Chapter 3 Review

Objective [3.1a] Find the LCM of two or more numbers using a list of multiples or factorizations.		
Brief Procedure	Example	Practice Exercise
To find the LCM of two or more numbers using a list of multiples: First determine whether the largest number is a multiple of all the other numbers. If so, it is the least common multiple, or LCM . If not, check multiples of the largest number until you get one that is a multiple of the others. That number is the LCM.	Find the LCM of 15 and 18 using a list of multiples. First observe that 18 is not a multiple of 15. Then check multiples: $2 \cdot 18 = 36$ Not a multiple of 15 $3 \cdot 18 = 54$ Not a multiple of 15 $4 \cdot 18 = 72$ Not a multiple of 15 $5 \cdot 18 = 90$ A multiple of 15 The LCM is 90.	1. Find the LCM of 12 and 16 using a list of multiples. A. 16 B. 36 C. 48 D. 192
To find the LCM of two or more numbers using factorizations, a) Find the prime factorization of each number. b) Create a product of factors, using each factor the greatest number of times that it occurs in any one factorization.	Find the LCM of 9 and 21. a) $9 = 3 \cdot 3,\ 21 = 3 \cdot 7$ b) Consider the factor 3. The greatest number of times that 3 occurs in any one factorization is two. LCM is $3 \cdot 3 \cdot$? Consider the factor 7. The greatest number of times that 7 occurs in any one factorization is one. LCM is $3 \cdot 3 \cdot 7 \cdot$? Since there are no other prime factors in either factorization, the LCM is $3 \cdot 3 \cdot 7 \cdot$, or 63.	2. Find the LCM of 8 and 20 using factorizations. A. 20 B. 40 C. 80 D. 160

Objective [3.2a] Add using fractional notation when denominators are the same.		
Brief Procedure	Example	Practice Exercise
Add the numerators, keep the denominator, and simplify, if possible.	Add and simplify: $\frac{3}{8} + \frac{7}{8}$. $\frac{3}{8}+\frac{7}{8} = \frac{3+7}{8} = \frac{10}{8} = \frac{2 \cdot 5}{2 \cdot 4} = \frac{2}{2} \cdot \frac{5}{4} =$ $1 \cdot \frac{5}{4} = \frac{5}{4}$	3. Add and simplify: $\frac{1}{12} + \frac{7}{12}$ A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. $\frac{2}{3}$ D. $\frac{7}{144}$

Objective [3.2b] Add using fractional notation when denominators are different, by multiplying by 1 to find the least common denominator.

Brief Procedure	Example	Practice Exercise
a) Find the least common multiple of the denominators. That number is the least common denominator, LCD. b) Multiply by 1, using an appropriate notation, n/n, to express each number in terms of the LCD. c) Add the numerators, keeping the same denominator. d) Simplify,if possible.	Add and simplify, if possible: $\frac{2}{9}+\frac{1}{6}$. $9 = 3\cdot 3$ and $6 = 2\cdot 3$ so the LCM of 9 and 6 is $2\cdot 3\cdot 3$, or 18. Thus the LCD is 18. $\frac{2}{9}+\frac{1}{6}$ $=\frac{2}{9}\cdot\frac{2}{2}+\frac{1}{6}\cdot\frac{3}{3}$ $=\frac{4}{18}+\frac{3}{18}$ $=\frac{7}{18}$ No simplification is necessary.	4. Add and simplify, if possible: $\frac{3}{4}+\frac{3}{10}$. A. $\frac{3}{7}$ B. $\frac{3}{14}$ C. $\frac{21}{20}$ D. $\frac{9}{40}$

Objective [3.2c] Solve applied problems involving addition with fractional notation.

Brief Procedure	Example	Practice Exercise
Use the five-step problem solving process.	Morton bought $\frac{1}{2}$ lb of Vermont cheddar cheese and $\frac{2}{3}$ lb of feta cheese. How many pounds of cheese did he buy? 1. *Familiarize.* Let $c =$ the number of pounds of cheese Morton bought. 2. *Translate.* $\underbrace{\text{Amount of cheddar}}\ \text{plus}\ \underbrace{\text{Amount of feta}}\ \text{is}\ \underbrace{\text{Total amount}}$ $\frac{1}{2} + \frac{2}{3} = c$ 3. *Solve.* We carry out the addition. The LCM of the denominators is 6. $\frac{1}{2}\cdot\frac{3}{3}+\frac{2}{3}\cdot\frac{2}{2}=c$ $\frac{3}{6}+\frac{4}{6}=c$ $\frac{7}{6}=c$ (continued)	5. Renza walked $\frac{3}{4}$ mi to campus and then $\frac{3}{5}$ mi to her parttime job. How far did she walk? A. $\frac{1}{3}$ mi B. $\frac{2}{3}$ mi C. $\frac{9}{20}$ mi D. $\frac{27}{20}$ mi

Objective [3.2c] continued		
Brief Procedure	**Example**	**Practice Exercises**
	4. *Check.* As a partial check, note that the result is larger than either of the individual amounts, so the answer seems reasonable. We can also repeat the calculation. The answer checks. 5. *State.* Morton bought $\frac{7}{6}$ lb of cheese.	

Objective [3.3a] Subtract using fractional notation.		
Brief Procedure	**Example**	**Practice Exercises**
If denominators are the same, subtract the numerators, keep the denominator, and simplify, if possible. If denominators are different, a) Find the least common multiple of the denominators. That number is the least common denominator, LCD. b) Multiply by 1, using an appropriate notation, n/n, to express each number in terms of the LCD. c) Subtract the numerators, keeping the same denominator. d) Simplify, if possible.	Subtract and simplify, if possible: $\frac{2}{3} - \frac{1}{4}$. The LCM of 3 and 4 is 12, so the LCD is 12. $\frac{2}{3} - \frac{1}{4} = \frac{2}{3} \cdot \frac{4}{4} - \frac{1}{4} \cdot \frac{3}{3}$ $= \frac{8}{12} - \frac{3}{12}$ $= \frac{5}{12}$ No simplification is necessary.	6. Subtract and simplify, if possible: $\frac{4}{5} - \frac{3}{8}$ A. $\frac{17}{40}$ B. $\frac{7}{40}$ C. $\frac{3}{10}$ D. $\frac{1}{3}$

Objective [3.3b] Use $<$ or $>$ with fractional notation to write a true sentence.		
Brief Procedure	**Example**	**Practice Exercise**
Multiply by 1 to make the denominators the same, if necessary. Then compare the numerators. The fraction with the larger numerator is the larger fraction.	Use $<$ or $>$ for $\square$ to write a true sentence: $\frac{3}{5} \square \frac{5}{8}$. $\frac{3}{5} \cdot \frac{8}{8} = \frac{24}{40}$ $\frac{5}{8} \cdot \frac{5}{5} = \frac{25}{40}$ Since $24 < 25$, it follows that $\frac{3}{5} < \frac{5}{8}$.	7. Use $<$ or $>$ for $\square$ to write a true sentence: $\frac{2}{3} \square \frac{5}{9}$. A. $<$ B. $>$

Objective [3.3c] Solve equations of the type $x+a=b$ and $a+x=b$, where a and b may be fractions.		
Brief Procedure	**Example**	**Practice Exercise**
Subtract a on both sides of the equation.	Solve: $x+\frac{1}{3}=\frac{4}{5}$. $x+\frac{1}{3}=\frac{4}{5}$ $x+\frac{1}{3}-\frac{1}{3}=\frac{4}{5}-\frac{1}{3}$ $x+0=\frac{4}{5}\cdot\frac{3}{3}-\frac{1}{3}\cdot\frac{5}{5}$ $x=\frac{12}{15}-\frac{5}{15}=\frac{7}{15}$	8. Solve: $x+\frac{5}{6}=\frac{7}{8}$. A. $\frac{1}{24}$ B. $\frac{41}{24}$ C. $\frac{41}{48}$ D. 1

Objective [3.3d] Solve applied problems involving subtraction with fractional notation.		
Brief Procedure	**Example**	**Practice Exercise**
Use the five-step problem solving process.	Bert spent $\frac{7}{4}$ hr doing his chemistry and English assignments. He spent $\frac{5}{6}$ hr on the chemistry assignment. How long did he spend on the English assignment? 1. *Familiarize.* Let t = the number of hours Bert spent on his English assignment. 2. *Translate.* This is a "how much more" situation. Chemistry time plus English time is Total time $\frac{5}{6} + t = \frac{7}{4}$ 3. *Solve.* We subtract $\frac{5}{6}$ on both sides of the equation. $\frac{5}{6}+t-\frac{5}{6}=\frac{7}{4}-\frac{5}{6}$ $t+0=\frac{7}{4}\cdot\frac{3}{3}-\frac{5}{6}\cdot\frac{2}{2}$ $t=\frac{21}{12}-\frac{10}{12}=\frac{11}{12}$ 4. *Check.* We return to the original problem and add: $\frac{5}{6}+\frac{11}{12}=\frac{5}{6}\cdot\frac{2}{2}+\frac{11}{12}=\frac{10}{12}+\frac{11}{12}=\frac{21}{12}=\frac{3}{3}\cdot\frac{7}{4}=\frac{7}{4}$. The answer checks. 5. *State.* Bert spent $\frac{11}{12}$ hr on his English assignment.	9. Mary has walked $\frac{3}{4}$ mi and will stop walking when she has walked $\frac{9}{8}$ mi. How much farther does she have to walk? A. $\frac{1}{2}$ mi B. $\frac{3}{8}$ mi C. $\frac{15}{8}$ mi D. $\frac{27}{32}$ mi

Objective [3.4a] Convert from mixed numerals to fractional notation.

Brief Procedure	Example	Practice Exercises
a) Multiply the whole number by the denominator. b) Add the result to the numerator. c) Keep the denominator.	Convert $5\frac{3}{8}$ to fractional notation. $5 \times 8 = 40$ and $40 + 3 = 43$, so $5\frac{3}{8} = \frac{43}{8}$.	10. Convert $3\frac{4}{5}$ to fractional notation. A. $\frac{7}{5}$ B. $\frac{12}{5}$ C. $\frac{19}{5}$ D. $\frac{34}{5}$

Objective [3.4b] Convert from fractional notation to mixed numerals.

Brief Procedure	Example	Practice Exercise
Divide the numerator by the denominator The quotient is the whole number part of the mixed numeral. The numerator of the fractional part is the remainder, and the denominator is the denominator of the fractional notation.	Convert $\frac{13}{3}$ to a mixed numeral. $3 \overline{)13}$ = 4, 12, remainder 1 $\frac{13}{3} = 4\frac{1}{3}$	11. Convert $\frac{11}{6}$ to a mixed numeral. A. $1\frac{1}{6}$ B. $1\frac{5}{6}$ C. $2\frac{1}{6}$ D. $2\frac{5}{6}$

Objective [3.4c] Divide, writing a mixed numeral for the quotient.

Brief Procedure	Example	Practice Exercise
Divide as usual. The quotient is the whole number part of the mixed numeral. The numerator of the fractional part is the remainder, and the denominator is the divisor.	Divide. Write a mixed numeral for the quotient. $5 \overline{)2367}$ We first divide as usual. 473 $5 \overline{)2367}$ 2000 367 350 17 15 2 The answer is $473\frac{2}{5}$.	12. Divide. Write a mixed numeral for the quotient. $7 \overline{)4115}$ A. $523\frac{2}{7}$ B. $568\frac{3}{7}$ C. $578\frac{4}{7}$ D. $587\frac{6}{7}$

Objective [3.5a] Add using mixed numerals.

Brief Procedure	Example	Practice Exercise
First add the fractions. Then add the whole numbers.	Add: $3\frac{5}{8}+4\frac{1}{2}$. The LCD is 8. $3\,\frac{5}{8} = 3\,\frac{5}{8}$ $+4\,\frac{1}{2}\cdot\frac{4}{4} = +4\,\frac{4}{8}$ $7\,\frac{9}{8} = 7+\frac{9}{8}$ $= 7+1\frac{1}{8}$ $= 8\frac{1}{8}$	13. Add: $5\frac{2}{3}+1\frac{3}{4}$. A. $7\frac{5}{12}$ B. $6\frac{5}{7}$ C. $6\frac{5}{12}$ D. $6\frac{1}{2}$

Objective [3.5b] Subtract using mixed numerals.

Brief Procedure	Example	Practice Exercise
First subtract the fractions, borrowing if necessary. Then subtract the whole numbers.	Subtract: $6\frac{1}{3}-4\frac{1}{2}$. $6\,\frac{1}{3}\cdot\frac{2}{2} = 6\,\frac{2}{6} = 5\,\frac{8}{6}$ $-4\,\frac{1}{2}\cdot\frac{3}{3} = -4\,\frac{3}{6} = -4\,\frac{3}{6}$ $1\,\frac{5}{6}$	14. Subtract: $9\frac{3}{8}-3\frac{3}{4}$. A. $5\frac{3}{8}$ B. $5\frac{5}{8}$ C. $6\frac{3}{8}$ D. $6\frac{5}{8}$

Objective [3.5c] Solve applied problems involving addition and subtraction with mixed numerals.

Brief Procedure	Example	Practice Exercise
Use the five-step problem solving process.	Melanie bought $1\frac{1}{2}$ lb of apples and $2\frac{3}{4}$ lb of pears. What was the total weight of the fruit? 1. *Familiarize.* Let w = the total weight of the fruit, in pounds. 2. *Translate.* $\underbrace{\text{Weight of apples}}_{\downarrow}$ plus $\underbrace{\text{Weight of pears}}_{\downarrow}$ is $\underbrace{\text{Total weight}}_{\downarrow}$ $1\frac{1}{2} + 2\frac{3}{4} = w$ (continued)	15. Sam is $73\frac{1}{4}$ in. tall, and Ray is $70\frac{1}{2}$ in. tall. How much taller is Sam? A. $3\frac{3}{4}$ in. B. $3\frac{1}{4}$ in. C. $2\frac{3}{4}$ in. D. $2\frac{1}{4}$ in.

Objective [3.5c] continued		
Brief Procedure	**Example**	**Practice Exercise**
	3. *Solve.* We carry out the addition. The LCD is 4. $$\begin{array}{rcr} 1\,\frac{1}{2}\cdot\frac{2}{2} & = & 1\,\frac{2}{4} \\ +2\,\frac{3}{4} & = & +2\,\frac{3}{4} \\ \hline & & 3\,\frac{5}{4} = 4\frac{1}{4} \end{array}$$ 4. *Check.* We repeat the calculation. The answer checks. 5. *State.* The total weight of the fruit was $4\frac{1}{4}$ lb.	

Objective [3.6a] Multiply using mixed numerals.		
Brief Procedure	**Example**	**Practice Exercise**
First convert to fractional notation and multiply. Then convert the result to a mixed numeral, if appropriate.	Multiply: $1\frac{3}{8}\cdot 5\frac{2}{3}$. $1\frac{3}{8}\cdot 5\frac{2}{3} = \frac{11}{8}\cdot\frac{17}{3} = \frac{187}{24} = 7\frac{19}{24}$	16. Multiply: $6\frac{2}{5}\cdot 2\frac{3}{4}$. A. $12\frac{3}{10}$ B. $14\frac{1}{5}$ C. $15\frac{9}{10}$ D. $17\frac{3}{5}$

Objective [3.6b] Divide using mixed numerals.		
Brief Procedure	**Example**	**Practice Exercise**
First convert to fractional notation and divide. Then convert the result to a mixed numeral, if appropriate.	Divide: $4\frac{2}{3}\div 2\frac{3}{5}$. $4\frac{2}{3}\div 2\frac{3}{5} = \frac{14}{3}\div\frac{13}{5} = \frac{14}{3}\cdot\frac{5}{13} =$ $\frac{70}{39} = 1\frac{31}{39}$	17. Divide: $9\frac{1}{8}\div 3\frac{1}{4}$. A. $2\frac{5}{8}$ B. $2\frac{21}{26}$ C. $3\frac{5}{26}$ D. $3\frac{1}{2}$

Objective [3.6c] Solve applied problems involving multiplication and division with mixed numerals.		
Brief Procedure	Example	Practice Exercise
Use the five-step problem solving process.	A cookie recipe calls for $1\frac{3}{4}$ cups of sugar. How much is needed for 2 recipes? 1. *Familiarize*. Let s = the number of cups of sugar in 2 recipes. 2. *Translate*. The situation translates to the multiplication sentence $c = 2 \cdot 1\frac{3}{4}.$ 3. *Solve*. We carry out the multiplication. $c = 2 \cdot 1\frac{3}{4} = 2 \cdot \frac{7}{4} = \frac{2 \cdot 7}{4} = \frac{2 \cdot 7}{2 \cdot 2} = \frac{2}{2} \cdot \frac{7}{2} = \frac{7}{2} = 3\frac{1}{2}$ 4. *Check*. We can do a partial check by estimating: $2 \cdot 1\frac{3}{4} \approx 2 \cdot 2 = 4 \approx 3\frac{1}{2}$. We can also repeat the calculation. The answer checks. 5. *State*. For 2 recipes, $3\frac{1}{2}$ cups of sugar are needed.	18. A car travels 276 mi on $11\frac{5}{10}$ gal of gas. How many miles per gallon did it get? A. 24 B. 28 C. 30 D. 32

Objective [3.7a] Simplify expressions using the rules for order of operations.		
Brief Procedure	Example	Practice Exercise
1. Do all calculations within parentheses before operations outside. 2. Evaluate all exponential expressions. 3. Do all multiplications and divisions in order from left to right. 4. Do all additions and subtractions in order from left to right.	Simplify: $\left(\frac{3}{2}\right)^2 \div 9 + \frac{4}{5} \cdot \frac{1}{3}.$ $\left(\frac{3}{2}\right)^2 \div 9 + \frac{4}{5} \cdot \frac{1}{3}$ $= \frac{9}{4} \div 9 + \frac{4}{5} \cdot \frac{1}{3}$ $= \frac{9}{4} \cdot \frac{1}{9} + \frac{4}{5} \cdot \frac{1}{3}$ $= \frac{\cancel{9} \cdot 1}{4 \cdot \cancel{9}} + \frac{4 \cdot 1}{5 \cdot 3}$ $= \frac{1}{4} + \frac{4}{15}$ $= \frac{15}{60} + \frac{16}{60}$ $= \frac{31}{60}$	19. Simplify: $3\left(\frac{2}{3} - \frac{1}{6}\right) - \left(\frac{1}{4}\right)^2 \cdot \frac{8}{9}.$ A. $\frac{5}{9}$ B. $\frac{8}{9}$ C. $\frac{13}{9}$ D. $\frac{16}{9}$

Objective [3.7b] Estimate with fractional and mixed numeral notation.		
Brief Procedure	Example	Practice Exercise
Estimate a fraction (or the fractional part of a mixed numeral) as 0 when the numerator is very small in comparison to the denominator. Estimate a fraction as $\frac{1}{2}$ when the denominator is about twice the numerator. Estimate a fraction as 1 when the numerator is nearly equal to the denominator.	Estimate as a whole number or as a mixed numeral where the fractional part is $\frac{1}{2}$: $\frac{3}{4} + 2\frac{1}{8} - \frac{12}{25}$. $\frac{3}{4} + 2\frac{1}{8} - \frac{12}{25} \approx 1 + 2 - \frac{1}{2} = 2\frac{1}{2}$, or $\frac{5}{2}$	20. Estimate as a whole number or as a mixed numeral where the fractional part is $\frac{1}{2}$: $3\frac{5}{9} - 1\frac{1}{12} + \frac{19}{23}$. A. $2\frac{1}{2}$ B. 3 C. $3\frac{1}{2}$ D. 4