

Properties of real numbers Solutions
Commutative and Associative properties

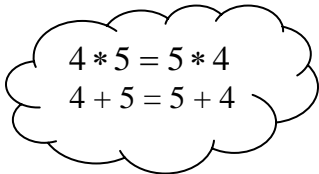
NAME:

This worksheet will try to make the properties of real numbers more meaningful and memorable. We will use them a lot during the semester. Having them firmly in your head will make algebra easier. Particularly, we investigate the Commutative and Associative properties. You will probably find that you are used to using these properties but do not call them by name.

Commutative property of real numbers over multiplication and addition

$$a * b = b * a$$

$$a + b = b + a$$


$$4 * 5 = 5 * 4$$

$$4 + 5 = 5 + 4$$

These properties tell us that the order does not matter when we multiply or add two numbers. We use this quite a lot, although often we do not specifically denote it.

What operations are not commutative? Think of two numbers. Subtract them in both directions. Do you get the same result? Do the same for division. Would you say subtraction and division are commutative? Write down evidence of your experimentation.

Neither subtraction nor division is commutative. Look at $6 \div 2 = 3$ and $2 \div 6 = .33$; you get two different answers when you switch the order of division. Notice the same is true for subtraction. Does $6 - 2$ equal $2 - 6$?

Associative property of real numbers over multiplication and addition

$$a + (b + c) = (a + b) + c$$

$$a * (b * c) = (a * b) * c$$

Let's verify these rules with actual numbers. For each side of the equation, work it out using the order of operations to simplify it. Notice this shows the equation is true. I'll work the first for you to show you what to do.

a.) $4 + (5 + 7) = (4 + 5) + 7$

left side: $4 + (5 + 7) = 4 + 12 = 16$

right side: $(4 + 5) + 7 = 9 + 7 = 16$



Do
parentheses
first.

$$\text{b.) } 12 + (3 + 6) = (12 + 3) + 6$$

$$\text{left side: } 12 + 9 = 21$$

$$\text{right side: } 15 + 6 = 21$$

$$\text{c.) } 3 * (6 * 2) = (3 * 6) * 2$$

$$\text{left side: } 3 * 12 = 36$$

$$\text{right side: } 18 * 2 = 36$$

$$\text{d.) } -2 * (7 * 10) = (-2 * 7) * 10$$

$$\text{left side: } -2 * 70 = -140$$

$$\text{right side: } -14 * 10 = -140$$