

7th Grade  
2.5 Properties of Operations

**RESTAURANTS** Land-Ho! Fish Market is having a Friday night special.



- Find the total cost for a 5-member family, without tax and tip, if each one orders a fish-bake dinner and cheesecake.   
 $5(2.15 + 8.95) = 55.60$    
 $5(11.10) = 55.60$    
 $8.95 \cdot 5 + 2.15 \cdot 5$    
 $5 \cdot 8.95 + 5 \cdot 2.15$
- Describe the method used to find the total cost.   
*Add dinners multiply by 5*
- Is there more than one way to find the total cost?   
*Multiply dinner by 5 & dessert by 5 then add together*

The expressions  $5(\$8.95 + \$2.15)$  and  $5(\$8.95) + 5(\$2.15)$  are **equivalent expressions** because they have the same value, \$55.50. This shows how the **Distributive Property** combines addition and multiplication.

**EXAMPLES Use the Distributive Property**

Use the Distributive Property to write each expression as an equivalent expression. Then evaluate the expression.

1  $5(3 + 2) = 5 \cdot 3 + 5 \cdot 2 = 25$       2  $(7 + 4)3 = 3 \cdot 4 + 3 \cdot 7 = 33$

**EXAMPLE Use the Distributive Property**

Multiply Mentally

- 1) Multiply 84 by 2

$2(80 + 4) = 2 \cdot 80 + 2 \cdot 4 = 160 + 8 = 168$

- 2) Multiply 138 by 2

$2(100 + 30 + 8) = 2 \cdot 100 + 2 \cdot 30 + 2 \cdot 8 = 200 + 60 + 16 = 276$

- 3) Multiply 36 by  $\frac{1}{2}$

$\frac{1}{2} \cdot 36 = \frac{1}{2} \cdot (30 + 6) = \frac{1}{2} \cdot 30 + \frac{1}{2} \cdot 6 = 15 + 3 = 18$

$\frac{70}{2} = 35$ ,  $\frac{14}{2} = 7$ ,  $35 + 7 = 42$  (Note: original image has 39, likely a typo for 42)

**Properties** are statements that are true for any number or variable.

Property	Arithmetic
Commutative	$6 + 1 = 1 + 6$ Comm (+) $7 \cdot 3 = 3 \cdot 7$ Comm (·)
Associative	$2 + (3 + 8) = (2 + 3) + 8$ Assoc (+) $3 \cdot (4 \cdot 5) = (3 \cdot 4) \cdot 5$ Assoc (·)
Distributive	$4(6 + 2) = 4 \cdot 6 + 4 \cdot 2$ Distr $3(7 - 5) = 3 \cdot 7 - 3 \cdot 5$
Identity	$9 + 0 = 9$ Identity (+) $5 \cdot 1 = 5$ Identity (·)
Inverse	$2 + (-2) = 0$ opposites for addition Inverse (+) $\frac{4}{1} \times \frac{1}{4} = 1 = \frac{4}{4}$ Inverse (·) $\frac{2}{3} \cdot \frac{3}{2} = 1$ reciprocal for mult.

*Switch order* (for Commutative)  
*# stay same parentheses change* (for Associative)  
*Rainbows Both mult + addition/subtr. Getting back to yourself* (for Distributive)  
*Undo to get the identity opposites or reciprocals* (for Inverse)

**EXAMPLES Identify Properties**

Name the property shown by each statement.

4)  $6 + (2 + 7) = (6 + 2) + 7$  Assoc (+)

5)  $15 \times 10 = 10 \times 15$  Comm (·)

6)  $4 \times 1 = 4$  Identity (·)

7)  $4(6 + 8) = 4(6) + 4(8)$  Distributive

8)  $-3 + 3 = 0$  Inverse (+)  
opposites

Name the property shown by each statement.

$7 = 1 \times 7$  Identity (·)

$24 + 5 = 5 + 24$  Comm (+)

$7 + 0 = 7$  Identity (+)

$(11 \times 4) \times 8 = 11 \times (4 \times 8)$  Assoc (·)

$2 \times \frac{1}{2} = 1$  Inverse (·)  
reciprocal  
 $\frac{a}{1} \rightarrow \frac{1}{a}$

**Your Turn** Name the property shown by each statement.

a.  $1 \times (3 \times 4) = (1 \times 3) \times 4$  Assoc (·)

b.  $a + 0 = a$  Identity (+)

**You Try:** Give an example of each property

Inverse (x)  $\frac{3}{4} \cdot \frac{4}{3} = 1$

Commutative (+)  $2 + 3 = 3 + 2$

Distributive  $2(4 + 6) = 2 \cdot 4 + 2 \cdot 6$

Associative (x)  $(11 \cdot 2) \cdot 3 = 11 \cdot (2 \cdot 3)$

Identity (+)  $3 + 0 = 3$

Inverse (+)  $3 + (-3) = 0$

# Homework

pg 32: 12-18 even, 19-30, 39, 43, 44