Expressions Written in Terms of One Variable

Translations					
$+$	$-$	$\times$ **OR** $\cdot$	$\div$ **OR** $\frac{a}{b}$	$=$	$(\ )$
sum increased by more and plus combined together	difference subtract minus decreased by less take away	of product multiple twice times	quotient per ratio divided by shared	is are were will be gives totals makes	times **the difference of** twice **the sum of** more than **the difference of** less than **the sum of**

EXAMPLE: Write a math expression to represent: Twice the sum of nine and a number.

SOLUTION: Assign a variable each time an unknown number is mentioned, translate any mathematical terms, and simplify.

STEP 1: Assign the variable n to the unknown number and write any translation words.

Twice	the	sum of	nine	and	a number
$2\ times$		$(add$	9	and	$n)$

STEP 2: Replace any translations with math terms and simplify the answer as needed.

$2(9+n)$

$\mathbf{18+2n}$

EXAMPLE: Write a math expression to represent: Three less than one half of a number.

SOLUTION: Assign a variable each time an unknown number is mentioned, translate any mathematical terms, and simplify.

STEP 1**:** Assign the variable n to the of a number

Three	less than	one half
3	$subtracted\ from$	$\frac{1}{2}\ times\ n$

unknown number and write any translation words.

STEP 2: Replace any translations with math terms and simplify the answer as needed. $\frac{1}{2}n - 3$

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A tactic for translating expressions is to describe two or more unknown numbers in terms of only one variable. It is important to make a good choice for the unknown number that the variable represents.

EXAMPLE: "The length of a rectangle is 3ft. longer than the width." Write a variable expression for each unknown by assigning a variable for one of the unknowns and using that same variable in an expression which represents the given relationship between the two unknowns.

SOLUTION: Consider the basic relationship:

The length is 3 ft. longer than the width.
length = 3 + width
Let w = width
Then $3 + w$ or $\boldsymbol{w + 3}$ = **length**

A situation that occurs frequently in math problems is to know the sum of two numbers and have to write a variable expression for each number.

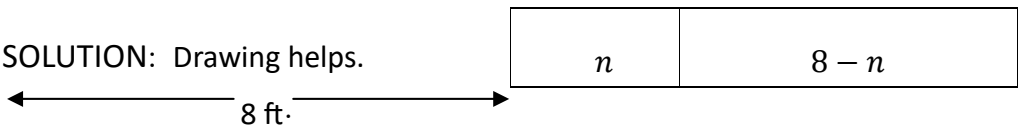
> Use one variable to represent two unknown parts when the sum of the two parts is known:
>
> Let $\boldsymbol{x}$ = one part
>
> Then $\boldsymbol{\text{total} - x}$ = the other part

EXAMPLE: The sum of two numbers is 23.

SOLUTION: Let $\boldsymbol{n}$ = one of the numbers (it does not matter which number) then
$\boldsymbol{23 - n}$ = the other number.

EXAMPLE: A board is 8 ft. long. It is cut into two pieces. Write a variable expression to represent the length of each piece.

SOLUTION: Drawing helps.



The sum of the two pieces is 8ft.

We can let $\underline{\boldsymbol{n}}$ = the length of one piece.

The length of the other piece would be what's left after cutting *n* from 8.

That would be $\underline{\boldsymbol{8-n}}$ (the sum – n).

Expressions Written in Terms of One Variable - Exercises

Assign the variable n to the number and write a mathematical expression for the sentence.

1. Twelve more than the product of fifteen and a number.
2. Half of the difference of seven and a number.
3. The product of 6 less than a number and 5.

Tell which unknown the variable represents.
Use that variable in expressions to represent the other unknown number(s).

4. The width of a rectangle is 2 cm less than the length.
   Let n = _____ then_____
   = _____

5. The number of nickels is three times the number of dimes.
   The number of quarters is two more than the number of dimes.
   Let n = the number of _____ then
   _____ = the number of _____ and
   _____ = the number of _____

6. The price of the hardback book is one dollar less than twice the price of the paperback book.
   Let *n* = price of the _____ book then
   _____ = price of the _____ book

7. The sum of two numbers is 15. Let _____ = one number
   and _____ = the other number

8. A total of $7,000 was invested. Part of it was invested in stocks and the rest of it was invested in bonds.
   Let _____ = the amount invested in stocks, and
   _____ = the amount invested in bonds.

Answer Key

1. $\mathbf{15n + 12}$
2. $\frac{1}{2}(7 - n)$
3. $5(n - 6)$
4. n = **length**, $\boldsymbol{n - 2}$ = **width** $\mathbf{15} - \boldsymbol{n}$ = the other number
5. **dimes**

   $\mathbf{3n}$ = number of **nickels**

   $\boldsymbol{n + 2}$ = number of **quarters**

6. $\boldsymbol{n}$ = price of **paperback** book

   $\mathbf{2n - 1}$ = price of **hardback** book
7. $\boldsymbol{n}$ = one number
8. $\boldsymbol{n}$ = the amount invested in stocks

   $\mathbf{7000} - \boldsymbol{n}$ = the amount invested in bonds