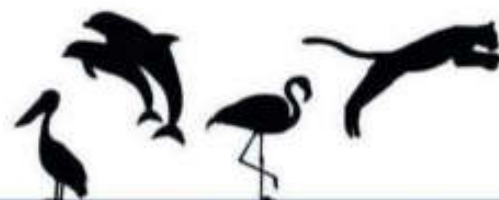


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BEGINNING

Algebra



SECOND EDITION

Beginning **ALGEBRA**

Second Edition

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$$\sqrt{\frac{1}{16}} = \frac{1}{4} \quad \text{Because } \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$$

$$\sqrt{\frac{4}{9}} = \frac{2}{3} \quad \text{Because } \frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$$

TIP: To simplify square roots, it is advisable to become familiar with the following squares and square roots.

$0^2 = 0 \rightarrow \sqrt{0} = 0$	$7^2 = 49 \rightarrow \sqrt{49} = 7$
$1^2 = 1 \rightarrow \sqrt{1} = 1$	$8^2 = 64 \rightarrow \sqrt{64} = 8$
$2^2 = 4 \rightarrow \sqrt{4} = 2$	$9^2 = 81 \rightarrow \sqrt{81} = 9$
$3^2 = 9 \rightarrow \sqrt{9} = 3$	$10^2 = 100 \rightarrow \sqrt{100} = 10$
$4^2 = 16 \rightarrow \sqrt{16} = 4$	$11^2 = 121 \rightarrow \sqrt{121} = 11$
$5^2 = 25 \rightarrow \sqrt{25} = 5$	$12^2 = 144 \rightarrow \sqrt{144} = 12$
$6^2 = 36 \rightarrow \sqrt{36} = 6$	$13^2 = 169 \rightarrow \sqrt{169} = 13$

5. Order of Operations

When algebraic expressions contain numerous operations, it is important to evaluate the operations in the proper order. Parentheses (), brackets [], and braces { } are used for grouping numbers and algebraic expressions. It is important to recognize that operations within parentheses and other grouping symbols must be done first. Other grouping symbols include absolute value bars, radical signs, and fraction bars.

Order of Operations

1. Simplify expressions within parentheses and other grouping symbols first. These include absolute value bars, fraction bars, and radicals. If imbedded parentheses are present, start with the innermost parentheses.
2. Evaluate expressions involving exponents and radicals.
3. Perform multiplication or division in the order that they occur from left to right.
4. Perform addition or subtraction in the order that they occur from left to right.

Example 3 Applying the Order of Operations

Simplify the expressions.

- | | |
|-----------------------------|---|
| a. $17 - 3 \cdot 2 + 2^2$ | b. $\frac{1}{2} \left(\frac{5}{6} - \frac{3}{4} \right)$ |
| c. $25 - 12 \div 3 \cdot 4$ | d. $6.2 - -2.1 + \sqrt{15 - 6}$ |
| e. $28 - 2[(6 - 3)^2 + 4]$ | |

Solution:

- a.** $17 - 3 \cdot 2 + 2^2$
 $= 17 - 3 \cdot 2 + 4$ Simplify exponents.
 $= 17 - 6 + 4$ Multiply before adding or subtracting.
 $= 11 + 4$ Add or subtract from left to right.
 $= 15$
- b.** $\frac{1}{2}\left(\frac{5}{6} - \frac{3}{4}\right)$ Subtract fractions within the parentheses.
 $= \frac{1}{2}\left(\frac{10}{12} - \frac{9}{12}\right)$ The least common denominator is 12.
 $= \frac{1}{2}\left(\frac{1}{12}\right)$
 $= \frac{1}{24}$ Multiply fractions.
- c.** $25 - 12 \div 3 \cdot 4$ Multiply or divide in order from left to right.
 $= 25 - 4 \cdot 4$ Notice that the operation $12 \div 3$ is performed first (not $3 \cdot 4$).
 $= 25 - 16$ Multiply $4 \cdot 4$ before subtracting.
 $= 9$ Subtract.
- d.** $6.2 - |-2.1| + \sqrt{15 - 6}$
 $= 6.2 - |-2.1| + \sqrt{9}$ Simplify within the square root.
 $= 6.2 - (2.1) + 3$ Simplify the square root and absolute value.
 $= 4.1 + 3$ Add or subtract from left to right.
 $= 7.1$ Add.
- e.** $28 - 2[(6 - 3)^2 + 4]$
 $= 28 - 2[(3)^2 + 4]$ Simplify within the inner parentheses first.
 $= 28 - 2[(9) + 4]$ Simplify exponents.
 $= 28 - 2[13]$ Add within the square brackets.
 $= 28 - 26$ Multiply before subtracting.
 $= 2$ Subtract.

Skill Practice Simplify the expressions.

6. $14 - 3 \cdot 2$ 7. $\frac{13}{4} - \frac{1}{4}(10 - 2)$ 8. $1 + 2 \cdot 3^2 \div 6$
 9. $|-20| - (7 - 2)$ 10. $60 - 5[(6 - 3) + 2^2]$

Skill Practice Answers

6. 8 7. $\frac{5}{4}$ 8. 4
 9. 15 10. 25