

Chapter 1- Numbers and Operations Notes

1.1 A Brief History of Numbers, Types and Uses

Numbers are mathematical symbols for representing quantities - the idea of how many or how much; and positions or order. Numbers are also used for the purpose of identification, and in computers to represent everything our senses comprehend, from passwords to internet searches. The history of numbers is tied to the history of human development. Historically, different peoples and cultures represented quantities differently. The differences were in terms of symbols, base, and whether cumulative or positional in representing quantities. The Hindu-Arabic representation of quantities, now used all over the world, is the result of the effort of humans to find an efficient number system. The Hindus also introduced a symbol for zero, and the Arabs added the decimal point. This gave the world an efficient method of representing all quantities with only eleven symbols, the ten digits and the decimal point.

Indeed, the cardinal use of numbers became important as kingdoms, empires, and individuals saw the need to take stock of their assets and liabilities. Increased trade and commerce between kingdoms, empires and individuals also made it important to take stock of one's assets and liabilities in order to calculate gains or profits. Certainly, the natural way to take stock of assets and liabilities was to count. Counting at the beginning meant matching the quantity of assets to an equal quantity of some objects such as stones, sticks, etc. or making marks of equal quantity as assets on the walls of caves, pots or bones. Finally, symbols were used to represent quantities.

However, our society has other uses for numbers. Numbers are used to tell the order of things in a group such as first, second, third, etc. An example is the 6th person in a line, when we are talking about customers lined-up at a cashier. This is called the ordinal use of numbers because it does not show quantities, but rather it tells us the rank or position of something. Numbers also have nominal uses, in that we use them

to name or identify something or people such as a player on a hockey, football or basketball team. Other examples of the uses of numbers for nominal purposes are:

- Student number
- Social Insurance Number
- Bank card number
- Telephone number
- Ontario Health Insurance Plan (OHIP) card number
- Credit card Number (i.e. visa card, master card, etc.)
- Passport number
- Bar codes (numbers used to identify and track products)

The nature of our society has made it increasingly necessary to use numbers for a variety of nominal purposes and this is likely to grow as our society becomes more complex.

1.2 Natural or Counting Numbers

These are numbers of quantities of units of items. They are 1, 2, 3, 4 ...

Properties: The sum of any two natural numbers is a natural number. The Product of any two Natural Numbers is a natural number. From this observation, the following types of problems arose: Examples: 1) $\square + 2 = 5$ 2) $\square \times 6 = 24$.

In the addition statement above, so long as the number on the right side of the equation is greater than the given number on the left side, a Natural Number solution could be found. In the case of the multiplication statement, so long as the number on the right is a multiple of the given number on the left, a Natural Number solution could be found. What about if the given number on the left is greater than the number on the right of the equation in the addition problem or the number on the right of the equation in the multiplication problem is not a multiple of the given number on the left?

Example: 1a) $\square + 5 = 2$ 2a) $\square \times 6 = 20$.

It is clear that, no natural number is a solution of any of these problems. To solve these problems, new types of Numbers had to be found. The human ingenuity took over and Signed Numbers or Integers, and Fractions or Rational Numbers, were constructed from Natural Numbers. Historically, fractions were used first before negative integers, because commercial transactions could not avoid dealing with parts of a whole or unit.

1.3 Operation with Numbers

Operations can be performed with numbers. An operation has the purpose to change numbers in certain ways. The basic operations are addition, subtraction, multiplication, division, and exponentiation (raising a number to certain power). With the use of computers and other electronic gadgets, calculations can be done at a greater speed and better accuracy compared to calculations by manual methods. However, it is very important for students to understand the underlying logic in these operations.

In this section, the emphasis is on the properties of operations and the order of operations to be done. First, the properties of operations consisting of commutative, associative, and distributive will be explored. Counter-examples will be given for operators that do not have certain properties. There will be no proofs, but illustrative examples will be given. This will be followed by the order of operations. It could well be that the student might have learned these concepts in previous studies. Nevertheless, our special approach will help the student to understand those concepts thoroughly.

a) Commutative

Example 1

Addition: $9 + 3 = 12$
 $3 + 9 = 12$
 $9 + 3 = 3 + 9$

Example 2

Subtraction: $9 - 3 = 6$
 $3 - 9 = -6$
 $9 - 3 \neq 3 - 9$

Example 3

Multiplication: $9 \times 3 = 27$

$$3 \times 9 = 27$$

$$9 \times 3 = 3 \times 9$$

Example 4

Division: $9 \div 3 = 3$

$$3 \div 9 = \frac{1}{3}$$

$$3 \div 9 \neq 9 \div 3$$

From the examples, we make the following conclusions: Addition and multiplication are commutative. This means that for any numbers such as A and B:

$A + B = B + A$, as illustrated by example 1.

$A \times B = B \times A$, as illustrated by example 3.

Subtraction and Division are not commutative. This means there are two numbers A and B such that:

$A - B \neq B - A$ as illustrated by example 2 for $A = 9$ and $B = 3$.

$A \div B \neq B \div A$ as illustrated by example 4 for $A = 9$ and $B = 3$.

So, the commutative property deals with the effect of the starting number of an operation on the outcome.

Associative:

1. **Addition:** Does it matter whether, for example, $17 + 8 + 5$ is evaluated from the right or left? That is $17 + 8$, then add 5, which is $(17 + 8) + 5$

Which works out as: $17 + 8 = 25$; $25 + 5 = 30$: So $(17 + 8) + 5 = 30$. Or $8 + 5$ added to 17 which is $17 + (8 + 5)$. Which works out as: $8 + 5 = 13$; $17 + 13 = 30$: So $17 + (8 + 5) = 30$. Therefore, $(17 + 8) + 5 = 17 + (8 + 5)$ No direction of evaluation does not matter.

2. **Subtraction:** Does it matter whether, for example $17 - 8 - 5$ is evaluated from the right or left?

That is $17 - 8$, then subtract 5, which is $(17 - 8) - 5$

Which works out as: $17 - 8 = 9$; $9 - 5 = 4$: So $(17 - 8) - 5 = 4$.

Or, instead, if we do $8 - 5$ first and then subtract from 17, which is $17 - (8 - 5)$.

This works out as: $8 - 5 = 3$; $17 - 3 = 14$: So $17 - (8 - 5) = 14$

Therefore $(17 - 8) - 5 \neq 17 - (8 - 5)$ Yes, direction (left or right) of evaluation matters.

3. **Multiplication:** Does it matter whether, for example, $18 \times 6 \times 2$ is evaluated from the right or left?

That is 18×6 then multiply by 2, which is $(18 \times 6) \times 2$

Which works out as: $18 \times 6 = 108$; $108 \times 2 = 216$: So $(18 \times 6) \times 2 = 216$.

6×2 then multiply 18 by it, which is $18 \times (6 \times 2)$.

Which works out as: $6 \times 2 = 12$; $18 \times 12 = 216$: So $18 \times (6 \times 2) = 216$

Therefore, $(18 \times 6) \times 2 = 18 \times (6 \times 2)$ No direction of evaluation does not matter.

4. Division: Does it matter, if for example $24 \div 6 \div 2$ is evaluated from right or left?

That is $24 \div 6$ then divide by 2, which is $(24 \div 6) \div 2$

Which works out as: $24 \div 6 = 4$; $4 \div 2 = 2$: So $(24 \div 6) \div 2 = 2$

OR

$6 \div 2$ then divide 24 by it, which is $24 \div (6 \div 2)$

Which works out as: $6 \div 2 = 3$; $24 \div 3 = 8$: So $24 \div (6 \div 2) = 8$

Therefore, $(24 \div 6) \div 2 \neq 24 \div (6 \div 2)$ Yes direction (left or right) of evaluation matters.

Conclusions:

Addition and Multiplication **are** Associative. This means for any three numbers

A, B, and C:

$$(A + B) + C = A + (B + C) \text{ as illustrated by 1.}$$

$$(A \times B) \times C = A \times (B \times C) \text{ as illustrated by 3}$$

Subtraction and division **are not** associative. This means there are numbers A, B, C:

$$(A - B) - C \neq A - (B - C) \text{ as illustrated by 2 for } A = 17, B = 8, C = 5.$$

$$(A \div B) \div C \neq A \div (B \div C) \text{ as illustrated by 4 for } A = 24, B = 6, C = 2.$$

b) Distributive Property (or law)

The Distributive Property (or law) allows us to multiply a sum by multiplying each addend separately, and then add up the products. The Distributive Property has many uses. One of them is that, it helps us to do multiplication, ‘mentally’. Another use is that it helps us to simplify formulas and to manipulate algebraic expressions. Learning mathematics without an understanding of the distributive property is like cooking without pots or pans.

Example 1 What is 98×5 ? We can separate 98 into tens and ones, 90 and 8, and then multiply each by 5.

$$(90 \times 5) + (8 \times 5)$$

$$450 + 40 = 490$$

In my mind, I can calculate the answer of (90×5) quickly and then add (8×5) to get 490. This device is extremely useful when checking multiplication computations.

Example 2

An employee makes \$12/hour. In the week of May, she worked 72 regular hours. How much wages did she earn in that week?

$$12 \times 72 = (12 \times 70) + (12 \times 2) \quad (\text{Note: You can easily do this mentally})$$

$$840 + 24 = \$864$$

Example 3

$$213 \times 3 = (200 \times 3) + (13 \times 3) = 600 + 39 = 639.$$

The distributive property, helps us to do a variety of multiplications, ‘mentally’..

In general, the Distributive Property is as follows:

$$a(b + c) = ab + ac, \text{ or}$$

$$a(b + c + d) = ab + ac + ad$$

C. Identity Property

It states that when 0 and 1 are combined in arithmetic operation of addition and multiplication, respectively, they do not affect the results.

Addition

$$2 + 0 = 2, \quad 5 + 0 = 5$$

No matter the number added to 0, the result is always that number.

Multiplication

$$4 \times 1 = 4, \quad 3 \times 1 = 3$$

The above examples demonstrate that no matter the size of the number multiplied by 1, the result is always that number. Though this property seems obvious, it helps us to manipulate numbers and understand algebra.

D. Reciprocals

Division by a number is the same as multiplication by its reciprocal. For example,

$$120 \div 10 = 120 \times \frac{1}{10} = \frac{120}{10} = 12. \text{ Indeed, the reciprocal of a number is the same as its}$$

multiplicative inverse. That is, the reciprocal of x a number is the number $\frac{1}{x}$. So the

reciprocal of 2 is $\frac{1}{2}$. The reciprocal of 6 is $\frac{1}{6}$. (Zero '0' is the only number without a

reciprocal). An important property of reciprocal is that the product of a number and its reciprocal is always 1. 1 is also the multiplicative identity; that is the number which when multiplied with any other numbers does not affect the result. So the

reciprocal of 3 = $\frac{1}{3}$ and $3 \times \frac{1}{3} = 1$. Reciprocal is an important mathematics concept

and the student must get familiar with it.

1.4 Order of Operations

It would look funny if you were to put on your socks after you have put on your shoes. As well, it would be ‘improper’ to put on your tie around your neck before you wear your shirt. The order in which two or more actions are performed in everyday life activities makes a difference in the result. Similarly, in mathematics the order in which operations or actions are completed makes a difference in the result.

Without a standardized rule for evaluation, what would be the meaning of $17 - 8 \times 5$? Some may evaluate it from the left side and others from the right side, each arriving at different answers. Mathematicians have agreed on a standardized rule that tells us the order in which operations are to be performed. This standardized rule is called the ***ORDER OF OPERATIONS***. This is one of the most important rules in mathematics. Mastering it is necessary for computations involving more than one operation and constructing and applying formulas.

The acronym for the *Order of Operations* is PEDMAS or BEDMAS. P is for Parentheses, B is for Brackets, E for Exponentiation, D for Division, M for Multiplication, A for Addition, and S for Subtraction. Parentheses and brackets are the same, and parentheses and brackets will be used interchangeably.

Parenthesis in an arithmetic expression means, the computation in the brackets must be done first. Where there is an inner bracket and outer bracket, the operations in the inner bracket should be performed first.

Example: $23 - (42 - 32)$ means, first compute $42 - 32 = 10$, then $23 - 10 = 13$.

Then for the computation, whether inside a parenthesis or outside parenthesis the acronym for the order of operation (without parentheses) is **EDMAS**.

Exponentiation must be done first if present. Then ***Division and/or Multiplication*** in the order from left to right whichever operation come ‘first’. That is, whether, for division or multiplication only, or division and multiplication, it is still from left to right. There is no inherent hierarchy. It all depends on the position of the operations

relative to the other or to each other. After that, then **Addition and/or Subtraction** in the order from left to right whichever operation come ‘first’. That is, for addition or subtraction only, or addition and subtraction, it is still from left to right. There is no inherent hierarchy. It all depends on the position of the operations relative to the other or to each other.

EDMAS in terms of hierarchy is: **1st Exponent, 2nd Division/Multiplication** (“*first come first done from left to right*”), **3^d Addition/Subtraction** (“*first come first done from left to right*”).

Parenthesis or bracket in the form () or { } are useful devices for organizing calculations, whether one is doing it manually or electronically. For example, what is $2 \times 5 \times 3 + 8 - 7$? Though we can use brackets to help us to organize the calculation, the order in which we will do the calculation matters. So $2(5 \times 3) + (8 - 7) = 2(15) + 1 = 30 + 1 = 31$. The following two examples will illustrate this point.

Example 1

Gina ordered the following items for her little corner store.

12 cookbooks at \$2.75 each

60 Greeting cards at \$3.20 each

24 boxes of ball point pens at \$4.50 per box

What is the total cost of Gina’s order?

Solution

$$\begin{aligned} \text{Total purchases} &= (12 \times 2.75) + (60 \times 3.20) + (24 \times 4.50) \\ &= 33.00 + 192.00 + 108.00 \\ &= \$333.00 \end{aligned}$$

Therefore, the total cost of Gina’s purchases is \$333.00.

As the calculation is well-organized using brackets, she can check again to make sure that she has not made any mistakes. This illustrates the importance of brackets.

Example 2

Martina works in a group home as a personal support worker. On Monday, she went grocery shopping with \$120 in her purse. She incurred the following expenses:

5.5 pounds of chicken breast at \$3.49 per pound, 4 kg of orange at \$2.10 per kg, 6.5 kg of lean ground beef at \$1.20 per kg, 20L skim milk (2%) at \$3.88 per 4L, 48 containers of yogurt at \$3.99 for 12 containers, 4 loaves of whole wheat bread at 1 loaf for \$1.59 and 7 cans of pasta sauce at \$2.15 a can. Martina spent \$10.50 on taxi fare. How much did she have after these expenses?

Solution

$$\begin{aligned}
 \text{Martina had this left in her purse} &= \$120 - \{(5.5 \times 3.49) + (4 \times 2.10) + (6.5 \times 1.20) + \\
 &\quad (5 \times 3.88) + (4 \times 3.99) + (4 \times 1.59) + (7 \times 2.15) + 10.50\} \\
 &= \$120 - (19.20 + 8.40 + 7.80 + 19.40 + 15.96 \\
 &\quad + 6.36 + 15.05 + 10.50) \\
 &= \$120 - 102.67 \\
 &= \$17.33
 \end{aligned}$$

Note that 20 litres of milk was purchased at \$3.88 per 4L. That means that she bought 5 of 4 litres milk. So we multiplied \$3.88 by 5 to get \$19.40. Similarly, she bought 48 yogurts at 12 for \$3.99. This implies that she bought 4 of 12 in a case. That was why we multiplied \$3.99 by 4 to get \$15.96.

Chapter 1- Numbers and Operations Problems(Only use a calculator in the questions involving money-otherwise, do them by hand)

1. Simplify a) $29 - 16 \div 4 + 8$
b) $16 - 3 \div (10 + 2)$
2. The following represents the operations performed in simplifying the same expression. Put them in the correct order.
a) $\{18 - 12\} \times 2$ b) 6×2 c) $\{18 - (4 + 8)\} \times 2$ d) 12
3. A fellow student worked out the expression $4 \times 12 \div (3 \times 2 - 4)$ in the following way: $4 \times 12 \div (6 - 4) = 4 \times 12 \div 6 - 4 = 4 \times 2 - 4 = 8 - 4 = 4$. What did the student do wrong?
4. It is possible to evaluate the expression $\{6 + 18 \div 2 - 11\} \div \{14 - 21 \times 2 \div 3\}$? Why or why not?
5. Consider the following expression: $14 + 6 \div 2$. Which of the following makes sense to you? why? i) $14 + 6 \div 2 = 14 + 3 = 17$ ii) $14 + 6 \div 2 = 20 \div 2 = 10$
6. Evaluate $6 \div 2 \times 3 - 4$
7. Mabel and her mom are going shopping on Saturday. They bought at least one item from each of the 3 departments that they visited in a neighbourhood store. Mabel gave the cashier \$120 and she got back \$11.76 change. What items did they buy (NO PST OR GST TODAY)? Hint: Use deduction

HOUSEWARES

Shirt: \$30.98
Dress: \$49.90
Slacks: \$39.90

CLOTHING

Dish towels: \$11.38
Curtain Rods: \$12.98
Bath Mats: \$29.58

TOOLS

Hammer: \$17.90
Saw: \$23.90
Drill: \$25.78

8. Marcos received a prescription from his doctor. The doctor prescribed the following capsules: four red capsules each day for five days, three orange capsules each day for 4 days, two yellow capsules each day for three days, and one green capsule each day for two days. Each capsule costs \$0.68.

- Using parenthesis or brackets, set up the computation needed to find the total cost of the capsules.
- Calculate the total cost of the capsules from (a).

9. In her first year of operation, a dog breeder's dogs produced 4 puppies. In her second year, her dogs produced three times as many puppies. In her third year, her dogs produced 5 times as many puppies as the first year.

- How many puppies will the breeder have in her first three years?
- If she sells the puppies for \$1.20 each and her cost for each puppy (feeding, care-taking, veterinary fee) is \$35, how much profit would she make?

10. Simplify each of the following:

a) $14 + (7 - 1)(8 - 2)$ b) $6\{4(7-3)\} - 50$

11. What is the reciprocal of each of the following numbers?

a) $\frac{1}{4}$ b) 100 c) 30 d) 55 e) $\frac{3}{4}$

12. Ben is making wooden toys for the next arts and craft sale. Each toy costs Ben \$1.80 to make. If he sells the toys for \$3 each, how many will he have to sell in order to make a profit of exactly \$36?

13. Simplify each of the following.

a) $\frac{16-8}{8-2}$ b.) $\frac{30-26}{25-19}$ c.) $\frac{20-12}{18-12}$ d) $5 \times 4 + 15 \times 2$ e) $(7 + 2) \times 6 - 3$

14. Write true or false to each of the statement below.

- a) The use of product bar code is an example of the ordinal uses of numbers.
- b) Stock-taking in a wholesale is an example of nominal use of numbers.
- c) The process of figuring out a change is an example of cardinal use of numbers.
- d) Positioning applicants for the purpose of musical audition involves ordinal use of numbers.
- e) Figuring out the total wages payable to an employee involves ordinal use of numbers.
- f) Every number has a reciprocal.
- g) The distributive property helps us to multiply numbers mentally.
- h) Division is commutative but multiplication is not.
- i) Addition is commutative.

15. The distributive property of multiplication over subtraction is stated as

$$a(b - c) = ab - ac$$

Illustrate this property by working the following problems in two ways.

- a) $6(8 - 5)$ b) $8(9 - 3)$ c) $5(11 - 7)$ d) $2(17 - 12)$

16. Classify each as either true or false.

- a) $(48 \div 12) \div 2 = 48 \div (12 \div 2)$
- b) $(12 + 6) \div 3 = (12 \div 3) + (6 \div 3)$
- c) $18 \div (3 + 3) = (18 \div 3) + (18 \div 3)$
- d) $3 + (9 \times 4) = 3 \times (9 + 4)$

17. Compute where possible.

- a) $8(3) \div 4$ b) $14 \div 0$ c) $3(5 + 1) \div 2$ d) $0 \div 16$

18. Name the property that is used in each case.

- a) $(6+5) \times (4 + 8) = (5 + 6) \times (8 + 4)$ b) $(5 \times 4) \times 7 = 5 \times (4 \times 7)$
- c) $(7 \times 3) \times 2 = 7 \times (3 \times 2)$ d) $1 \times (4 + 2) = (2 + 4)$

19. State which statement is either true or false. Explain your answer.

a) $8 \times 0 = 8$ b) $(16 + 1) + 0 = 17$ c) $(16 + 1) 0 = 17$

20. The following table summaries the number properties applicable to each operation. Complete the table: if a number property is applicable to an operation write yes otherwise write no.

Number Property	x	\div	+	-
Commutative				
Associative				
Distributive				

21. Ted bought a flat colour TV set for \$999.99. He made 9 equal payments of \$75.00. How much money is left for him to pay on the TV? Ted set up four different calculations below to help him answer that question. Which is correct?

a) $(999.99 - 9) \times 75$ b) $(999.99 - 75) \div 9$ c) $9 \times 75 - 999.99$ d) $999.99 - 9 \times 75$

22. Siana bought a motorcycle for \$350. She put \$50 down and paid the rest in 5 equal payments. Which of the following calculation will give the right answer?

a) $350.00 - 50.00 \times 5$ b) $(350.00 - 50.00) \div 5$
 c) $350.00 \div 5 - 50.00 \div 5$ d) $350.00 \div 5 - 50.00$

23. Anna bought 45 shares of a stock at \$98.75 a share and sold them at \$129.85 a share. Buying and selling the stock cost him \$20.25. How much did he gain?

Which of the calculations below gives the correct answer?

a) $45 (129.85 - 98.75) - 20.25$ b) $45 \times 129.85 - 98.75 - 20.25$
 c) $45 \times 129.85 - (45 \times 98.75 + 20.25)$ d) $45(129.85 - 98.75 - 20.25)$

24. Simplify each of the following.

a) $\frac{6 \times 9 + 2 \times 23}{10 \times 10}$ b) $8 + 4 \div 2 - 1$ c) $8 - (5 + 10 \div 5)$

24. A water tap wastes 255mL of water every 15 min. How many litres of water would be wasted in a month consisting of 30 days? Nana worked out four different calculations as follows, which one gives the correct answer to the question?

Explain your answer.

- a) $255 \div 1000 \div 15 \times 30 \times 24 \times 60$ b) $255 \times 30 \times 60 \times 24 \div 15 \div 1000$
 c) $255 \times 30 \div 15 \times 60 \times 24 \div 1000$ c) $30 \times 60 \div 15 \div 1000 \times 255 \times 24$

25. Attendance at a community festival was estimated to be 290 people. There were 17 rows of chairs with 24 chairs in each row. How many empty chairs were there?

26. During our trip from New York to Brampton, we travelled 350 km. We bought 75 L of gasoline at \$0.93/L and 2l of motor oil at \$1.69/L. Wear and tear on the car amounts to \$0.37/Km. How much did it cost to operate our car on the trip?

We worked out the computations below. Which will give us the correct answer?

- a) $75 \times 0.93 + 2 \times 1.69 + 350 \times 0.37$ b) $0.93 \div 75 + 1.69 \div 2 + 0.37 + 350$
 c) $(75 + 2) (0.93 + 1.69) + 450 \times 0.37$ c) $(70 + +2 + 350) (0.93 + 1.69 + 0.17)$

27. The distributive property helps us to calculate products of numbers mentally.

$$\begin{aligned} \text{For example, } 256 \times 101 &= 256 \times (100 + 1) \\ &= 256 \times 100 + 256 \times 1 \\ &= 25600 + 256 \\ &= 25,866 \end{aligned}$$

Use the distributive property to calculate each of the products mentally.

- a) 24×11 b) 87×900 c) 65×98 d) 16×49 e) 13×230

28. a) Does $(240 + 314) \div 16 = 240 \div 16 + 314 \div 16$?
- b) Is there a distributive property of division over addition? How?
- c) Does $(123 - 25) \div 4 = 123 \div 4 - 25 \div 4$? Explain.
- d) Is there a distributive property of division over subtraction. Why?
29. What is the product of any number and its reciprocal? Give an example to illustrate your answer.

An even number is a whole number that is divisible exactly into two groups of whole numbers, or that is a multiple of two. Examples of even numbers are 2, 4, 6, 8... An odd is a whole number can not be divided into exactly two groups whole numbers. Example of odd numbers are 1, 3, 5, 7, 9... An important property of even and odd number is that even numbers ends in 0, 2, 4, 6, 8... and odd in 1, 3, 5, 7, 9...

30. State which of the following numbers are even and which are odd.

- a) 781 b) 8322 c) 923 d) 486 e) 239 f) 124

31. Use your own examples to show whether the answer is even or odd in each of these cases when two numbers are combined as follows:

- a) even+ even b) even + odd c) odd + odd d) even x even e) odd x odd

32. Ms. Smith paid \$124,000 for a townhouse five years ago. The price of the house has since doubled in the real estate market . How much is the house worth now?

Four students answered the question with the following calculations:

Christina's calculation: $124,000 + 2 \times 124,000$

Joe's calculation: $124,000 \times 2 \times 5$

Laura's calculation: $124,000 \times 2 \times 2 \times 2 \times 2 \times 2$

Cecilia's calculation: $124,000 \times 2$

Which of them provides a correct method for the calculation? Justify your answer.

Chapter 1- Answers to Numbers and Operations Problems

1. a) 33 b) 13
2. c, a, b and d
3. The student should have worked the bracket first.
4. No, because the expression simplifies to $4 \div 0$ which is undefined.
5. Both make sense. For consistency, mathematicians agreed that division should be worked first before addition.
6. 5 7. Slacks, curtain rod, bath mat and drill
8. a) $(4 \times 5 \times 0.68) + (3 \times 4 \times 0.68) + (2 \times 3 \times 0.68) + (1 \times 2 \times 0.68)$
b) \$27.20
9. a) $4 + (3 \times 4) + (4 \times 5) = 36$ puppies
b) Profit = $(120 \times 36) - (35 \times 36) = \$3,060$
10. a) 50 b) 46
11. a) $\frac{4}{1}$ b) $\frac{11}{100}$ c) $\frac{1}{30}$ d) $\frac{1}{55}$ e) $\frac{4}{3}$
12. 30 pieces
13. a) $\frac{4}{3}$ b) $\frac{2}{3}$ c) $\frac{4}{3}$ d) 50 e) 51
14. a) False b) True c) True d) True e) False f) True g) True h) False i) True
15. a) $6(8 - 5) = 18$, $48 - 30 = 18$
b) $8(9 - 3) = 48$, $72 - 24 = 48$
c) $5(11 - 7) = 20$, $55 - 35 = 20$
d) $2(5) = 10$, $34 - 24 = 10$
16. a) False b) True c) False d) True
17. a) 6 b) Impossible c) 9 d) 0
18. a) Commutative b) Commutative c) Commutative d) Distributive
19. a) False b) True c) False
- 20.
- | | Multiplication | Division | Addition | Subtraction |
|--------------|----------------|----------|----------|-------------|
| Commutative | Yes | No | Yes | No |
| Associative | Yes | No | Yes | No |
| Distributive | Yes | No | No | No |
21. d 22. b 23. c 24. a) 1 b) 9 c) 1 24. b
25. 118 26. a

28. a) Yes b) No c) Yes, because using PEDMAS OR BEDMAS we have:

$$(123 - 25) \div 4 = 24.50 \text{ and } (123 \div 4) - (25 \div 4) = 24.50$$

d) No

29. 1

30. The even numbers are 8322, 486, 124. The odd number: 781, 923, 239

31. a) even + even = even, b) even + odd = odd, c) odd + odd = even d) even x even

e) odd x odd = odd

32. Cecilia= \$248,000.