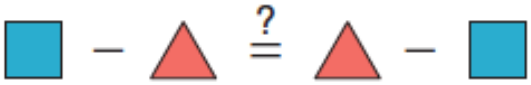
M4 Axioms – Practice Questions

1. Try some whole numbers to determine whether the properties hold.

a. Is subtraction commutative?

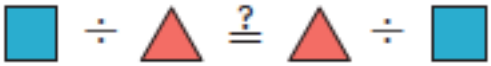


b. Is the set of even numbers closed for addition?

2. Try some numbers in the following equations. Does the right side equal the left? Can you find a case in which the equation does not hold? It only takes once counterexample to show that the property does not hold.

a.

b.



3. Which number property is being used in each of the equations below?

a. $3 \times (2 \times 7 + 1) = 3 \times (7 \times 2 + 1)$

b. $18 + (43 \times 7) \times 9 = 18 + 43 \times (7 \times 9)$

c. $(12 + 17) \times (16 + 5)$
$= (12 + 17) \times 16 + (12 + 17) \times 5$

Determine whether each set in exercises 4 and 5 is closed for the given operation. Explain your answer. If not closed, give an example to show why not.

4.

a. The set of even whole numbers for multiplication.

b. The set of whole numbers less than 100 for addition.

c. The set of all whole numbers whose units digits are 6 for multiplication.

5.

a. The set of odd whole numbers for division

b. $\{0, 1\}$ for division

c. The set of multiples of 10 for division

6. Evaluate the expression in the following exercises. Explain your order of operations.

a. $6 + 4 \times 8 - 3$ **b.** $5 \times 10 - 2 \times 6$

c. $5 \times (10 - 2) \times 6$ **d.** $45 \div 3 \times 5 - 2$

Write the numbers in exercises 7 and 8 in scientific notation. Show your work.

7.

a. Number of years since Earth's formation is 4,600,000,000

b. Diameter of an atom in centimeters is .000000027

8.

a. A light-year, the distance that light travels in 1 year, is 5.868×10^{13} miles. The Sun is 2.7×10^4 light-years from the center of our galaxy. Find this distance in miles by computing $5.868 \times 10^{13} \times 2.7 \times 10^4$.

b. At one point in *Voyager I*'s journey to Jupiter, its radio waves traveled 4.619×10^8 miles to reach Earth. These waves travel at a speed of 3.1×10^5 miles per second. Compute $(4.619 \times 10^8) \div (3.1 \times 10^5)$ to determine the number of seconds it took these signals to reach Earth.

9. Write the numbers in positional numeration.

a. Wavelength of X-rays in inches is 1.2×10^{-9}

b. Approximate length of solar year in seconds is 3.15569×10^7

10. Beneath the equation below is a sequence of calculator steps. Determine whether the sequence produces the correct answers. If not, revise the steps so that the correct answer is obtained from a calculator.

$8 \times (12 \div 3) = 32$

1. Enter 8
2. $\boxed{\times}$
3. Enter 12
4. $\boxed{\div}$
5. Enter 3
6. $\boxed{=}$

1. **a.** No. For example, $3 - 5 \neq 5 - 3$.
b. Yes; the sum of two even numbers is another even number.

2. **a.** The two sides of the equation are equal. Division is distributive over addition.
b. Division is not commutative; $8 \div 4 \neq 4 \div 8$

3. **a.** Commutative property for multiplication
b. Associative property for multiplication
c. Distributive property for multiplication

4. **a.** Closed; the product of two even numbers is another even number.
b. Not closed. For example, $2 \times 60 > 100$.
c. Closed; the product of two whole numbers whose unit digit is 6 is another whole number whose unit digit is 6 since $6 \times 6 = 36$.

5. **a.** Not closed; for example, $\frac{3}{11}$ is not an odd whole number.
b. Not closed; $\frac{0}{1} = 0$, $\frac{1}{1} = 1$, but $\frac{0}{0}$ and $\frac{1}{0}$ are undefined.
c. Not closed; $\frac{20}{10} = 2$

6. **a.** 35 **b.** 38 **c.** 240 **d.** 73

7. **a.** 4.6×10^9 **b.** 2.7×10^{-8}

8. **a.** 1.58436×10^{18} miles **b.** 1.49×10^3 seconds

9. **a.** .0000000012 **b.** 31,556,900

10. Yes, the correct answer is obtained.