p.27 Properties

For addition $a + b = b + a$ For multiplication $ab = ba$	$4+7=7+4$ $11=11$ $(-3)(5)=(5)(-3)$ $-15=-15$
For addition $(a + b) + c = a + (b + c)$ For multiplication $(ab)(c) = a(bc)$	$(4+1)+6=4+(1+6)$ $5+6=4+7$ $11=11$ $(3\cdot1)4=3(1\cdot4)$ $3(4)=3(4)$ $12=12$
$a(b + c) = ab + ac$	$9(6+3)=9(6)+9(3)$ $9(9)=54+27$ $81=81$ 54 -27 81
For addition $a + 0 = a$ For multiplication $1a = a$	$4+0=4$ $-12+0=-12$ $-\frac{1}{4}+0=-1/4$ $1(4)=4$ $1(-6)=-6$ $1\left(\frac{3}{4}\right)=3/4$
opposites $a + (-a) = 0$	$4+(-4)=0$ $(-3)+3=0$ $\left(-1/4\right)+\frac{1}{4}=0$ $.25+(-.25)=0$
$\left(\frac{a}{b}\right)\left(\frac{b}{a}\right) = 1$ if $a,b \neq 0$	$\frac{1}{4}\left(\frac{4}{1}\right)=\frac{4}{4}=1$ $-\frac{3}{4}\left(-\frac{4}{3}\right)=\frac{12}{12}=1$

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Commutative, Associative & Distributive Properties

Commutative Property of Addition (change order)	Commutative Property of Multiplication (change order)
The order in which 2 numbers are added does not change the sum (answer).	The order in which 2 numbers are multiplied does not change the product (answer).
$A + B = B + A$	$(A)(B) = (B)(A)$
$4 + 2 = 2 + 4$	$(4)(2) = (2)(4)$
$6 = 6$	$8 = 8$

Does the Commutative Property work for Subtraction or Division? NO!

Try it: $4 - 2 = 2 - 4$? $2 \neq -2$ $\qquad$ $4 \div 2 = 2 \div 4$? $2 \neq \frac{1}{2}$ $\quad \frac{2}{4} = \frac{1}{2}$

Associative Property of Addition (same order)	Associative Property of Multiplication (same order)
Grouping numbers (with parentheses) differently does not change the sum (answer).	Grouping numbers (with parentheses) differently does not change the product (answer).
$(A + B) + C = A + (B + C)$	$(A \bullet B) \bullet C = A \bullet (B \bullet C)$
$(3 + 2) + 1 = 3 + (2 + 1)$	$(3 \cdot 2) \cdot 1 = 3 \cdot (2 \cdot 1)$
$5 + 1 = 3 + 3$	$(6)(1) = (3)(2)$
$6 = 6$	$6 = 6$

Does the Associative Property work for Subtraction or Division? NO!

Try it: $(3 - 2) - 1 = 3 - (2 - 1)$? $1 - 1 = 3 - 1$, $0 \neq 2$ $\qquad$ $(8 \div 4) \div 2 = 8 \div (4 \div 2)$? $2 \div 2 = 8 \div 2$, $1 \neq 4$

Distributive Property:

Multiply the number outside (touching) the parentheses by every term inside the parentheses.

$A(B + C) = A \bullet B + A \bullet C$

$3(2 + 4) = 3 \cdot 2 + 3 \cdot 4$

$(3)(6) = 6 + 12$

$18 = 18$

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Identity, Inverse, Multiplication Property of Zero, & Symmetric Property

Additive Identity — Multiplicative Identity

Identity Property of Addition	Identity Property of Multiplication
Any number plus zero always equals that number & does not change its value.	Any number multiplied by one always equals that number & does not change its value.
$A + 0 = A$	$(A)(1) = A$
$4 + 0 = 0$	$(4)(1) = 4$

Inverse: Opposite

Additive Inverse — Multiplicative Inverse

Inverse Property of Addition	Inverse Property of Multiplication
A number added to its inverse (opposite) will equal 0.	A number multiplied by its inverse (reciprocal) will equal 1.
$A + (-A) = 0$	$A \cdot \frac{1}{A} = 1$
$7 + (-7) = 0$	$(2) \cdot \frac{1}{(2)} = 1$ $\quad \frac{2}{1} \cdot \frac{1}{2} = \frac{2}{2} = 1$

Multiplication Property of Zero:
Any number multiplied by zero equals zero.
$A \cdot 0 = 0$
$5 \cdot 0 = 0$

Symmetric Property:

If $A = B$ then $B = A$.

If $(A \cdot B) = C$ then $C = (A \cdot B)$

If $(2 \cdot 3) = 6$ then $6 = (2 \cdot 3)$

If $(A + B) = (C + D)$ then $(C + D) = (A + B)$

If $(2 + 3) = (4 + 1)$ then $(4 + 1) = (2 + 3)$