Properties of Addition

This module is from Fundamentals of Mathematics by Denny Burzynski and Wade Ellis, Jr. This module discusses properties of addition. By the end of the module students should be able to understand the commutative and associative properties of addition and understand why 0 is the additive identity.

Section Overview

- The Commutative Property of Addition
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- The Associative Property of Addition The Additive Identity
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We now consider three simple but very important properties of addition.
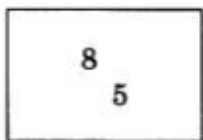
The Commutative Property of Addition

Commutative Property of Addition

If two whole numbers are added in any order, the sum will not change.

Sample Set A

Example:
Add the whole numbers

$8 + 5 = 13$
$5 + 8 = 13$

The numbers 8 and 5 can be added in any order. Regardless of the order they are added, the sum is 13.

Practice Set A

Exercise:

Problem:

Use the commutative property of addition to find the sum of 12 and 41 in two different ways.

```
    12
41
```

Solution:

12 + 41 = 53 and 41 + 12 = 53

Exercise:

Problem: Add the whole numbers

```
   837
1,958
```

Solution:

837 + 1,958 = 2,795 and 1,958 + 837 = 2,795

The Associative Property of Addition

Associative Property of Addition

If three whole numbers are to be added, the sum will be the same if the first two are added first, then that sum is added to the third, or, the second two are added first, and that sum is added to the first.

Using Parentheses

It is a common mathematical practice to **use parentheses** to show which pair of numbers we wish to combine first.

Sample Set B

Example:

Add the whole numbers.

43
16
27

43 and 16 are associated.
$(43 + 16) + 27 = 59 + 27 = 86.$
$43 + (16 + 27) = 43 + 43 = 86.$
16 and 27 are associated.

Practice Set B

Exercise:

Problem:

Use the associative property of addition to add the following whole numbers two different ways.

17
32
25

Solution:

(17 + 32) + 25 = 49 + 25 = 74 and 17 + (32 + 25) = 17 + 57 = 74

Exercise:

Problem:

1,629
806
429

Solution:

(1,629 + 806) + 429 = 2,435 + 429 = 2,864

1,629 + (806 + 429) = 1,629 + 1,235 = 2,864
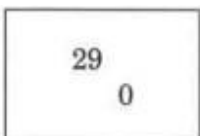
The Additive Identity

0 Is the Additive Identity

The whole number 0 is called the **additive identity**, since when it is added to any whole number, the sum is identical to that whole number.

Sample Set C

Example:

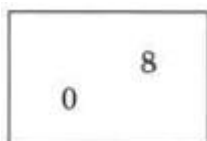Add the whole numbers.

29
  0

$$29 + 0 = 29$$
$$0 + 29 = 29$$
Zero added to 29 does not change the identity of 29.

Practice Set C

Add the following whole numbers.

Exercise:

Problem:

    8
0

Solution:

8

Exercise:

Problem:

```
┌─────────────┐
│  0          │
│        5    │
└─────────────┘
```

Solution:

5

Suppose we let the letter x represent a choice for some whole number. For the first two problems, find the sums. For the third problem, find the sum provided we now know that x represents the whole number 17.

Exercise:

Problem:

```
┌─────────────┐
│   x         │
│        0    │
└─────────────┘
```

Solution:

x

Exercise:

Problem:

```
┌─────────────┐
│         0   │
│   x         │
└─────────────┘
```

Solution:

x

Exercise:

Problem:

```
┌─────────────────┐
│                 │
│   0             │
│      x          │
│                 │
└─────────────────┘
```

Solution:

17

Exercises

For the following problems, add the numbers in two ways.

Exercise:

Problem:

```
┌─────────────────┐
│                 │
│   8             │
│       29        │
│                 │
└─────────────────┘
```

Solution:

37

Exercise:

Problem:

```
┌─────────────────┐
│                 │
│  36             │
│      12         │
│                 │
└─────────────────┘
```

Exercise:

Problem:

```
        36
   48
```

Solution:

45

Exercise:

Problem:

```
        26
  117
```

Exercise:

Problem:

```
  456
      112
```

Solution:

568

Exercise:

Problem:

```
      1,096
  4,251
```

Exercise:

Problem:

```
73,205
   49,118
```

Solution:

122,323 **Exercise:**

Problem:

```
265,094
   32,508
```

Exercise:

Problem:

```
    32
        8
  5
```

Solution:

45

Exercise:

Problem:

```
  16
18
      14
```

Exercise:

Problem:

```
   52
10
      38
```
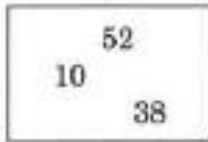
Solution:

100

Exercise:

Problem:

```
  84
        7
36
```

Exercise:

Problem:

```
    114
17
       425
```
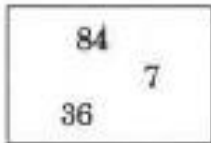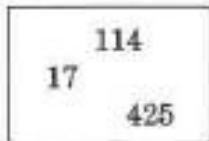
Solution:

556

Exercise:

Problem:

```
   1019
11
      586
```

```
┌─────────────────┐
│ 37,728          │
│        1,261    │
│ 4,472           │
└─────────────────┘
```
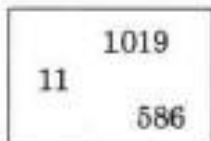
Solution:

43,461

For the following problems, show that the pairs of quantities yield the same sum.

Exercise:

Problem: (11 + 27) + 9 and 11 + (27 + 9)

Exercise:

Problem: (80 + 52) + 6 and 80 + (52 + 6)

Solution:

132 + 6 = 80 + 58 = 138

Exercise:

Problem: (114 + 226) + 108 and 114 + (226 + 108)

Exercise:

Problem: (731 + 256) + 171 and 731 + (256 + 171)

Solution:

987 + 171 = 731 + 427 = 1,158

The fact that (a first number + a second number) + third number = a first number + (a second num ber + a third number) is an example of the property of addi tion.

Exercise:

Problem:

The fact that 0 + any number = that particular number is an example of the property of addi tion.

Solution:

Identity **Exercise:**

Problem:

The fact that a first number + a second number = a second number + a first number is an example of the property of addi tion.

Exercise:

Problem:

Use the numbers 15 and 8 to illustrate the com mutative property of addition.

Solution:

15 + 8 = 8 + 15 = 23

Exercise:

Problem:

Use the numbers 6, 5, and 11 to illustrate the associative property of addition.

The number zero is called the additive identity. Why is the term identity so appropriate?

Solution:

...because its partner in addition remains identically the same after that addition

Exercises for Review Exercise:

Problem: ([link]) How many hundreds in 46,581?

Exercise:

Problem: ([link]) Write 2,218 as you would read it.

Solution:

Two thousand, two hundred eighteen.

Exercise:

Problem: ([link]) Round 506,207 to the nearest thousand.

Exercise:

482 + 68

Problem: ([link]) Find the sum of

Solution:

550

Exercise:

3,318

Problem: ([link]) Find the difference:

− 429