# Chapter 1 Review

## *Section 1.1 Whole Numbers*

| Concept | Example |
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| **Whole Numbers** | 0, 1, 2, 3, 4, 5, 6,7, 8, 9, 10, 11, 12, 13, ... and so on. |
| **Counting numbers,** or **natural numbers** | 1, 2, 3, 4, 5, ..., 10, 11, 12, ... and so on. |
| The four basic **operations** are addition (+), subtraction (–), multiplication (x), and division (÷). | $5 + 2 = 7$    $7 - 2 = 5$<br>$3 \times 2 = 6$    $6 \div 2 = 3$ |
| A **sum** is both the written addition, and the result of adding.<br>A **difference** is both the written subtraction, and the result of subtracting.<br>A **product** is both the written multiplication, and the result of multiplying.<br>A **quotient** is both the written division, and the result of dividing. | *addend* + *addend* = *sum*<br>*minuend* – *subtrahend* = *difference*<br>*factor* x *factor* = *product*<br>*dividend* ÷ *divisor* = *quotient, and*<br>$\text{divisor}\overline{)\,\text{dividend}}$ with *quotient* above |
| **Multiplication** is an abbreviation for repeated addition. Numbers in a product are called **factors**. | $5 \cdot 8 = 8 + 8 + 8 + 8 + 8 = 40$; $5 \cdot 8 = 40$.<br>5 and 8 are factors of 40. |
| A number is in **factored form** when it is written as a product of factors. | Factored forms of 40:<br>$1 \cdot 40$, $2 \cdot 20$, $4 \cdot 10$, and $5 \cdot 8$. |
| If *a* and *b* are two whole numbers, then their product, $a \cdot b$, is a **multiple** of *a* and a multiple of *b*. | 5, 10, 15, 20, and 25 are multiples of 5 because each has a factored form that includes 5:<br>5 = $1 \cdot 5$, 10 = $2 \cdot 5$, 15 = $3 \cdot 5$, 20 = $4 \cdot 5$, 25 = $5 \cdot 5$ |
| **The Multiplication Property of 0:**<br>$a \cdot 0 = 0$ and $0 \cdot a = 0$ | $5 \cdot 0 = 0$ and $0 \cdot 5 = 0$ |

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| **Division** is the inverse operation of multiplication. It can be thought of as repeated subtraction. If the repeated subtraction results in 0, then the divisor *divides evenly into* the dividend; we also say that the dividend is *divisible* by the divisor. | $15 \div 5$: $15 - 5 = 10$ *Once*<br>$10 - 5 = 5$ *Twice*<br>$5 - 5 = 0$ *Three times*<br>$15 \div 5 = 3$<br>5 divides evenly into 15 and 15 is divisible by 5. |
| Division by 0 is not allowed:<br>$a \div 0$, or $\frac{a}{0}$ , is undefined. | $12 \div 0$ is undefined. |
| The written form of an operation is called an **expression**. | **5 + 4** |
| To **evaluate** means to "find the value of." | Evaluate $5 + 4$: $5 + 4 = 9$. |
| Parentheses group different values together so that they can be treated as one **quantity**. | $(5 + 2) \cdot 4 = 7 \cdot 4$ |
| The **Commutative Property** allows us to change the order of a sum or product.<br>The Commutative Property of Addition<br>$a + b = b + a$<br>The Commutative Property of Multiplication:<br>$a \times b = b \times a$ | $6 + 2 = 2 + 6$<br>$6 \cdot 2 = 2 \cdot 6$ |
| The **Associative Property** allows us to change the grouping in a sum or product.<br>The Associative Property of Addition<br>$(a + b) + c = a + (b + c)$<br>The Associative Property of Multiplication:<br>$(a \cdot b) \cdot c = a \cdot (b \cdot c)$ | $(6 + 4) + 3 = 6 + (4 + 3)$<br>$(5 \cdot 2) \cdot 4 = 5 \cdot (2 \cdot 4)$ |

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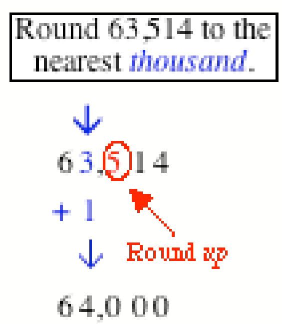
| An **identity** is a number that, when applied, won't change the value of another number or quantity.<br><br>The identity for addition, or **additive identity**, is 0:<br>$a + \mathbf{0} = a$ and $\mathbf{0} + a = a$<br><br>The identity for multiplication, or **multiplicative identity**, is 1:<br>$a \cdot \mathbf{1} = a$ and $\mathbf{1} \cdot a = a$ | $12 + 0 = 12$; also $0 + 12 = 12$<br><br>$15 \cdot 1 = 15$; also $15 \cdot 1 = 15$ |
| **The Distributive Property of Multiplication over Addition:**<br><br>We can *distribute* a multiplier, **a**, to a sum (b + c) so that it multiplies both numbers in the sum:<br><br>$\mathbf{a} \cdot (b + c) = \mathbf{a} \cdot b + \mathbf{a} \cdot c$ | $\mathbf{3} \cdot (6 + 4) = \mathbf{3} \cdot 6 + \mathbf{3} \cdot 4$<br>$= 18 + 12$<br>$= 30$ |

## *Section 1.2 Rounding Whole Numbers*

| Concept | Example |
|---|---|
| To round a whole number:<br><br>1. Identify the **place digit**.<br>2. Identify the **rounding digit**.<br>3. i. if the rounding digit is 5 or higher, round *up*.<br>ii. if the rounding digit is 4 or lower, round *down*.<br>4. Write all digits after the place digit as zeros. |  |

## *Section 1.3 Applications of Addition and Subtraction*

| Concept | Example |
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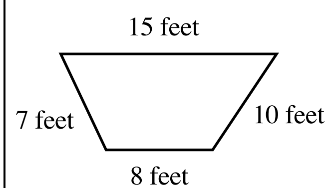
| The last sentence in an application problem is usually in the form of a question asking us to find an amount of something. In the question, you should look for a word or phrase that indicates which operation is to be used.<br><br>In an addition problem, you will likely see words like *total*, *combined*, *sum*, and *in all*.<br><br>It is appropriate to answer the question in the form of a sentence. | At a weekend craft fair, Joy sold some candles that she made. On Saturday, Joy earned \$126, and on Sunday, she earned \$189. What is the *total* amount Joy earned that weekend?<br><br>126<br>+ 189<br>315<br><br>Joy earned a total of \$315 that weekend. |
| The **perimeter** of a geometric figure is the total measure around the figure. The perimeter is found by adding the lengths of all of the sides. | <br><br>The perimeter is:<br><br>7 feet + 8 feet + 10 feet + 15 feet = 40 feet |
| Generally, subtraction is used when we are asked to compare two numbers. Phrases like, "How much more than..." or "What is the difference between..." or "What was the change in..." almost always indicate subtraction. | The weekday edition circulation of the Daily Bugle newspaper is 1,273 homes. The Sunday edition of the Daily Bugle has a circulation of 1,518 homes. How many more homes get the Sunday edition compared to the weekday edition?<br><br>1,518<br>– 1,273<br>245<br><br>245 more homes get the Sunday edition compared to the weekday edition. |

## *Section 1.4 Applications of Multiplication and Division*

| Concept | Example |
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| In multiplication applications, there are two numbers:<br><br>One number that will be repeated, and<br><br>another number that indicates the number of times it is repeated. | Martina contributes \$15 out of her paycheck each month to the United Way. What is Martina's total yearly contribution to the United Way?<br><br>$\begin{array}{r} 15 \\ \underline{\times\ 12} \\ 180 \end{array}$<br><br>Martina's total yearly contribution to the United Way is \$180. |
| **Area** is the amount of surface in an enclosed region and is always measured in square units. The area of a rectangle is the product of its width and length:<br>$Area = length \times width.$ | <br><br><br>The area is:<br>7 inches · 10 inches = 70 square inches |
| A key word meaning division is *each*. It is often found in the last sentence. | One Las Vegas hotel has 1,098 rooms, and there are 18 cleaning crews for the whole hotel. If the rooms are divided evenly between the 18 crews, how many rooms is each crew responsible for cleaning?<br><br>$1{,}098 \div 18 = 61$<br><br>Each crew is responsible for cleaning 61 rooms. |

## *Section 1.5 Exponents, Square Roots, and the Order of Operations*

| Concept | Example |
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| **Exponents** give us a way to abbreviate repeated multiplication using the powers of a whole number. In the notation $2^3$, 2 is the **base**, and $^3$ is the **exponent** or **power**. The whole number 2 is raised to the power of 3. | $2^3$ represents the repeated multiplication $2 \cdot 2 \cdot 2$ and is read "2 to the *third power*." |

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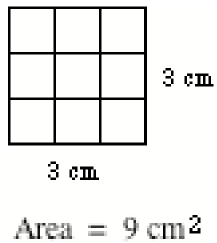
| **The Power of 1**:<br>If *b* represents any base, then $b^1 = b$. | $5^1 = 5$ |
| **The Powers of 10**:<br>The exponent of 10 indicates the number of zeros that follow the 1. | $10^5$ is a 1 followed by five zeros: 100,000.<br><br>10,000 can be abbreviated as $10^4$, the number of zeros indicating the power of 10. |
| Numbers that end in one or more zeros can be abbreviated using powers of 10. | $700 = 7 \cdot 10^2$.<br>$970{,}000 = 97 \cdot 10^4$. |
| A perfect square is a rectangle with equal side measures, and a number. The number is equivalent to the area of the square. The **square root** of a perfect square is the length of one side of the square. If $r^2 = p$, then r is a **square root** of p. Also, if r is a square root of p, then $r^2 = p$. | <br>A square root of 9 is 3. Because $3^2 = 9$, 3 is a square root of 9. |
| The square root symbol, a **radical** $\sqrt{\phantom{x}}$ , is used to represent a square root of a number. | $\sqrt{9} = 3$. 9 is the **radicand**. |
| Some grouping symbols form quantities. | ( ), [ ], and { } |
| The radical is both a grouping symbol and an operation. | $\sqrt{25} + 10 = 5 + 10 = 15$ |
| **The Order Of Operations:**<br><br>1. Evaluate within all grouping symbols (one at a time), if there are any.<br>2. Apply any exponents.<br>3. Apply multiplication and division *reading from left to right.*<br>4. Apply addition and subtraction *reading from left to right.* | $(3 + 9) \div 2^2 \cdot 3 - 2$ Evaluate within the parentheses.<br>$= 12 \div 2^2 \cdot 3 - 2$ Apply the exponent.<br>$= 12 \div 4 \cdot 3 - 2$ Apply division.<br>$= 3 \cdot 3 - 2$ Apply multiplication.<br>$= 9 - 2$ Apply subtraction.<br>$= 7$ |

## *Section 1.6 Factors*

| Concept | Example |
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| A **factor pair** of a number is two factors whose product is the number. | One factor pair of 18 is 2 and 9 because $2 \cdot 9 = 18$. Other factor pairs of 18 are 1 and 18 and 3 and 6. |
| A whole number is considered to be a **prime** number if it has exactly two distinct, whole number factors: 1 and itself; 1 is not a prime number because it has only one factor, 1 itself. | The first ten prime numbers are<br><br>2, 3, 5, 7, 11, 13, 17, 19, 23, and 29. |
| A whole number that has more than two distinct factors is a **composite** number. A composite number is a whole number (greater than 1) that is not prime. The number 1 is neither prime nor composite. | The first ten composite numbers are<br><br>4, 6, 8, 9, 10, 12, 14, 15, 16, and 18. |
| Divisibility Test for 2:<br><br>2 is a factor of a whole number if and only if the number is even (has either 0, 2, 4, 6, or 8 in the ones place). | 2 is a factor of each of these numbers:<br><br>28, 46, 174, 382, and 590. |
| Divisibility Test for 5:<br><br>5 is a factor of a whole number if and only if the number has either 5 or 0 in the ones place. | 5 is a factor of each of these numbers:<br><br>35, 70, 105, 230, and 775. |
| Divisibility Test for 10:<br><br>10 is a factor of a whole number if and only if the number has 0 in the ones place. | 10 is a factor of each of these numbers:<br><br>70, 190, 230, and 900. |
| Divisibility Test for 3:<br><br>3 is a factor of a whole number if and only if the number's digits add to a multiple of 3. | 3 is a factor of each of these numbers:<br>105 because $1 + 0 + 5 = 6$, a multiple of 3.<br>264 because $2 + 6 + 4 = 12$, a multiple of 3. |
| Divisibility Test for 9:<br><br>9 is a factor of a whole number if and only if the number's digits add to a multiple of 9. | 9 is a factor of each of these numbers:<br>198 because $1 + 9 + 8 = 18$, a multiple of 9.<br>513 because $5 + 1 + 3 = 9$, a multiple of 9. |

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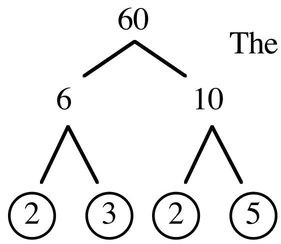
| A **factor tree** shows composite and prime factors of a number. The **prime factorization** of a composite number is the product of the prime factors (including repetitions) of the number. | <br>The prime factorization of 60:<br>$60 = 2 \cdot 2 \cdot 3 \cdot 5$<br>$60 = 2^2 \cdot 3 \cdot 5$ |
| **The Division Method:**<br><br>Repeatedly divide by *the lowest possible prime number*, generating a new quotient each time. The divisibility tests will help determine which prime to use as a divisor. In the division method, the primes we divide by are called **prime divisors**.<br><br>This process is complete when the new quotient is a prime number. | Find the prime factorization of 60:<br><br>$60 \div 2 = 30$    $2 \,\underline{)\,60}$<br>$30 \div 2 = 15$    $2 \,\underline{)\,30}$ ← New quotient<br>$15 \div 3 = 5$    $3 \,\underline{)\,15}$ ← New quotient<br>5 ← New quotient<br><br>The prime factorization of 60 is the product of all of the prime divisors and of the last prime (5). So, the prime factorization of 60 is<br>$2 \cdot 2 \cdot 3 \cdot 5$ or $2^2 \cdot 3 \cdot 5$. |

## *Section 1.7 Equations*

| Concept | Example |
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| An **equation** is a mathematical sentence in which one expression = another expression. A letter, such as *x*, is called a **variable**, and it represents a number, an unknown value. It is the unknown value that is to be solved for in an equation. A known value, such as 8, is called a **constant**. When a variable is multiplied by a number, we call that number a **coefficient**. | $x + 8 = 15$ and $24 = 6 \cdot x$<br>are equations.<br><br>The variable is *x*. 8, 15, and 24 are constants.<br>6 is a coefficient. |
| **The Subtraction Property of Equality:**<br><br>If $\mathbf{x + a = b}$, we can subtract the same value, **a**, from each side:<br><br>$x + a = b$<br>$x + a - \mathbf{a} = b - \mathbf{a}$ | $x + 8 = 15$<br>$x + 8 - 8 = 15 - 8$<br>$x + 0 = 7$<br>$x = 7$ |

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| **The Division Property of Equality:**<br><br>If $\boldsymbol{x \cdot a = b}$, we can divide each side by the same value, **a**:<br><br>$x \cdot a = b$<br>$x \cdot a \div \mathbf{a} = b \div \mathbf{a}$ | $24 = 6 \cdot x$<br>$24 \div 6 = 6 \div 6 \cdot x$<br>$4 = 1 \cdot x$<br>$x = 4$ |

## *Section 1.8 Solving Applications Using Equations*

| Concept | Example |
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| To solve an application problem:<br><br>1. Read the problem and think about the situation.<br><br>2. Decide what the unknown value is (usually from the last sentence in the problem), and represent it by a variable by writing a **legend**.<br><br>3. Write an equation, based on a formula.<br><br>4. Solve the equation.<br><br>5. Write a complete sentence answer to the question. | A textbook salesperson drove 212 miles on Monday, 87 miles on Tuesday, and 146 miles on Wednesday. What is the total number of miles she drove in those three days?<br><br>**Legend:**<br>Let $x$ = the total number of miles.<br><br>**Formula:**<br>Miles + miles + miles = total miles<br><br>$212 + 87 + 146 = x$<br><br>$445 = x$<br><br>$x = 445$<br><br>**Sentence:**<br>She drove a total of 455 miles. |

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| The basic formula for addition:<br><br>The sum of all of the parts equals the whole. | Manuel works for FedEx in the accounts receivable department. One client owes FedEx \$4,328 for the month of April, but the client paid only \$2,550. How much money does Manuel still need to collect from the client?<br><br>**Legend:**<br>Let $x$ = the amount to be collected from the client<br><br>**Formula:**<br>\$ collected + \$ still to be collected = total due<br><br>$2550 + x = 4328$<br><br>$2550 - 2550 + x = 4328 - 2550$<br><br>$x = 1778$<br><br>**Sentence:**<br>Manuel still needs to collect \$1,178 from the client. |
| The basic formula for multiplication:<br><br>(Number of same parts) x part = whole. | Karea works for a pool supply company. She placed an order for 6 identical pool sweepers. The total price for the 6 sweepers is \$1,134. How much does each pool sweeper cost?<br><br>**Legend:**<br>Let $x$ = the cost of each pool sweeper.<br><br>**Formula:**<br>\$ collected + \$ still to be collected = total due<br><br>$6 \cdot x = 1134$<br><br>$6 \div 6 \cdot x = 1134 \div 6$<br><br>$x = 189$<br><br>**Sentence:**<br>Each pool sweeper costs \$189. |