

# Gen Phys

- Get out your notebook, pen/pencil and worksheet.
- Leave **EVERYTHING** else in your cubbies
- Lab notebooks on the demo table on the way out.
- **Test of Math Methods this Friday!**

# Lesson 5

## Sums and Differences with Variables

Objective:

Solve sum and differences equations  
that contain a variable.

In solving an adding/subtracting equation, first identify the sum term and the two addends.

Recall the two basic patterns:

The plus sign here means the **sum term** is on the other side.

$$[\text{sum}] = [\text{one addend}] + [\text{other addend}]$$

The minus sign here means the **sum term** is to its left.

$$[\text{one addend}] = [\text{sum}] - [\text{other addend}]$$

Recall the 8 equations that relate sums and differences, this time using variables.

$$\begin{array}{ccc}
 z = x + y & \xleftrightarrow{c} & z = y + x \\
 \swarrow s & & \swarrow s \\
 x + y = z & \xleftrightarrow{c} & y + x = z \\
 \updownarrow d & & \updownarrow d \\
 z - x = y & & z - y = x \\
 \swarrow s & & \swarrow s \\
 y = z - x & & x = z - y
 \end{array}$$

s: the symmetric property of equality.    If  $a = b$ , then  $b = a$ .

c: the commutative property of addition.     $a + b = b + a$

d: the definition of subtraction.     $a - b = c \iff b + c = a$

$$z = x + y$$

$$z = y + x$$

$$x + y = z$$

$$y + x = z$$

The sum equals one addend plus the other addend.

$$z - x = y$$

$$z - y = x$$

$$y = z - x$$

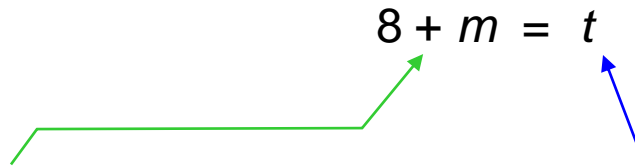
$$x = z - y$$

One addend equals the sum minus the other addend.

The top four equations are explicit for the sum  $z$ .

The bottom four equations are explicit for one of the addends,  $x$  or  $y$ .

Identify the sum term and the two addends in the equation.

$$8 + m = t$$
A diagram showing the equation  $8 + m = t$ . A green arrow starts from the left side of the equation and points to the  $t$  on the right side. A blue arrow points from the  $t$  back to the  $+$  sign. Another blue arrow points from the  $t$  to the  $8$ .

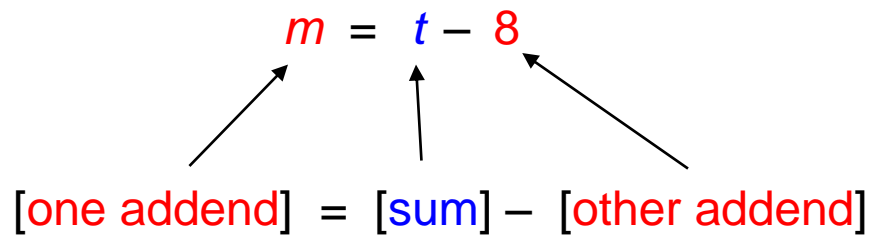
The plus sign on the left side means  $t$  on the right side is the sum.

So the 8 and the  $m$  are the addends.

Now, solve the equation for  $m$ .

What kind of term is  $m$ ? It is an addend.

Recall, one addend is the sum minus the other addend. So,

$$m = t - 8$$
A diagram showing the equation  $m = t - 8$ . Three arrows point from the terms in the equation to a corresponding equation below. The first arrow points from  $m$  to  $[one\ addend]$ . The second arrow points from  $t$  to  $[sum]$ . The third arrow points from  $8$  to  $[other\ addend]$ .

$[one\ addend] = [sum] - [other\ addend]$

Identify the sum term and the two addends in the equation.

$$s = m - 4$$


The minus sign on the right side means  $m$  is the sum.

So the  $s$  and the  $4$  are the addends.

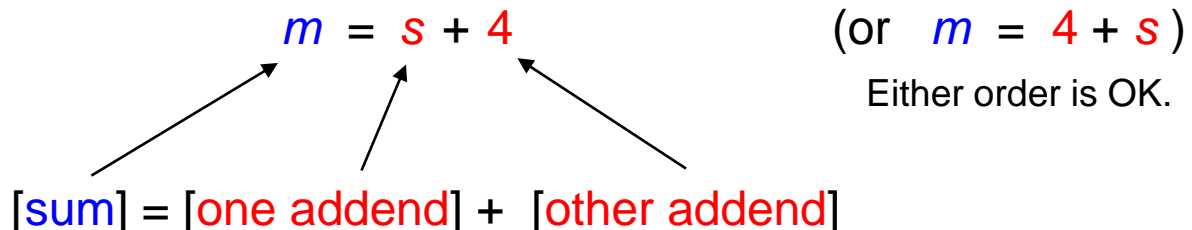
Now, solve the equation for  $m$ .

What kind of term is  $m$ ? It is the sum.

Recall, the sum equals one addend plus the other addend. That is,

$$m = s + 4$$

(or  $m = 4 + s$ )  
Either order is OK.



[sum] = [one addend] + [other addend]

Identify the sum term and the two addends in the equation.

$$p - m = 7$$



The minus sign on the left side means  $p$  is the sum.

So the  $m$  and the  $7$  are the addends.

Now, solve the equation for  $m$ .

What kind of term is  $m$ ? It is an addend.

Recall, one addend is the sum minus the other addend. So,

$$m = p - 7$$

[one addend] = [sum] - [other addend]

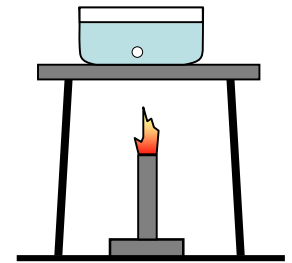


**Application (Thermodynamics):** The amount of heat  $Q$  transferred to a system is equal to the change in internal energy  $\Delta U$  of the system minus the work  $W$  done on the system:  $Q = \Delta U - W$ .

Suppose we know  $Q$  and  $\Delta U$  and we want to calculate  $W$ .

Let's solve the equation for  $W$ .

$$Q = \Delta U - W$$



Which term is the sum?  $\Delta U$  So  $Q$  and  $W$  are the two addends.

$$[\text{one addend}] = [\text{sum}] - [\text{other addend}]$$

$$W = \Delta U - Q$$

Remember:

$$[\text{sum}] = [\text{one addend}] + [\text{other addend}]$$

$$[\text{one addend}] = [\text{sum}] - [\text{other addend}]$$

$$1. 41 = x - 3n$$

$$4. \frac{a}{b} = x - 7$$

$$2. cy = 3 + x$$

$$5. y + x = 18$$

$$3. \frac{m}{n} - x = 5$$

$$6. 23 - x = a$$

1.  $41 = x - 3n$

2.  $cy = 3 + x$

3.  $\frac{m}{n} - x = 5$

$$4. \quad \frac{a}{b} = x - 7$$

$$5. \quad y + x = 18$$

$$6. \quad 23 - x = a$$

