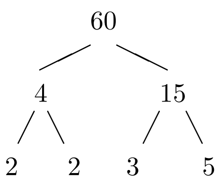
Introductory Algebra
Chapter R Review

Objective [R.1a] Find all the factors of numbers and find prime factorizations of numbers.

Brief Procedure	Example	Practice Exercises
To find all the factors of a number, find factorizations of the number.	Find all the factors of 36. $36 = 1 \cdot 36$ $\quad 36 = 4 \cdot 9$ $36 = 2 \cdot 18$ $\quad 36 = 6 \cdot 6$ $36 = 3 \cdot 12$ Factors: 1, 2, 3, 4, 6, 9, 12, 18, 36	1. Find all the factors of 20. A. 4, 5 B. 2, 10 C. 2, 4, 5, 10 D. 1, 2, 4, 5, 10, 20
To find the prime factorization of a number, first factor the number in any way possible and then continue factoring until all the factors are prime numbers, or use a factor tree, or perform a string of successive divisions of the number by prime divisors.	Find the prime factorization of 60. Factoring: $60 = 4 \cdot 15 = 2 \cdot 2 \cdot 3 \cdot 5$ Factor tree:  $60 = 2 \cdot 2 \cdot 3 \cdot 5$ Successive divisions: First divide by 2: $60 = 2 \cdot 30$ Divide by 2 again: $60 = 2 \cdot 2 \cdot 15$ Divide by the next prime, 3: $60 = 2 \cdot 2 \cdot 3 \cdot 5$	2. Find the prime factorization of 63. A. $3 \cdot 21$ B. $9 \cdot 7$ C. $1 \cdot 3 \cdot 3 \cdot 7$ D. $3 \cdot 3 \cdot 7$

Objective [R.1b] Find the LCM of two or more numbers using prime factorizations.

Brief Procedure	Example	Practice Exercise
a) Write the prime factorization of each number. b) Write the product of the factors found in step (a), 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 $3 \cdot 3 \cdot 7$, or 63.	3. Find the LCM of 8 and 20 using factorizations. A. 20 B. 40 C. 80 D. 160

Objective [R.2a] Find equivalent fractional expressions by multiplying by 1.		
Brief Procedure	**Example**	**Practice Exercise**
Multiply the fraction by 1 using n/n. If a specific denominator is desired, choose n by determining the number the original denominator should be multiplied by in order to get the desired denominator.	Find a name for $\frac{2}{3}$ with a denominator of 12. Since $3 \cdot 4 = 12$, we multiply by $\frac{4}{4}$: $\frac{2}{3} = \frac{2}{3} \cdot \frac{4}{4} = \frac{2 \cdot 4}{3 \cdot 4} = \frac{8}{12}$	4. Find a name for $\frac{3}{4}$ with a denominator of 20. A. $\frac{3}{20}$ B. $\frac{8}{20}$ C. $\frac{15}{20}$ D. $\frac{19}{20}$

Objective [R.2b] Simplify fractional notation.		
Brief Procedure	**Example**	**Practice Exercise**
Remove a factor of 1 to get the name for the fraction that has the smallest numerator and denominator.	Simplify: $\frac{16}{36}$. $\frac{16}{36} = \frac{4 \cdot 4}{4 \cdot 9} = \frac{4}{4} \cdot \frac{4}{9} = 1 \cdot \frac{4}{9} = \frac{4}{9}$	5. Simplify: $\frac{9}{24}$. A. $\frac{1}{6}$ B. $\frac{1}{3}$ C. $\frac{3}{8}$ D. $\frac{9}{8}$

Objective [R.2c] Add, subtract, multiply, and divide using fractional notation.		
Brief Procedure	**Example**	**Practice Exercises**
To add or subtract when denominators are the same, add or subtract numerators, keep the denominator, and simplify, if possible. When 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) Add or subtract and simplify as described above.	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.	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 [R.2c] (continued)

Brief Procedure	Example	Practice Exercises
To multiply using fractional notation, a) Write the products in the numerator and the denominator, but do not carry out the products. b) Factor the numerator and the denominator. c) Factor the fraction to remove factors of 1. d) Carry out the remaining products.	Multiply and simplify: $\frac{3}{4} \cdot \frac{2}{9}$. $\frac{3}{4} \cdot \frac{2}{9} = \frac{3 \cdot 2}{4 \cdot 9} = \frac{3 \cdot 2 \cdot 1}{2 \cdot 2 \cdot 3 \cdot 3} =$ $\frac{3 \cdot 2}{3 \cdot 2} \cdot \frac{1}{2 \cdot 3} = 1 \cdot \frac{1}{2 \cdot 3} = \frac{1}{2 \cdot 3} = \frac{1}{6}$	7. Multiply and simplify: $\frac{5}{6} \cdot \frac{4}{15}$. A. $\frac{2}{9}$ B. $\frac{3}{7}$ C. $\frac{4}{18}$ D. $\frac{20}{90}$
To divide using fractional notation, multiply the dividend by the reciprocal of the divisor. Then simplify.	Divide and simplify: $\frac{5}{4} \div \frac{25}{16}$. $\frac{5}{4} \div \frac{25}{16} = \frac{5}{4} \cdot \frac{16}{25} = \frac{5 \cdot 16}{4 \cdot 25} = \frac{5 \cdot 4 \cdot 4}{4 \cdot 5 \cdot 5} =$ $\frac{5 \cdot 4}{5 \cdot 4} \cdot \frac{4}{5} = \frac{4}{5}$	8. Divide and simplify: $\frac{2}{3} \div \frac{8}{9}$. A. $\frac{3}{4}$ B. $\frac{5}{6}$ C. $\frac{4}{3}$ D. $\frac{16}{27}$

Objective [R.3a] Convert from decimal notation to fractional notation.

Brief Procedure	Example	Practice Exercise
a) Count the number of decimal places, b) move the decimal point that many places to the right, and c) write the answer over a denominator with a 1 followed by that number of zeros.	Write fractional notation for 3.471. 3.$\underline{471}$ — 3 places 3.471. — Move 3 places. $\frac{3471}{1\underline{000}}$ — 3 zeros $3.471 = \frac{3471}{1000}$	9. Write fractional notation for 16.09. A. $\frac{1609}{10}$ B. $\frac{1609}{100}$ C. $\frac{1609}{1000}$ D. $\frac{1609}{10,000}$

Objective [R.3b] Add, subtract, multiply, and divide using decimal notation.		
Brief Procedure	**Example**	**Practice Exercises**

To add using decimal notation first line up the decimal points. Then add digits from right to left, carrying if necessary. If desired, extra zeros can be written to the right of the decimal point so the numbers have the same number of decimal places.	Add: 14.26 + 63.589.
	     1 (carry)
	  1 4.2 6 0 Writing an extra zero
	+ 6 3.5 8 9
	  7 7.8 4 9
		10. Add: 3.08 + 25.962
		A. 5.6762
		B. 26.27
		C. 29.042
		D. 56.762

To subtract using decimal notation, line up the decimal points. Then subtract digits from right to left, borrowing if necessary. If desired, extra zeros can be written to the right of the decimal point so the numbers have the same number of decimal places.	Subtract: 67.345 − 24.28.
	     2 14
	  6 7.~~3~~ ~~4~~ 5
	− 2 4.2 8 0 Writing an extra zero
	  4 3.0 6 5
		11. Subtract: 221.04 − 13.192
		A. 89.02
		B. 89.12
		C. 207.848
		D. 207.948

To multiply using decimal notation, a) Ignore the decimal points and multiply as though both factors were whole numbers. b) Then place the decimal point in the result. The number of decimal places in the product is the sum of the numbers of places in the factors. (Count places from the right.)	Multiply: 2.8×0.03. 2. 8 (1 decimal place) × 0. 0 3 (2 decimal places) 0. 0 8 4 (3 decimal places)	12. Multiply: 4.63×2.5. A. 1.1575 B. 11.575 C. 115.75 D. 1157.5

To divide by a whole number,
a) place the decimal point directly above the decimal point in the dividend, and
b) divide as though dividing whole numbers.
	Divide: $36.8 \div 8$.
	    4.6
	8)3 6.8
	   3 2 0
	     4 8
	     4 8
	       0
		13. Divide: $615.6 \div 12$.
		A. 513
		B. 51.3
		C. 5.13
		D. 0.513

To divide when the divisor is not a whole number:
a) Move the decimal point in the divisor as many places to the right as it takes to make it a whole number. Move the decimal point in the dividend the same number of places to the right and place the decimal point in the quotient.
b) Divide as whole numbers, inserting zeros if necessary.
	Divide: $21.35 \div 6.1$.
	        3 . 5
	6.1∧)2 1.3∧5
	     1 8 3 0
	       3 0 5
	       3 0 5
	          0
		14. Divide: $24.07 \div 2.9$.
		A. 0.083
		B. 0.83
		C. 8.3
		D. 83

Objective [R.3c] Round numbers to a specified decimal place..

Brief Procedure	Example	Practice Exercises
To round to a given place: a) Locate the digit in that place. b) Consider the next digit to the right. c) If the digit to the right is 5 or higher, round up; if it is 4 or lower, round, down.	Round 46.1938 to the nearest hundredth. 46.19[3]8 ↓ 46.19 Thousandths digit is 4 or lower. Round down.	15. Round 327.249 to the nearest tenth. A. 327.2 B. 327.3 C. 327.24 D. 327.25

Objective [R.4a] Convert from percent notation to decimal notation.

Brief Procedure	Example	Practice Exercise
Move the decimal point two places to the left and drop the percent symbol.	Find decimal notation for 4.3%. Move the decimal point two places to the left and drop the percent symbol. 0.04.3 4.3% = 0.043	16. Find decimal notation for 54.8%. A. 0.0548 B. 0.548 C. 5.48 D. 548

Objective [R.4b] Convert from percent notation to fractional notation.

Brief Procedure	Example	Practice Exercise
Replace "%" with "$\times\frac{1}{100}$" and carry out the multiplication. (You need not simplify unless instructed to do so.)	Find fractional notation for 24%. $24\% = 24 \times \frac{1}{100} = \frac{24}{100}$	17. Find fractional notation for 55%. A. $\frac{5}{10}$ B. $\frac{55}{100}$ C. $\frac{100}{55}$ D. $\frac{55}{20}$

Objective [R.4c] Convert from decimal notation to percent notation.

Brief Procedure	Example	Practice Exercise
Move the decimal point two places to the right and write a percent symbol.	Find percent notation for 0.09. First move the decimal point two places to the right. 0.09. Then write a percent symbol. 0.09 = 9%	18. Find percent notation for 1.5. A. 0.015% B. 0.15% C. 15% D. 150%

Objective [R.4d] Convert from fractional notation to percent notation.

Brief Procedure	Example	Practice Exercise
First find decimal notation by dividing the numerator by the denominator. Then convert the decimal notation to percent notation by moving the decimal point two places to the right and writing a percent symbol.	Find percent notation for $\frac{3}{5}$. Find decimal notation by division. $\begin{array}{r} 0.6 \\ 5\overline{)3.0} \\ \underline{3\,0} \\ 0 \end{array}$ $\frac{3}{5} = 0.6$ Convert to percent notation. 0.60. $\llcorner\!\_\!\lrcorner\uparrow$ $\frac{3}{5} = 60\%$	19. Find percent notation for $\frac{7}{8}$. A. 62.5% B. $77.\overline{7}\%$ C. 78% D. 87.5%

Objective [R.5a] Write exponential notation for a product.

Brief Procedure	Example	Practice Exercise
Count the number of identical factors. Make that number the exponent, using the repeated factor as the base.	Write exponential notation for $6 \cdot 6 \cdot 6 \cdot 6$. $\underbrace{6 \cdot 6 \cdot 6 \cdot 6}_{\downarrow} = 6^4$ 4 factors	20. Write exponential notation for $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$. A. 32 B. $5 \cdot 2$ C. 5^2 D. 2^5

Objective [R.5b] Evaluate exponential expressions.

Brief Procedure	Example	Practice Exercise
Rewrite the exponential expression as a product and compute.	Evaluate: 3^4. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$	21. Evaluate: 5^3. A. 15 B. 125 C. 243 D. 625

Objective [R.5c] Simplify expressions using the rules for order of operations.

Brief Procedure	Example	Practice Exercise
1. Do all calculations within grouping symbols 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: $64 \div 4^2 \cdot 3 + (12 - 7)$. $64 \div 4^2 \cdot 3 + (12 - 7)$ $= 64 \div 4^2 \cdot 3 + 5$ $= 64 \div 16 \cdot 3 + 5$ $= 4 \cdot 3 + 5$ $= 12 + 5$ $= 17$	22. Simplify: $9 + (19 - 9)^2 \div 5 \cdot 2$. A. 19 B. 49 C. 121 D. 220