Multiplication by 0 and 1. Patterns in Multiplication table.
Branching Algorithm.

Math 2 Classwork 17

Warm Up

1 Write down as an algebraic expression:

a) The "sum of 12 and x": ______________________

b) "5 less than x": _____________________________

c) The" difference of 10 and x": ________________

d) The " 20 more than x" _____________________

2 Compare using >, <, or =

$4 \times 2 \ldots 14 + 14$	$10 \times 17 \ldots 17 \times 9$	$35 \times 1 \ldots 35 \times 2$
$5 \times 2 \ldots 5 \times 2 \times 2$	$11 + 11 + 11 \ldots 11 \times 7$	$4 \times 5 \ldots 2 \times 10$
$3 \times 6 \ldots 2 \times 9$	$6 + 6 + 6 + 6 \ldots 2 \times 12$	$9 \times 4 \ldots 7 \times 4$

3 Calculate without removing parentheses:

a) 14 – (4 – 1) =____________________

208 – (100 + 8) =__________________

444 – (44 + 400) =_________________

b) Now remove parenthesis and calculate:

14 – (4 – 1) =_____________________

208 – (100 + 8) = _________________

444 – (44 + 400) =_________________

4 Solve the equations and check the answers.

563 + ***x*** = 709	***x*** + 714 = 851	852 – ***z*** = 34
x = _____	***x*** = _____	***z*** = _____

Homework Review

5 Rewrite the expressions below replacing addition with multiplication where possible.

a) 2 + 2 + 2 + 2 + 2 + 5 = ______________________________

b) 5 + 5 + 5 + 5 + 4 = _________________________________

c) 3 + 3 + 3 + 3 + 3 + 3 + 6 = ___________________________

d) 7 + 7 + 7 + 3 = ____________________________________

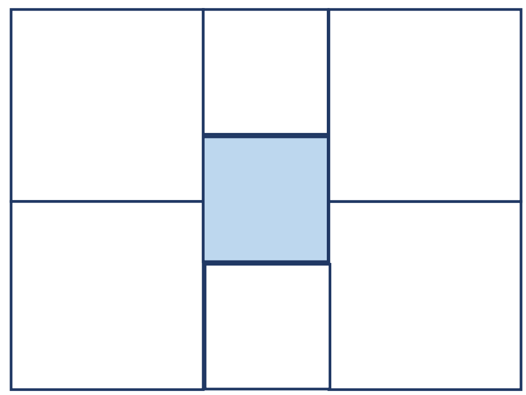
6 The rectangle below is divided on 7 squares. Find a perimeter of the rectangle if the side of shaded square is 2cm.

Find the length and width of the rectangle first.

Length = ____________

Width = _____________

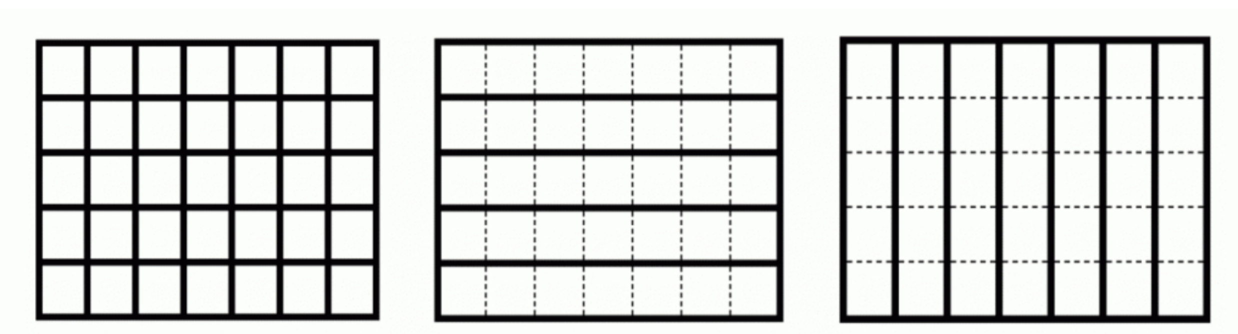
Perimeter =



New Material I

The “equal groups” (arrays) thinking about multiplication.
The equal groups are a way of thinking, whereas repeated addition is a way of doing.

Example: $5 \times 7 = 7 \times 5 = 7 + 7 + 7 + 7 + 7 = 5 + 5 + 5 + 5 + 5 + 5 + 5$



Thus, 5 groups of 7 is the same as 7 groups of 5, so 5 × 7 = 7 × 5.

Lesson 17 Multiplication by 0 and 1. Patterns in Multiplication table. Branching Algorithm.

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a) Perform the following operations and write their results:

1 × 2 = ____________________________

1 × 3 = ____________________________

1 × 6 = ____________________________

Conclusion: 1 × ***a*** = __________

or one group of ***a*** equals ***a***

b) Perform the following operations and write their results:

0 × 2 = __________________________

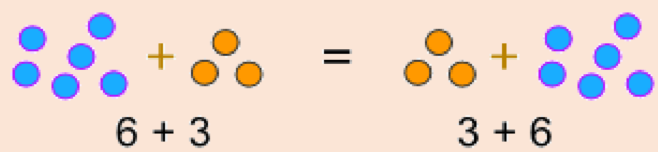
0 × 3 = ___________________________

0 × 6 = ___________________________

Conclusion: 0 × ***a*** = __________

or zero group of ***a*** equals ***0***

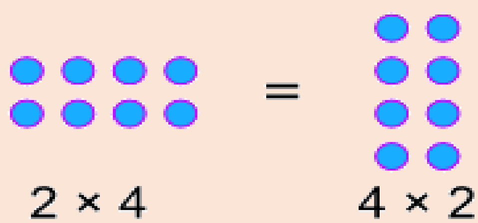
The **Commutative property** of addition says changing the order of the numbers we are adding, does not change the sum.



Remember, when we add:

____

The **Commutative property** of multiplication says that the order in which we multiply numbers does not change the product.



When we **multiply**: **a × b = b × a**

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a) Use the commutative property of multiplication to evaluate the expressions:

3 × 1 = 1 × 3 = ______

5 × 1 = 1 × 5 = ______

7 × 1 = × = ______

9 × 1 = × = ______

Conclusion: ***a*** × 1 = __________

or ***a*** groups of one equals ***a.***

b) Use the commutative property of multiplication to evaluate the expressions:

3 × 0 = 0 × 3 = ______

5 × 0 = 0 × 5 = ______

7 × 0 =___×___= ______

Conclusion: ***a*** × 0 = __________

or ***a*** group of zeros equals ***0.***

Multiplication by 0 and 1. Patterns in Multiplication table. Branching Algorithm.

Patterns in Multiplication Table.

Pattern in math is an ordered set of numbers, shapes, or other mathematical objects, arranged according to a rule.

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Q1: Find all multiples of 2 in the multiplication table. What do those numbers have in the one's place? ___________________________

Q2: Find all multiples of 4 in the multiplication table. What do those numbers have in the one's place? ____________________Is there any connection to the multiples of 2?

Q3: Find all multiples of 5 in the multiplication table. What do those numbers have in the one's place? ____________________. What is the pattern in the ten's place? ____________________

Q4: Look at the darker shaded section of the multiplication table (right of the diagonal) and on the lighter shaded section (left of the diagonal). What do you notice? Can the multiplication table be drawn in the form of a triangle?

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

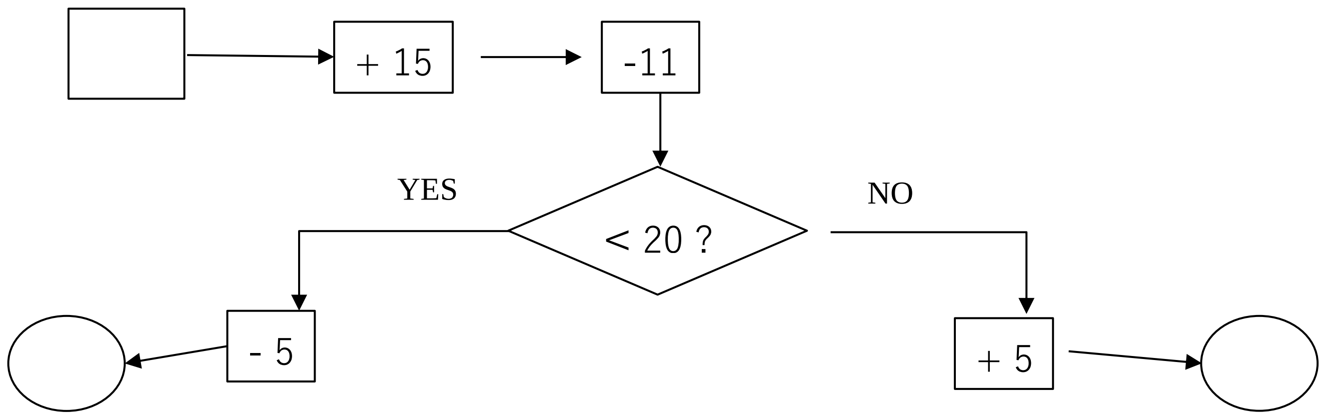
New Material II

Three important characteristics of the algorithm:

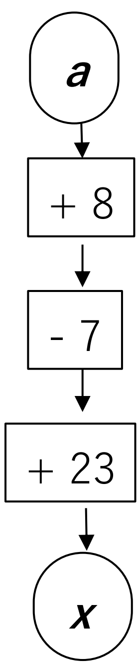
- It should be **finite:** If your algorithm never ends when you try to solve a problem, then it is useless
- It should have well **defined instructions**: Each step of the algorithm has to be precisely defined; **the** instructions should be unambiguously specified for each case.
- It should be **effective:** The algorithm should solve the problem it was designed to solve in the most optimal way.

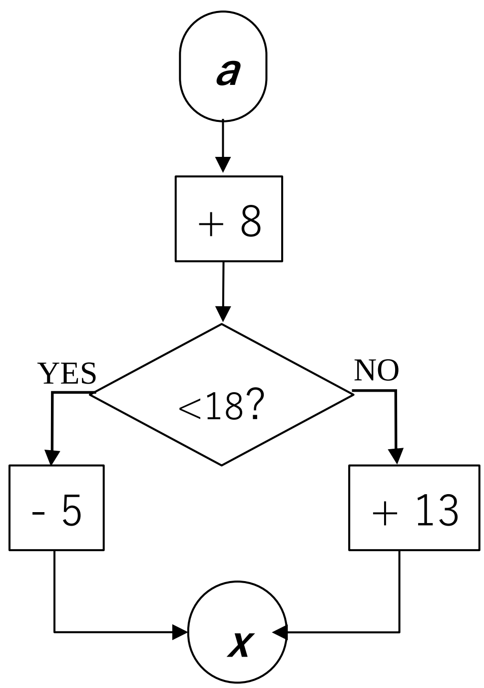
Branching Algorithms

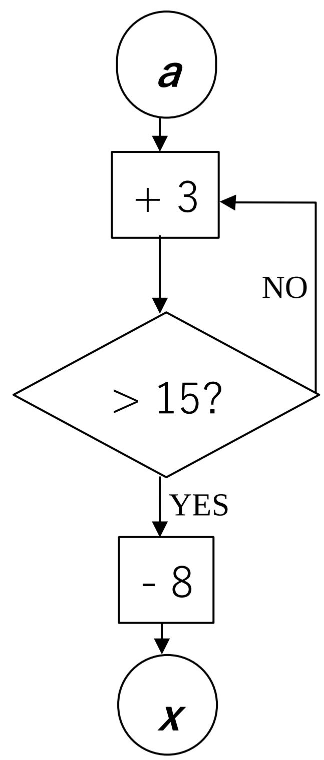
10 In a 1st box write any number between 10 and 20 in the square. Then, do the calculations according to the algorithm.



11 Which of those algorithms are ***linear, or branching, or cyclic***? Find the value of ***x*** for every ***a*** by following each algorithm.







a	3	9	15
x			

a	3	9	15
x			

a	3	9	15
x			

Did you Know …?

Multiplication table – rows with patterns –
multiplying by 5's and 9's

1. Let's start with the multiplication by 5's.
The first 10 multiples of 5 are: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50
The pattern is obvious: All even numbers end in zero: 10, 20, 30, 40, …
It makes sense since every two 5's give us another 10. All odd numbers, multiplying by 5's, end in five. Use those two rules to count quickly:
4 × 15 = 6<u>0</u>   2 × 125 = 25<u>0</u>   21 × 5 = 5<u>5</u>

2. The pattern in the multiplication by 9's is even simpler!
Read the first ten multiples of 9: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90 aloud.
For the one's place, we see that number 9 has nine, number 18 has eight and going through the list, we get that the values on one's place are 9, 8, 7, 6, 5, 4, 3, 2, 1, 0.
The ten's place starts with 0 and goes up by one while the one's place is 9 again and goes down by 1: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
The first digit of the product is one less than the number you are multiplying by, and the second is whatever you need to make the two digits add up to 9.
For example: 9 × 4 = 36. It fits the pattern because 3 is one less than 4, and you need 6 to be added to 3 to make a sum of both numbers equal 9.
9 × 6 = 54 9 × 9 = 81 9 × 7 = 63
3. There is a finger trick, which is very useful. To multiply 9 x 6, you should put the sixth finger down and look at your hands. You will have 5 fingers up on one side of the down finger and 4 on the other.