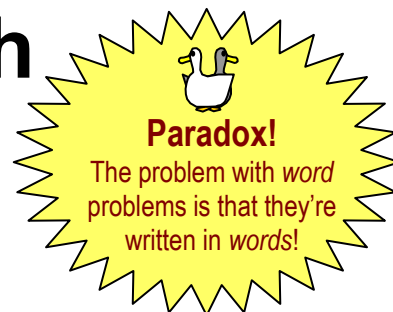


Words To Math



Translating often imprecise words into precise math symbols is challenging because of the tremendous number of ways that the same thing can be said with different words. To complicate the task, some words can have multiple, even opposite, meanings.

This table translates some of the key words you'll encounter.

<p>Ann is the same age as Bob.</p> <p style="text-align: center;">is</p> <p><u>Ann's</u> age equals <u>Bob's</u> age. $A = B$</p>	=	<p>Carl and Don are the same height.</p> <p style="text-align: center;">are</p> <p><u>Carl's</u> height equals <u>Don's</u> height. $C = D$</p>
<p>Ellen has 2 more toys than Frank.</p> <p style="text-align: center;">more</p> <p><u>Ellen's</u> toys equal <u>Frank's</u> toys plus 2 more. $E = F + 2$</p>	+	<p>George is 3 years older than Hanna.</p> <p style="text-align: center;">older</p> <p><u>George's</u> age equals <u>Hanna's</u> age plus 3 years. $G = H + 3$</p>
<p>Ida worked 1 hour less than Jack.</p> <p style="text-align: center;">less</p> <p><u>Ida's</u> time equals <u>Jack's</u> time minus 1 hour. $I = J - 1$</p>	-	<p>Kelly is 4 years younger than Lance.</p> <p style="text-align: center;">younger</p> <p><u>Kelly's</u> age equals <u>Lance's</u> age minus 4 years. $K = L - 4$</p>
<p>Mel earns 5 times what Nat does.</p> <p style="text-align: center;">times</p> <p><u>Mel's</u> income is 5 times <u>Nat's</u> income. $M = 5 \cdot N$</p>	•	<p>Ole worked half of Pam's hours.</p> <p style="text-align: center;">part of whole</p> <p><u>Ole's</u> hours were $\frac{1}{2}$ times <u>Pam's</u> hours. $O = \frac{1}{2} \cdot P$</p>
<p>Toys cost \$24 per dozen.</p> <p style="text-align: center;">per</p> <p>One <u>Toy</u> costs \$24 divided by 12. $T = 24 / 12$</p>	/	<p>Vera ate 3 of 4 pieces.</p> <p style="text-align: center;">whole of whole</p> <p><u>Vera's</u> portion was 3 divided by 4. $V = 3 / 4$</p>

Variable₁ = Variable₂ [+ - × /] number
 Variables traditionally are written to the left, e.g., $E = F + 2$ is preferred to $E = 2 + F$.



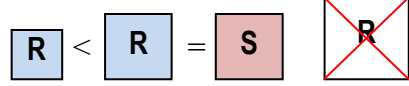
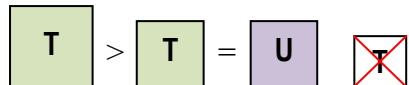
Words-to-Math Chart

Add more examples to this chart as you encounter them.

Words	Math	Sample Sentences	Equation
<ul style="list-style-type: none"> ➤ equal ➤ is / are ➤ was / were ➤ has / had / have ➤ same / identical ➤ as many(much) as 	=	<ul style="list-style-type: none"> ❖ Ann and Bob have equal wealth. ❖ Ann is the same age as Bob. ❖ Ann has as many cars as Bob. 	A = B
<ul style="list-style-type: none"> ➤ sum ➤ add / plus ➤ more / greater ➤ older / longer ➤ increase / exceed 	+	<ul style="list-style-type: none"> ❖ C is the sum of D and 3. ❖ Cal has 3 more items than Deb. ❖ Cal's height exceeds Deb's by 3 inches. 	C = D + 3
<ul style="list-style-type: none"> ➤ difference ➤ subtract / minus ➤ less / fewer ➤ younger / shorter ➤ decrease / diminish ➤ left / remains 	-	<ul style="list-style-type: none"> ❖ E is the difference between F and 4. ❖ Earl has 4 fewer items than Fran. ❖ E remains after F is decreased by 4. 	E = F - 4
<ul style="list-style-type: none"> ➤ product ➤ multiply / times ➤ @ (at) ➤ increased by a factor ➤ twice, thrice, etc. 	•	<ul style="list-style-type: none"> ❖ G is the product of 5 and H. ❖ Gene has 5 times what Hal has. ❖ G is the cost of 5 items @ H dollars each. 	G = 5 • H
<ul style="list-style-type: none"> ➤ quotient ➤ divide ➤ split ➤ per ➤ reduced by a factor 	/	<ul style="list-style-type: none"> ❖ I is the quotient of J and 6. ❖ Ida's share is Jo's split 6 ways. ❖ I equals J reduced by a factor of 6. 	I = J / 6
<ul style="list-style-type: none"> ➤ <i>part</i> of whole 	•	<ul style="list-style-type: none"> ❖ Ken has $\frac{1}{2}$ of what Lou has. <input type="checkbox"/> 	K = $\frac{1}{2}$ • L
<ul style="list-style-type: none"> ➤ <i>whole</i> of whole 	/	<ul style="list-style-type: none"> ❖ Moe has 2 of 3 items. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 	M = 2 / 3

“Inequality” Words To Math

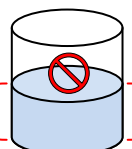
Sometimes inequality words aren't inequalities. Sometimes they are opposite what they seem.

Words	Math	Sample Sentences	Equation
<ul style="list-style-type: none"> ➤ greater/more than (with number--equality) ➤ greater/more than (without number--inequality) 	<p>+</p> <p>></p>	<ul style="list-style-type: none"> ❖ Nan's height is 4 more than Ona's. ❖ Nan's height is greater than Ona's. 	<p>$N = O + 4$</p> <p>$N > O$</p>
<ul style="list-style-type: none"> ➤ less/fewer than (with number--equality) ➤ less/fewer than (without number--inequality) 	<p>-</p> <p><</p>	<ul style="list-style-type: none"> ❖ Pat's height is 5 less than Qua's. ❖ Pat's height is less than Qua's. 	<p>$P = Q - 5$</p> <p>$P < Q$</p>
<ul style="list-style-type: none"> ➤ no greater than ➤ no more than ➤ at most 	<p>\leq</p>	<ul style="list-style-type: none"> ❖ Ray has no more than Sue. ❖ Ray has at most what Sue has.  <p>R can be less than or equal to S but not more.</p>	<p>$R \leq S$</p>
<ul style="list-style-type: none"> ➤ no less than ➤ no fewer than ➤ at least 	<p>\geq</p>	<ul style="list-style-type: none"> ❖ Tim has no fewer than Uvi. ❖ Tim has at least what Uvi has.  <p>T can be more than or equal to U but not less.</p>	<p>$T \geq U$</p>

Paradox!
 “No more”
 or
 “At most”
 means
 equal or
 less!

BrainAid

Imagine cup C is no more than or at most ½ full.



No more than ½ full At most ½ full

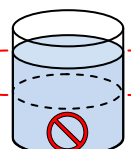
$C \leq \frac{1}{2}$

Can't be more than ½ full.
 Must be ½ full or less.

Paradox!
 “No less”
 or
 “At least”
 means
 equal or
 more!

BrainAid

Imagine cup C is no less than or at least ½ full.



No less than ½ full At least ½ full

$C \geq \frac{1}{2}$

Can't be less than ½ full.
 Must be ½ full or more.

Imagine **NO** and **AT** mean **NOT**, which reverses the meaning of what follows.

No More	At Most	No Less	At Least
Not More	Not Most	Not Less	Not Least
Less	Less	More	More

Imagine that **NO** and **AT** also add extra “ink” for an equal-sign mark below the reversed > or < signs.

More	>	Least	<
No More	\leq	At Least	\geq

Variable Size Paradox

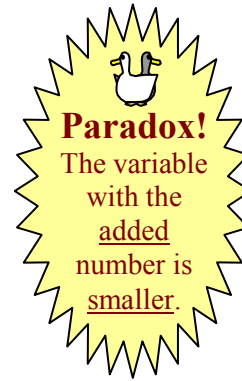
Beware of opposite expectations!

Addition Paradox

John is 3 years older than Kim. Which is the correct translation?

$$J + 3 = K \quad \text{or} \quad J = K + 3$$

It might seem that the +3 would go with John since he's older. But if John were 10 years old, adding 3 years to his age would make Kim 13, which can't be right as Kim is younger. Therefore, John's age is Kim's age plus 3 ($J = K + 3$).



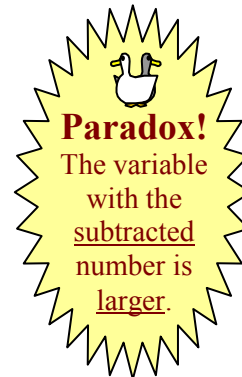
It takes *more* of a smaller quantity to equal a larger quantity.

Subtraction Paradox

Ralph weighs 5 lbs. less than Sam. Which is the correct translation?

$$R - 5 = S \quad \text{or} \quad R = S - 5$$

One might reason that the -5 should go with Ralph since he weighs less. But if Ralph weighed 100 lbs., subtracting 5 would make Sam 95 lbs., which can't be right as Sam weighs more. Therefore, Ralph's weight is Sam's weight minus 5 ($R = S - 5$).



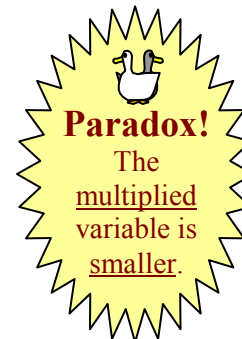
It takes *less* of a larger quantity to equal a smaller quantity.

Multiplication Paradox

Via has twice the wealth of Will. Which is the correct translation?

$$2 \cdot V = W \quad \text{or} \quad V = 2 \cdot W$$

To show Via is richer, it might seem logical to multiply her wealth by 2. But if Via had \$1000, multiplying by 2 would mean Will had \$2000, which can't be right as Will has less wealth. In fact, Via's wealth is 2 times Will's wealth ($V = 2 \cdot W$).



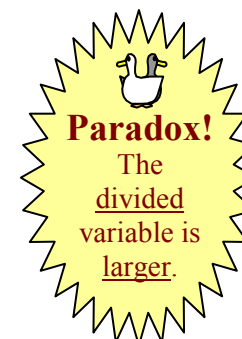
You must multiply a smaller quantity to equal a larger one.

Division Paradox

Cal has half as many toys as Dora. Which is the correct translation?

$$C / 2 = D \quad \text{or} \quad C = D / 2$$

To show he has half as many, you might be tempted to divide Cal's toys by 2. But if Cal had 10 toys, dividing by 2 would mean Dora had 5 toys, which can't be right as Dora has more toys. In reality, Cal's toys equal Dora's toys divided by 2 ($C = D / 2$).



You must divide a larger quantity to equal a smaller one.



Your Turn



Translate words to math using the underlined letters as variables.

1. John's share was 7 greater than Kate's share.
2. The Length was 10 times the Width.
3. Mel's age is 5 years more than twice Nan's age.
4. Tom's price was \$8 less than $\frac{1}{2}$ of the List price.
5. R is the product of 15 and the difference between S and T.
6. X is the quotient of 20 and the sum of Y and Z.
7. Bab's amount was at least 50.
8. Kit's share was no more than 100.

Answers: [1] $J=K+7$ [2] $L=10W$ [3] $M=2N+5$ [4] $T=\frac{1}{2}L-8$ [5] $R=15(S-T)$ [6] $X=20/(Y+Z)$ [7] $B \geq 50$ [8] $K \leq 100$