

CHAPTER 2

Algebraic Expressions

2.1 Grouping and the Order of Operations

1)

b) $P = 7.64 \text{ mm} + 5.2 \text{ mm} + 4.8 \text{ mm}$
 $P = 5.2 \text{ mm} + 4.8 \text{ mm} + 7.64 \text{ mm}$
 $P = 4.8 \text{ mm} + 7.64 \text{ mm} + 5.2 \text{ mm}$

c) $P = 7.64 \text{ mm} + (5.2 \text{ mm} + 4.8 \text{ mm})$
 $P = 7.64 \text{ mm} + 10.0 \text{ mm}$
 $P = 17.64 \text{ mm}$

d) $P = 5.2 \text{ mm} + 4.8 \text{ mm} + 7.64 \text{ mm}$
 $P = 17.64 \text{ mm}$

$$P = 4.8 \text{ mm} + 7.64 \text{ mm} + 5.2 \text{ mm}$$
$$P = 17.64 \text{ mm}$$

3)

Rectangular Field
AREA = LENGTH WIDTH

$$A = (220 \text{ ft}) [198 \text{ ft} + 297 \text{ ft} + 396 \text{ ft}]$$

$$A = (220 \text{ ft}) (891 \text{ ft})$$

$$A = 196,020 \text{ ft}^2$$

$$A = (220 \text{ ft}) [198 \text{ ft} + 297 \text{ ft} + 396 \text{ ft}]$$

$$A = (220 \text{ ft}) (198 \text{ ft}) + (220 \text{ ft}) (297 \text{ ft}) + (220 \text{ ft}) (396 \text{ ft})$$

$$A = 43,560 \text{ ft}^2 + 65,340 \text{ ft}^2 + 87,120 \text{ ft}^2$$

$$A = 196,020 \text{ ft}^2$$

5)

a) $4 \ 512 = 4 \ 500 + 4 \ 12$

b) Justin has used the Distributive Property of Multiplication over Addition (Fact 2.2).

c) $11 \ 4.03 = 11 (4.00 + 0.03)$
 $= 11 \ 4.00 + 11 \ 0.03$
 $= 44.00 + 0.33$
 $= 44.33$

7)

Factoring is the opposite of *expansion*—See the first two comments after Fact 2.2.

9)

$$3 - 4 \div 2 = 3 - 2 = 1$$

According to the rule of operations (Fact 2.3) we must divide before we subtract.

Had we subtracted first, we would arrive at an incorrect answer of $\frac{1}{2}$.

11)

$$a) \quad \frac{3 + 24 - 6}{6 - 2} = \frac{27 - 6}{4} = \frac{21}{4} = 5.25$$

- b) Since the horizontal fraction bar is a symbol of grouping, we need to perform the operations in both the numerator and denominator before carrying out the actual division. In the calculator, this problem would be entered $(3 + 24 - 6) / (6 - 2)$. These parentheses are needed because it is necessary to perform the addition and subtraction *before* the actual division (which is opposite the order of the rule of operations) in this problem. In general, *whenever it is necessary that operations in an algebraic expression be performed in any order opposite the normal rule for order of operations, parentheses and/or grouping symbols are required.*

13) Answers will vary.

15)

$$\begin{aligned} a) \quad & (a + b) - (8 + c) \\ & = (a + b) + ^{-1} (8 + c) && \text{Fact 2.6-c} \\ & = (a + b) + ^{-1} 8 + ^{-1} c && \text{Fact 2.2} \\ & = a + b + ^{-1} 8 + ^{-1} c && \text{Fact 2.6-a} \\ & = a + b - 8 - c && \text{Fact 1.8} \end{aligned}$$

$$\begin{aligned} b) \quad & ^{-1}(y + 6) + z \\ & = ^{-1} (y + 6) + z \\ & = ^{-1} y + ^{-1} 6 + z \\ & = ^{-1} y + ^{-6} + z \\ & = z - y - 6 && \text{Fact 1.1 \& Fact 1.8} \end{aligned}$$

$$\begin{aligned} c) \quad & 3 - (s - t) \\ & = 3 + ^{-1} (s - t) \\ & = 3 + ^{-1} s - (^{-1}) t \\ & = 3 + ^{-1} s + ^{+} t \\ & = 3 - s + t \end{aligned}$$

Skill and Review

17) Wall has area of 450 ft^2 .

$$a) \quad \text{Cynthia's wall painting rate} = \frac{450 \text{ ft}^2}{9 \text{ hours}} = \frac{50 \text{ ft}^2}{1 \text{ hr}} = 50 \frac{\text{ft}^2}{\text{hr}}$$

$$b) \quad \text{Since } 1 \text{ hr} = 60 \text{ min, Cynthia's wall painting rate in feet per minute is}$$

$$\frac{50 \text{ ft}^2}{60 \text{ min}} = \frac{5}{6} \frac{\text{ft}^2}{\text{min}} \approx 0.83 \frac{\text{ft}^2}{\text{min}}.$$

$$c) \quad \text{From (a), we know Cynthia can paint } 50 \text{ ft}^2 \text{ of wall per hour. Since } 1$$

$$\text{wall} = 450 \text{ ft}^2, \text{ Cynthia can paint } \frac{50}{450} = \frac{1}{9} \frac{\text{wall}}{\text{hr}} \approx 0.11 \frac{\text{wall}}{\text{hr}}.$$

19)

a) $16 - ^{-}3 = 16 + ^{+}3 = ^{+}19 = 19$

b) Example: On a cold day, at 6 a.m., the temperature was $^{-}3^{\circ}\text{F}$. At noon it was 16°F . What was the change in temperature throughout this time period?

Change in Temp = Final Temp - Starting Temp

$$\text{Change in Temp} = 16^{\circ}\text{F} - ^{-}3^{\circ}\text{F} = 16^{\circ}\text{F} + ^{+}3^{\circ}\text{F} = ^{+}19^{\circ}\text{F}$$

The temperature rose 19°F throughout this time period.