dividing mixed numbers, first change to them into improper fractions and then change the operation to multiplication and invert the fraction to the right.

Ex. S Divide: $\frac{5}{18} \div \frac{25}{27}$.

Solution:
Invert the fraction to the right and multiply:

$$\frac{5}{18} \div \frac{25}{27} = \frac{5}{18} \bullet \frac{27}{25} = \frac{1 \bullet 5}{2 \bullet 9} \bullet \frac{9 \bullet 3}{5 \bullet 5}$$

$$= \frac{1 \bullet \cancel{5}}{2 \bullet \cancel{9}} \bullet \frac{\cancel{9} \bullet 3}{\cancel{5} \bullet 5} = \boxed{\frac{3}{10}}$$

Ex. T Divide: $\dfrac{3\frac{7}{8}}{5\frac{1}{6}}$.

Solution:
Change the mixed the numbers into improper fractions, invert the fraction to the right and multiply:

$$\frac{3\frac{7}{8}}{5\frac{1}{6}} = (3\frac{7}{8}) \div (5\frac{1}{6}) = \frac{31}{8} \div \frac{31}{6}$$

$$= \frac{31}{8} \bullet \frac{6}{31} = \frac{1 \bullet 31}{2 \bullet 4} \bullet \frac{2 \bullet 3}{31 \bullet 1}$$

$$= \frac{1 \bullet \cancel{31}}{4 \bullet \cancel{2}} \bullet \frac{\cancel{2} \bullet 3}{\cancel{31} \bullet 1} = \frac{1 \bullet 3}{4 \bullet 1} = \boxed{\frac{3}{4}}$$

Ex. U Find the quotient of 12 & $\frac{2}{3}$.

Solution:
Write 12 over 1, invert the fraction to the right and multiply:

$$12 \div \frac{2}{3} = \frac{12}{1} \div \frac{2}{3} = \frac{12}{1} \bullet \frac{3}{2}$$

$$= \frac{6 \bullet 2}{1} \bullet \frac{3}{2 \bullet 1} = \frac{6 \bullet \cancel{2}}{1} \bullet \frac{3}{\cancel{2} \bullet 1}$$

$$= \frac{6 \bullet 3}{1 \bullet 1} = \frac{18}{1} = \boxed{18}$$

Ex. W Find 6 divided into $2\frac{3}{8}$.

Solution:
Change the numbers into improper fractions, invert the fraction to the right and multiply:

$$2\frac{3}{8} \div 6 = \frac{19}{8} \div \frac{6}{1} = \frac{19}{8} \bullet \frac{1}{6} = \boxed{\frac{19}{48}}$$

Simplify the following:

31) $\frac{35}{36} \div \frac{21}{11}$ 32) $\frac{16}{25} \div \frac{13}{20}$

33) $2\frac{3}{4} \div 4\frac{2}{3}$ 34) $3\frac{1}{7} \div 7\frac{1}{3}$

35) $\dfrac{\frac{17}{16}}{6\frac{3}{8}}$ 36) $\dfrac{2\frac{5}{8}}{\frac{15}{16}}$

37) $72 \div \frac{2}{3}$ 38) $1\frac{5}{18} \div 6$

Answers:

31) $\frac{55}{108}$ 32) $\frac{64}{65}$ 33) $\frac{33}{56}$

34) $\frac{3}{7}$ 35) $\frac{1}{6}$ 36) $2\frac{4}{5}$ or $\frac{14}{5}$

37) 108 38) $\frac{23}{108}$

To add or subtract fractions with the same denominators, add or subtract only the numerators and keep the denominator the same.

Ex. X Add: $\frac{3}{7} + \frac{2}{7}$.

Solution:
Add only the numerators:

$\frac{3}{7} + \frac{2}{7} = \frac{3+2}{7} = \boxed{\frac{5}{7}}$

Ex. Y Subtract: $\frac{8}{3} - \frac{1}{3}$.

Solution:
Subtract only the numerators:

$\frac{8}{3} - \frac{1}{3} = \frac{8 \check{S} 1}{3} = \boxed{\frac{7}{3} \text{ or } 2\frac{1}{3}}$

Ex. Z Simplify: $\frac{9}{10} - \frac{7}{10} + \frac{3}{10}$.

Solution:
Combine only the numerators:

$\frac{9}{10} - \frac{7}{10} + \frac{3}{10} = \frac{9 \check{S} 7 + 3}{10} = \frac{5}{10}$

$= \frac{5 \bullet 1}{5 \bullet 2} = \boxed{\frac{1}{2}}$

To add or subtract mixed numbers with the proper fraction having the same denominator, first change the mixed numbers into improper fractions and then add as before.

Ex. AA Simplify: $6\frac{3}{11} - 4\frac{5}{11} + 3\frac{1}{11}$.

Solution:
Change into improper fractions and combine only the numerators:

$6\frac{3}{11} - 4\frac{5}{11} + 3\frac{1}{11} = \frac{69}{11} - \frac{49}{11} + \frac{34}{11}$

$= \frac{69 - 49 + 34}{11} = \boxed{\frac{54}{11} \text{ or } 4\frac{10}{11}}$

Ex. AB Simplify: $9\frac{4}{15} + 6\frac{7}{15} - \frac{14}{15}$.

Solution:
Change into improper fractions and combine only the numerators:

$9\frac{4}{15} + 6\frac{7}{15} - \frac{14}{15} = \frac{139}{15} + \frac{97}{15} - \frac{14}{15}$

$= \frac{139 + 97 \check{S} 14}{15} = \frac{222}{15} = 14\frac{12}{15}$

$= 14\frac{3 \bullet 4}{3 \bullet 5} = \boxed{14\frac{4}{5} \text{ or } \frac{74}{5}}$

Simplify the following:

39) $\frac{5}{36} + \frac{7}{36} + \frac{3}{36}$ 40) $\frac{3}{8} + \frac{7}{8} - \frac{5}{8}$

41) $12\frac{7}{9} - 11\frac{2}{9}$ 42) $\frac{75}{16} - \frac{23}{16}$

43) $21\frac{3}{7} - \frac{6}{7}$ 44) $2\frac{5}{6} + 3\frac{4}{6}$

45) $9\frac{1}{4} + 15\frac{3}{4} - 21\frac{2}{4}$

46) $7\frac{7}{23} - 2\frac{14}{23} + \frac{3}{23}$

Answers:

39) $\frac{5}{12}$ 40) $\frac{5}{8}$

41) $\frac{14}{9}$ or $1\frac{5}{9}$ 42) $\frac{13}{4}$ or $3\frac{1}{4}$

43) $\frac{144}{7}$ or $20\frac{4}{7}$ 44) $\frac{13}{2}$ or $6\frac{1}{2}$

45) $\frac{7}{2}$ or $3\frac{1}{2}$ 46) $\frac{111}{23}$ or $4\frac{19}{23}$

When adding or subtracting fractions that do not have the same denominator, first find the LCD (Least Common Denominator). This can be done by choosing the largest denominator and list the multiples of that denominator until one finds a multiple that is divisible by **all** the denominators.

Ex. AC Find the LCD of $\frac{4}{15}$ & $\frac{7}{12}$.

Solution:
Since 15 is our largest denominator, list the multiples of 15 until a number is found that is divisible by 12:
15, 30, 45, 60
Since 60 is divisible by 12, then the $\boxed{\text{LCD} = 60.}$

Ex. AD Find the LCD of $\frac{17}{18}$ & $\frac{7}{24}$.

Solution:
Since 24 is our largest denominator, list the multiples of 24 until a number is found that is divisible by 18:
24, 48, 72
Since 72 is divisible by 18, then the $\boxed{\text{LCD} = 72.}$

Ex. AE Find the LCD of $\frac{1}{4}$, $\frac{4}{5}$, and $\frac{5}{42}$.

Solution:
Since 42 is our largest denominator, list the multiples of 42 until a number is found that is divisible by both 4 and 5:
42, 84, 126, 168, 210, 252, 294, 336, 378, 420
Since 420 is divisible by both 4 and 5, the $\boxed{\text{LCD} = 420.}$

Note that 84, 168, 252, and 336 was not the LCD since they were not divisible by 5 and 210 was not the LCD since it is not divisible by 4. To be the LCD, the number

must be divisible by all the denominators.

After finding the LCD, the next step is to build the fractions so that have the same denominator. This is done by multiplying the numerator and denominator by the same number that will yield the LCD in the denominator. To find the number to multiply, divide the LCD by the original denominator.

Ex. AF Build $\frac{4}{15}$ and $\frac{7}{12}$ so that their denominators equal the LCD.
Solution:
Recall from Ex. AC that the LCD was 60. Since 15 goes into 60 four times, multiply the top and bottom of $\frac{4}{15}$ by 4. Since 12 goes into 60 five times, multiply the top and bottom of $\frac{7}{12}$ by 5.

$$\frac{4}{15} = \frac{4 \bullet 4}{15 \bullet 4} = \boxed{\frac{16}{60}}$$

$$\frac{7}{12} = \frac{7 \bullet 5}{12 \bullet 5} = \boxed{\frac{35}{60}}$$

Ex AG Build $\frac{17}{18}$ and $\frac{7}{24}$ so that their denominators equal the LCD.
Solution:
Recall from Ex. AC that the LCD was 72. Since $72 \div 18 = 4$ and $72 \div 24 = 3$, we get:

$$\frac{17}{18} = \frac{17 \bullet 4}{18 \bullet 4} = \boxed{\frac{68}{72}}$$

$$\frac{7}{24} = \frac{7 \bullet 3}{24 \bullet 3} = \boxed{\frac{21}{72}}$$

Ex AH Build $\frac{1}{4}$, $\frac{4}{5}$, & $\frac{5}{42}$ so that their denominators equal the LCD.

Solution:
Recall from Ex. AD that the LCD was 420. Since 420 ÷ 4 = 105, 420 ÷ 5 = 84, and 420 ÷ 42 = 10, we get:

$$\frac{1}{4} = \frac{1 \bullet 105}{4 \bullet 105} = \boxed{\frac{105}{420}}$$

$$\frac{4}{5} = \frac{4 \bullet 84}{5 \bullet 84} = \boxed{\frac{336}{420}}$$

$$\frac{5}{42} = \frac{5 \bullet 10}{42 \bullet 10} = \boxed{\frac{50}{420}}$$

For the given fractions, find the LCD and Build the fractions so that their denominators equal the LCD:

47) $\frac{5}{12}$ & $\frac{13}{18}$ 48) $\frac{5}{6}$ & $\frac{3}{10}$

49) $\frac{7}{8}$, $\frac{5}{9}$, & $\frac{1}{6}$ 50) $\frac{23}{42}$ & $\frac{7}{18}$

51) $\frac{5}{21}$ & $\frac{8}{63}$ 52) $\frac{8}{11}$, $\frac{7}{22}$, & $\frac{4}{33}$

Answers:

47) LCD = 36, $\frac{5}{12} = \frac{15}{36}$, $\frac{13}{18} = \frac{26}{36}$

48) LCD = 30, $\frac{5}{6} = \frac{25}{30}$, $\frac{3}{10} = \frac{9}{30}$

49) LCD = 72, $\frac{7}{8} = \frac{63}{72}$, $\frac{5}{9} = \frac{40}{72}$, $\frac{1}{6} = \frac{12}{72}$

50) LCD = 126, $\frac{23}{42} = \frac{69}{126}$, $\frac{7}{18} = \frac{49}{126}$

51) LCD = 63, $\frac{5}{21} = \frac{15}{63}$, $\frac{8}{63} = \frac{8}{63}$

52) LCD = 66, $\frac{8}{11} = \frac{48}{66}$, $\frac{7}{22} = \frac{21}{66}$, $\frac{4}{33} = \frac{8}{66}$

After finding the LCD and building the fractions so that their denominators are equal to the LCD, the fractions then can be combined in the same manner as combining fractions with the same denominator.

Ex. AI Find the sum of $\frac{5}{8}$ & $\frac{7}{12}$.

Solution:
Find the LCD, build the fractions so their denominators equal the LCD and combine only the numerators:

$$\frac{5}{8} + \frac{7}{12} \quad (\text{LCD} = 24)$$

$$= \frac{5 \bullet 3}{8 \bullet 3} + \frac{7 \bullet 2}{12 \bullet 2} = \frac{15}{24} + \frac{14}{24}$$

$$= \boxed{\frac{29}{24} \text{ or } 1 \frac{5}{24}}$$

Ex. AJ Simplify: $\frac{5}{6} - \frac{1}{9} + \frac{2}{3}$.

Solution:
Find the LCD, build the fractions so their denominators equal the LCD and combine only the numerators:

$$\frac{5}{6} - \frac{1}{9} + \frac{2}{3} \quad (\text{LCD} = 18)$$

$$= \frac{5 \bullet 3}{6 \bullet 3} - \frac{1 \bullet 2}{9 \bullet 2} + \frac{2 \bullet 6}{3 \bullet 6}$$

$$= \frac{15}{18} - \frac{2}{18} + \frac{12}{18} = \frac{26}{18} = \boxed{\frac{13}{9} \text{ or } 1 \frac{4}{9}}.$$

When adding and subtracting mixed numbers, first change them into improper fractions. Then follow the steps above to get the answer.

Ex. AJ Simplify: $9 - 3\frac{4}{69} + 2\frac{7}{46}$.

Solution:
Rewrite each number as an improper fraction, find the LCD, build the fractions so their denominators equal the LCD and combine only the numerators:

$9 - 3\frac{4}{69} + 2\frac{7}{46} = \frac{9}{1} - \frac{211}{69} + \frac{99}{46}$

(LCD = 138)

$= \frac{9 \cdot 138}{1 \cdot 138} - \frac{211 \cdot 2}{69 \cdot 2} + \frac{99 \cdot 3}{46 \cdot 3}$

$= \frac{1242}{138} - \frac{422}{138} + \frac{297}{138}$

$= \boxed{\frac{1117}{138} \text{ or } 8\frac{13}{138}}$

Ex. AK Simplify: $6\frac{7}{12} - 4\frac{2}{5} + \frac{3}{4} + 8$.

Solution:
Rewrite each number as an improper fraction, find the LCD, build the fractions so their denominators equal the LCD and combine only the numerators:

$6\frac{7}{12} - 4\frac{2}{5} + \frac{3}{4} + 8$

$= \frac{79}{12} - \frac{22}{5} + \frac{3}{4} + \frac{8}{1}$ (LCD = 60)

$= \frac{79 \cdot 5}{12 \cdot 5} - \frac{22 \cdot 12}{5 \cdot 12} + \frac{3 \cdot 15}{4 \cdot 15} + \frac{8 \cdot 60}{1 \cdot 60}$

$= \frac{395}{60} - \frac{264}{60} + \frac{45}{60} + \frac{480}{60} = \frac{656}{60}$

$= \frac{4 \cdot 164}{4 \cdot 15} = \boxed{\frac{164}{15} \text{ or } 10\frac{14}{15}}$

Simplify the following:

53) $\frac{5}{6} + \frac{1}{8}$ 54) $\frac{2}{3} - \frac{2}{27}$

55) $\frac{7}{3} - \frac{5}{6} + \frac{5}{12}$

56) $6\frac{2}{5} - 3\frac{3}{4}$ 57) $16 - 2\frac{3}{7}$

58) $3\frac{7}{8} + 2\frac{9}{14} + 7$

59) $8\frac{4}{9} - 5$

60) $14\frac{3}{10} + 3\frac{7}{16} - 16\frac{3}{4}$

Answers:

53) $\frac{23}{24}$ 54) $\frac{16}{27}$

55) $\frac{23}{12}$ or $1\frac{11}{12}$ 56) $\frac{53}{20}$ or $2\frac{13}{20}$

57) $\frac{95}{7}$ or $13\frac{4}{7}$ 58) $\frac{757}{56}$ or $13\frac{29}{56}$

59) $\frac{31}{9}$ or $3\frac{4}{9}$ 60) $\frac{79}{80}$

When raising a fraction to a power, rewrite the fraction in expanded form and multiply.

Ex. AL Simplify: $\left(\frac{3}{5}\right)^4$

Solution:
Rewrite the expression in expanded form and multiply:

$\left(\frac{3}{5}\right)^4 = \left(\frac{3}{5}\right)\left(\frac{3}{5}\right)\left(\frac{3}{5}\right)\left(\frac{3}{5}\right)$

$= \frac{3 \cdot 3 \cdot 3 \cdot 3}{5 \cdot 5 \cdot 5 \cdot 5} = \boxed{\frac{81}{625}}$