

## Lesson 19: Substituting to Evaluate Addition and Subtraction

### Expressions

#### Classwork

##### Opening Exercise

My older sister is exactly two years older than I am. Sharing a birthday is both fun and annoying. Every year on our birthday we have a party, which is fun, but she always brags that she is two years older than I am, which is annoying. Shown below is a table of our ages, starting when I was born:

My Age (in years)	My Sister's Age (in years)
0	2
1	3
2	4
3	5
4	6

- Looking at the table, what patterns do you see? Tell a partner.
- On the day I turned 8 years old, how old was my sister?
- How do you know?
- On the day I turned 16 years old, how old was my sister?
- How do you know?
- Do we need to extend the table to calculate these answers?

## Example 1

My Age (in years)	My Sister's Age (in years)
0	2
1	3
2	4
3	5
4	6

- a. What if you don't know how old I am? Let's use a variable for my age. Let  $Y$  = my age in years. Can you develop an expression to describe how old my sister is?
- b. Please add that to the last row of the table.

## Example 2

My Age (in years)	My Sister's Age (in years)
0	2
1	3
2	4
3	5
4	6

- a. How old was I when my sister was 6 years old?
- b. How old was I when my sister was 15 years old?
- c. How do you know?

- d. Look at the table in Example 2. If you know my sister's age, can you determine my age?
- e. If we use the variable  $G$  for my sister's age in years, what expression would describe my age in years?
- f. Fill in the last row of the table with the expressions.
- g. With a partner, calculate how old I was when my sister was 22, 23, and 24 years old.

### Exercises

1. Noah and Carter are collecting box tops for their school. They each bring in 1 box top per day starting on the first day of school. However, Carter had a head start because his aunt sent him 15 box tops before school began. Noah's grandma saved 10 box tops, and Noah added those on his first day.
- a. Fill in the missing values that indicate the total number of box tops each boy brought to school.

School Day	Number of Box Tops Noah Has	Number of Box Tops Carter Has
1	11	16
2		
3		
4		
5		

- b. If we let  $D$  be the number of days since the new school year began, on day  $D$  of school, how many box tops will Noah have brought to school?
- c. On day  $D$  of school, how many box tops will Carter have brought to school?
- d. On day 10 of school, how many box tops will Noah have brought to school?
- e. On day 10 of school, how many box tops will Carter have brought to school?

2. Each week the Primary School recycles 200 pounds of paper. The Intermediate School also recycles the same amount but had another 300 pounds left over from summer school. The Intermediate School custodian added this extra 300 pounds to the first recycle week.

a. Number the weeks and record the amount of paper recycled by both schools.

Week	Total Amount of Paper Recycled by the Primary School This School Year in Pounds	Total Amount of Paper Recycled by the Intermediate School This School Year in Pounds

b. If this trend continues, what will be the total amount collected for each school on Week 10?

3. Shelly and Kristen share a birthday, but Shelly is 5 years older.

a. Make a table showing their ages every year, beginning when Kristen was born.


b. If Kristen is 16 years old, how old is Shelly?

c. If Kristen is  $K$  years old, how old is Shelly?

d. If Shelly is  $S$  years old, how old is Kristen?



3. A train consists of three types of cars: box cars, an engine, and a caboose. The relationship between the types of cars is demonstrated in the table below.

Number of Box Cars	Number of Cars in the Train
0	2
1	3
2	4
10	12
100	102

- a. Tom wrote an expression for the relationship depicted in the table as  $B + 2$ . Theresa wrote an expression for the same relationship as  $C - 2$ . Is it possible to have two different expressions to represent one relationship? Explain.
- b. What do you think the variable in each student’s expression represents? How would you define them?
4. David was 3 when Marieka was born. Complete the table.

Marieka’s Age in Years	David’s Age in Years
5	8
6	9
7	10
8	11
10	
	20
32	
$M$	
	$D$

5. Caitlin and Michael are playing a card game. In the first round, Caitlin scored 200 points and Michael scored 175 points. In each of the next few rounds, they each scored 50 points. Their score sheet is below.

Caitlin’s points	Michael’s points
200	175
250	225
300	275
350	325

- a. If this trend continues, how many points will Michael have when Caitlin has 600 points?
- b. If this trend continues, how many points will Michael have when Caitlin has  $C$  points?
- c. If this trend continues, how many points will Caitlin have when Michael has 975 points?
- d. If this trend continues, how many points will Caitlin have when Michael has  $M$  points?

6. The high school marching band has 15 drummers this year. The band director insists that there are to be 5 more trumpet players than drummers at all times.
- How many trumpet players are in the marching band this year?
  - Write an expression that describes the relationship of the number of trumpet players ( $T$ ) and the number of drummers ( $D$ ).
  - If there are only 14 trumpet players interested in joining the marching band next year, how many drummers will the band director want in the band?