

Lesson Number 6

Adding & Subtracting (Combining) Integers

Professor Weissman's Algebra Classroom

I'm going to make Algebra so simple, anyone can do it; so interesting, everyone can enjoy it!



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What do the + and – signs mean in Arithmetic?

In Arithmetic, the + sign has only one meaning: Add. **8+3**

8+3 can only mean add 8 and 3.

In Arithmetic, the - sign has only one meaning: Subtract **8-3**

8-3 can only mean Subtract 8 and 3.

How are signed numbers combined?

If all the signs are the same then add their absolute values and keep the common sign.

$$-1-2-3-4-5 = -15$$

$$+1+2+3+4+5 = +15$$

How are numbers with different signs combined?

If an expression has both positive and negative signs, for example: $+1-2+3-4+5-6$

#1 Separate the positives and the negatives and combine each group.

$$\text{Positives: } +1+3+5 = +9$$

$$\text{Negatives: } -2-4-6 = -12$$

#2 Subtract the absolute values of the two results: $12-9 = 3$

#3 Use the sign of the number with the larger absolute value (the 12)

$$+1-2+3-4+5-6 = - 12$$

What do the + and – signs mean in Algebra?

In Algebra the plus and minus signs have several meanings.

1. They indicate the direction of the number

+8 up eight

-8 down eight

2. When they appear outside of parentheses they act as keep/change operators. That is they tell us either to keep or change the sign of the number inside parentheses

+ (+5) = +5 keep the sign inside

+ (-6) = -6 keep the sign inside

- (+5) = -5 change the sign inside

- (-6) = +6 change the sign inside

3. The minus sign could also mean just what it does in Arithmetic: Subtract.

(+8) - (+3) means Subtract



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Where are signed numbers combined in real life?



Charles, in the process of making a budget, is summarizing his weekly expenses: Rent \$140, Cellphone \$15, Transportation \$10, Food \$75, Clothing \$15, Leisure Activities \$10. He gets \$100 from a student loan and earns \$150 at his part time

job. Let's combine all these elements of his budget.

$$-140-15-10-75-15-10 = -265 +100+150=+250$$

We now combine the two sums: $-265+250 = -15$

What does the negative mean?

His income is not enough to cover all his expenses.

How will Charles make up the difference?

- More part time work?
- Savings from summer?
- Family assistance?
- Reduce expenses?

How do we subtract in Algebra?

What's the difference between a dirty dime and a shiny penny?

The word difference



means Subtract. The difference between any kind of dime and any penny is $10\phi - 1\phi$ or 9ϕ

$$(+8) - (+3)$$

The minus in the middle does mean subtract. However, it is easier if, instead of saying "Subtract +3 from +8, you consider the minus sign as a 'change operator' and say "Combine a +8 with the opposite of +3. Every expression can be simplified in three basic steps. Just remember the letters: SSC S=Separate S=Simplify C=Combine $(+8) - (+3)$

S $(+8) | - (+3)$ Separate into terms

S $+8 -3$ Simplify each term

C $+5$ Combine the results

How is an expression simplified if it has both addition and subtraction? For example: $-9 + (3-7) - (-2) + (-6) - (+10)$

No matter how complicated an expression in Algebra is, you can 'uncomplicated' it if you

#1 Think of the addition signs as "keep the sign operators" and the subtraction signs as "change the sign operators."

#2 Follow the SSC rule. again SSC means:

S=Separate the expression into terms. A term starts with a plus or minus sign that is NOT in parentheses.

S=Simplify each term so that it has no parentheses and is 'compressed' into one signed number.

C=Combine the results.

$$-9 + (7-3) - (-2) + (-6) - (+10)$$

$$-9 \mid + (7-3) \mid - (-2) \mid + (-6) \mid - (+10)$$

$$-9 \mid + 7-3 \mid +2 \mid -6 \mid -10$$

$$-9 \mid +4 \mid +2 \mid -6 \mid -10$$

$$-9 +4+2-6-10$$

Separate the negatives and the positives and find their sums:

$$-9-6-10 = -25$$

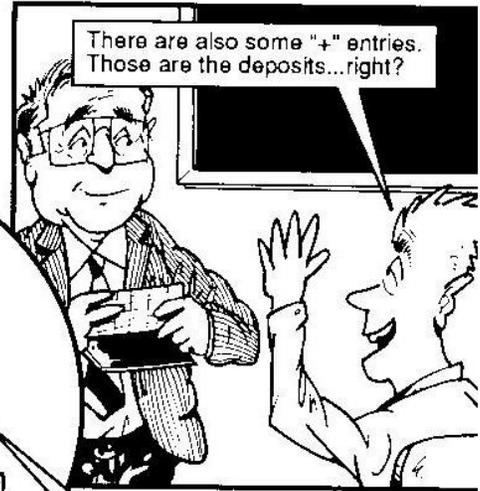
$$+4+2=+6$$

Combine these 2 sums:

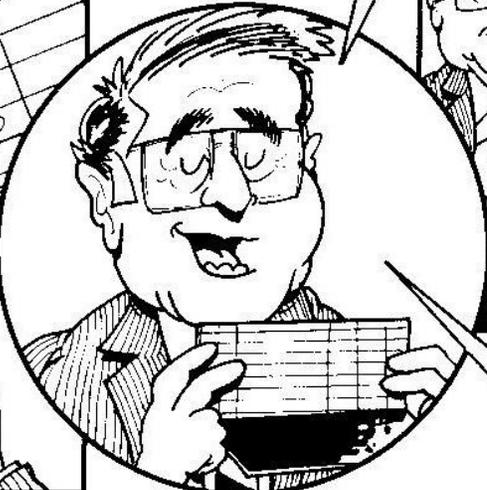
$$-25+6=-19$$

CHECK DATE	DESCRIPTION	PAYMENT	WITHDRAWAL	BALANCE
28 2/15	TRANSFER	\$300	\$50	
29 2/18	ELECTRIC COMPANY	\$50		
30 2/18	DEPOSIT	\$200		\$200
31 2/18	TRANSFER		\$350	
33 3/10	PHONE COMPANY FOR SALON			

Good example. The "-" is the direction. It means she withdrew money and the 350 is the magnitude or how much!



There are also some "+" entries. Those are the deposits...right?



Right! But, I notice our friend hasn't done the balance column for some time. Let me show you how to combine signed numbers.

First we combine all the deposits which are positives...then combine the negatives...

+300	- 50
+ 50	-200
+200	-350
+550	-600

It's easy to combine the numbers when all the signs are the same. This is an example of **CASE 1!**

CASE 1
LIKE SIGNS
 Add The Absolutes
 Keep The Common Sign

+550	-600
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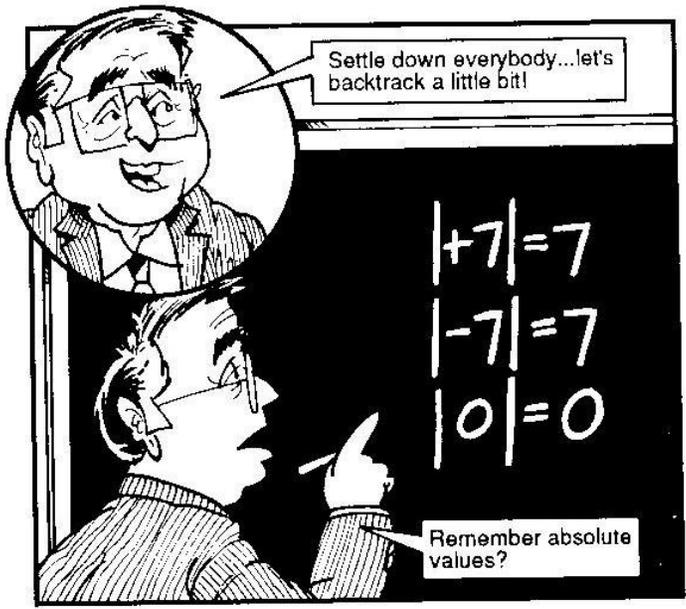
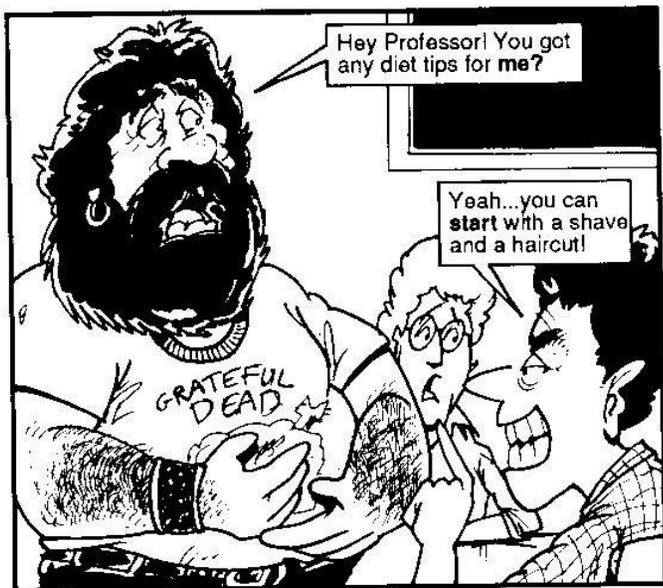
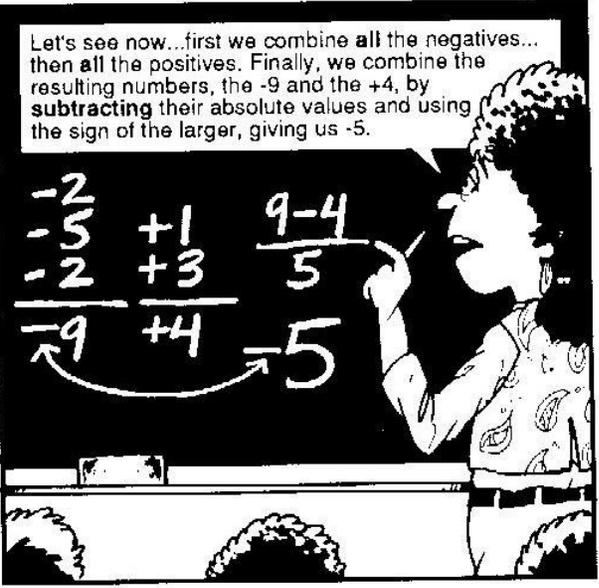
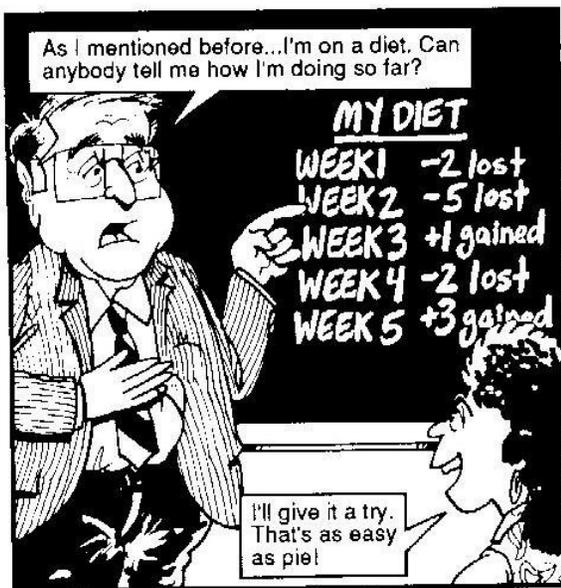
So we combine the resulting numbers as follows.

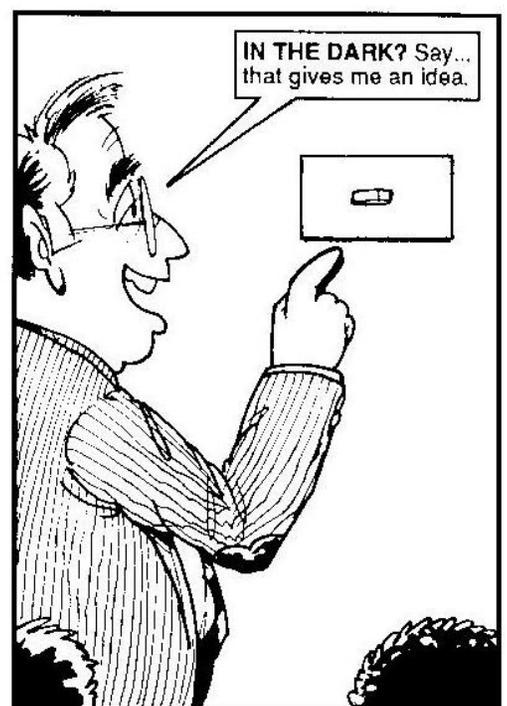
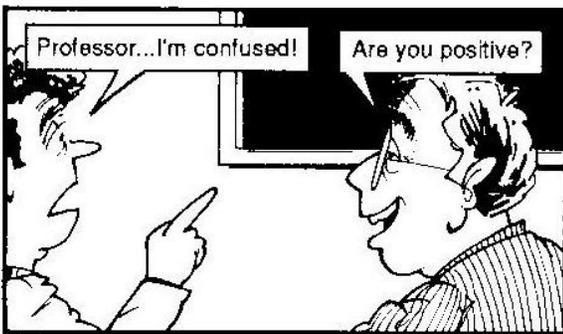
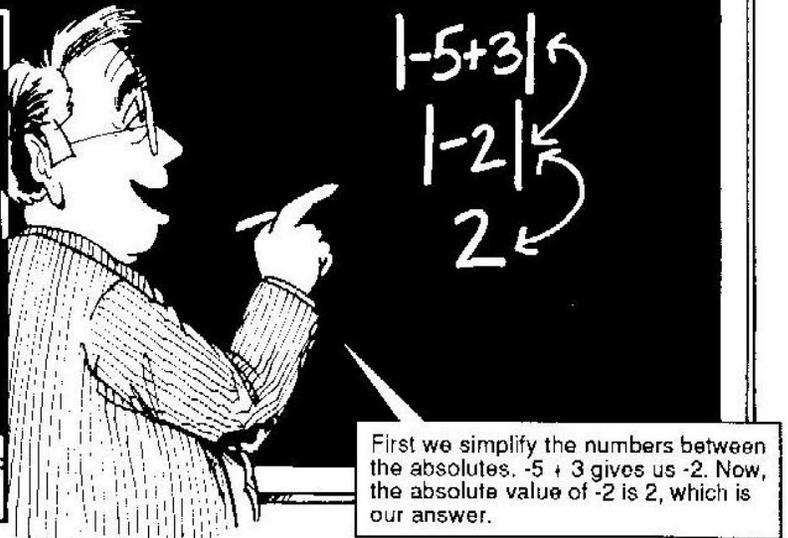
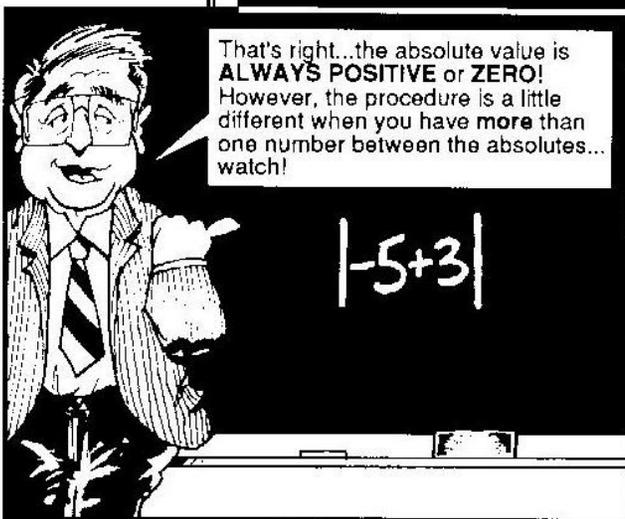
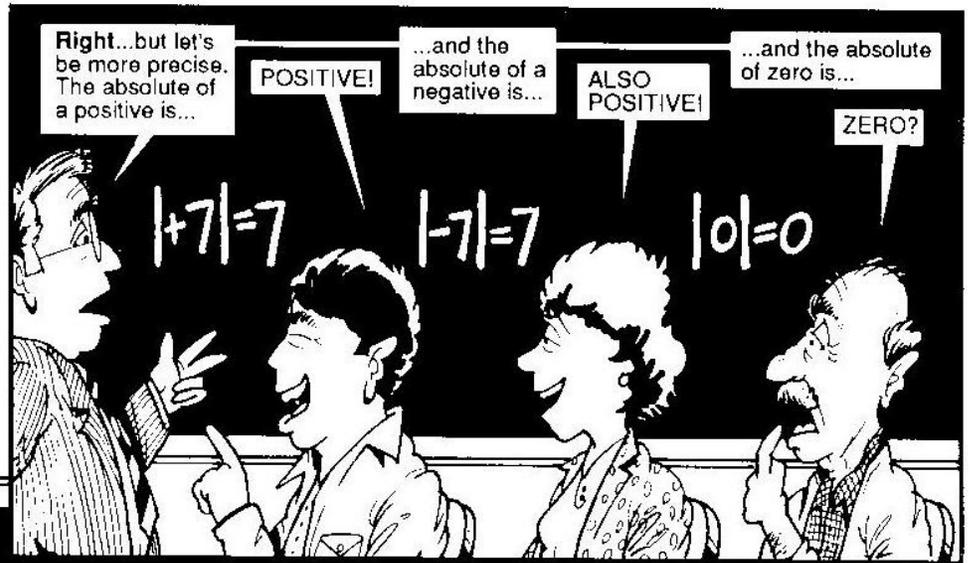
+550 - -600
600 - 550 = 50
-50

Subtracting the absolute numbers we get a result of 50. Then we must remember to use the sign of the number with the larger absolute which was a minus. This will give us a final answer of -50. Uh Oh...looks like you're a little short in your checking account. I think you **better** make a quick deposit.

As you notice... the two results have opposite signs. To combine them is a scenario for **CASE 2!**

CASE 2
UNLIKE SIGNS
 Subtract The Absolutes
 Use The Sign Of The Larger





CLICK

OK folks...it's time to learn about **subtraction**

IN THE DARK?

I'm scared!

HEY! Who turned out the lights?

Whoa! Whose hand is that?

HEY... somebody took my good pen!

OK...lights on! Now... if you'll excuse my graffiti, I'd like to make a point.

Subtraction acts like this switch. Think of the switch as a **subtraction symbol**.

SUBTRACTION SWITCH

+ ON OFF **-**

"Think Opposite!"

Look at the light. If it's on (or positive) you flip the switch (subtract) and the light is off (or negative).

And if the light is off or **negative** and you flip the switch again or subtract, then the light is on or **positive**.

SUBTRACTION SWITCH

+ **-**

"Think Opposite!"

Never mind the light switch...I think the Professor has flipped.

I heard that wiseguy... here let me make it real clear for you!

+10 - (-8)

See this subtraction sign. Picture it as that light switch because it will **change** the sign that follows.

OBSERVE...

+10 - (-8)
+10 + 8

Now we combine.

+10 - (-8)
+10 + 8
+10 + 8 = +18

The answer is +18!

Hey everybody, check it out!

To Subtract
A poem by Lenny Krinsky

Change The Sign, Then Combine

The End

Right...he's a poet and doesn't even know it (he he).

I GOT ONE PROFESSOR!
'Dere once was a man from Nantucket...

That's quite enough Longfellow. Anyway, did you see what happened to the parentheses and the sign outside.

$+10 + (-8)$
 $+10 + 8 = +18$

As we just saw, a negative outside of the parentheses **changes** the sign that follows. The -8 becomes a +8 and we **remove** the negative sign outside and the parentheses as well.

However, a positive outside of the parentheses **DOES NOT** change the sign that follows.

$+(-15)$
 -15

So, in this problem, the -15 **remains** -15 but, we here also, **remove** the outside positive sign and the parentheses.

$-(9-2)$

Now...in this example, the first negative sign will change **BOTH** signs that follow.

The 9 has no sign. That means it's **positive** so it becomes -9 and the -2 now changes to +2.

$-(9-2)$
 $-9+2$

Again, we **remove** the outside negative sign as well as the parentheses.

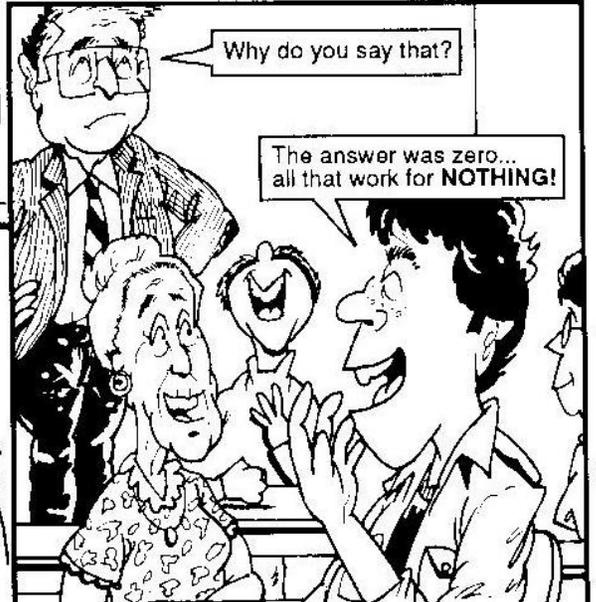
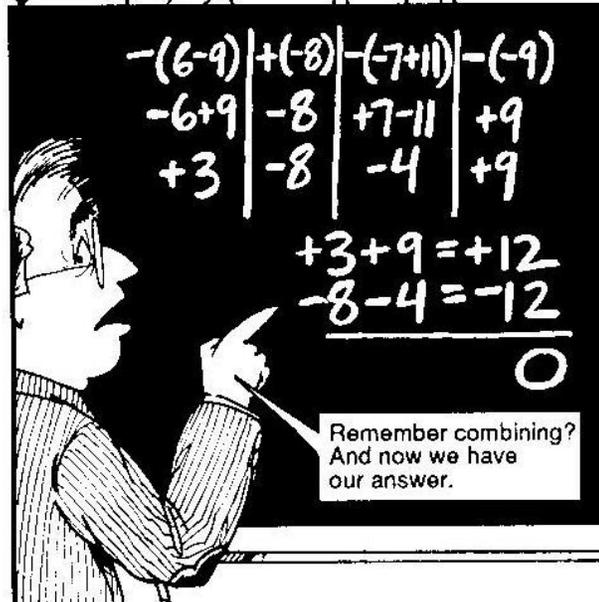
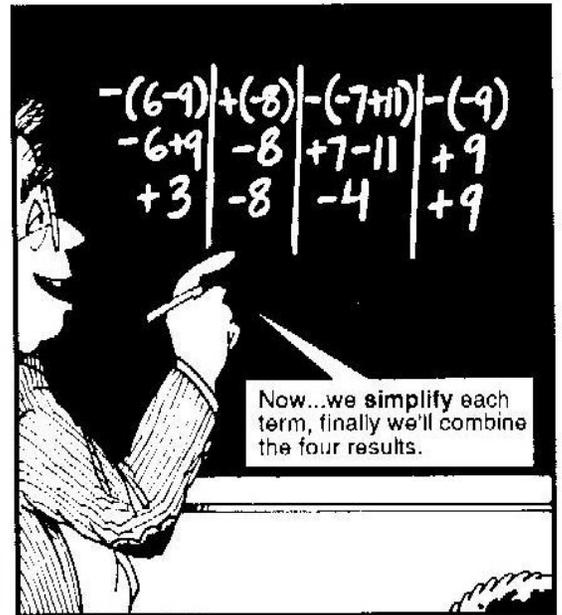
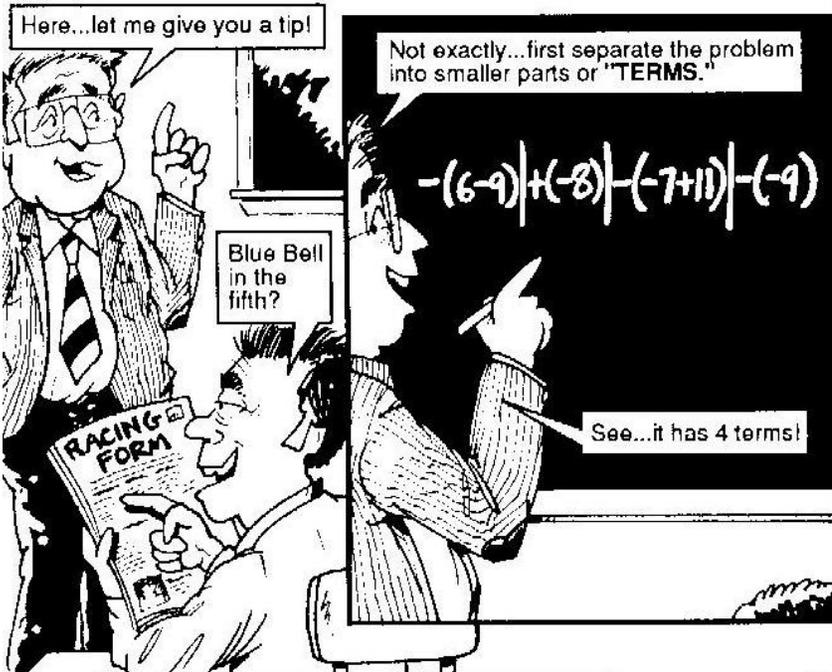
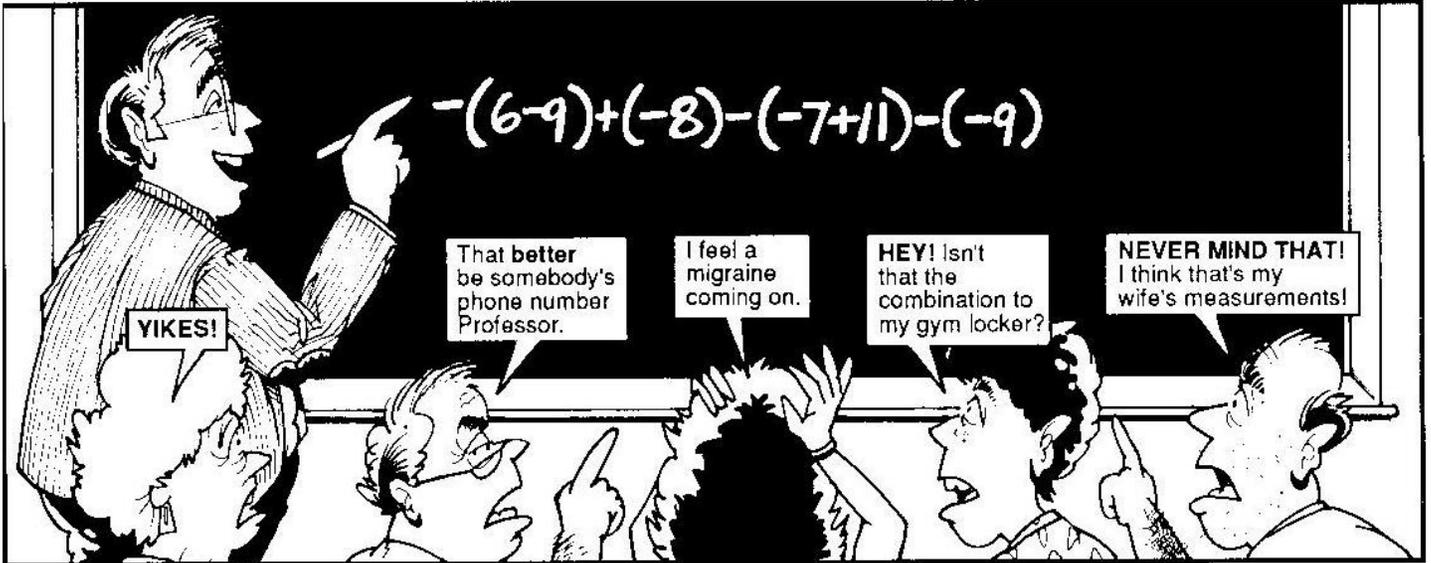
Can't we finish the problem Professor?

Psssst... keep it down **ALGEBRA BREATH!**

Sure...just combine, remember? We come up with -7.

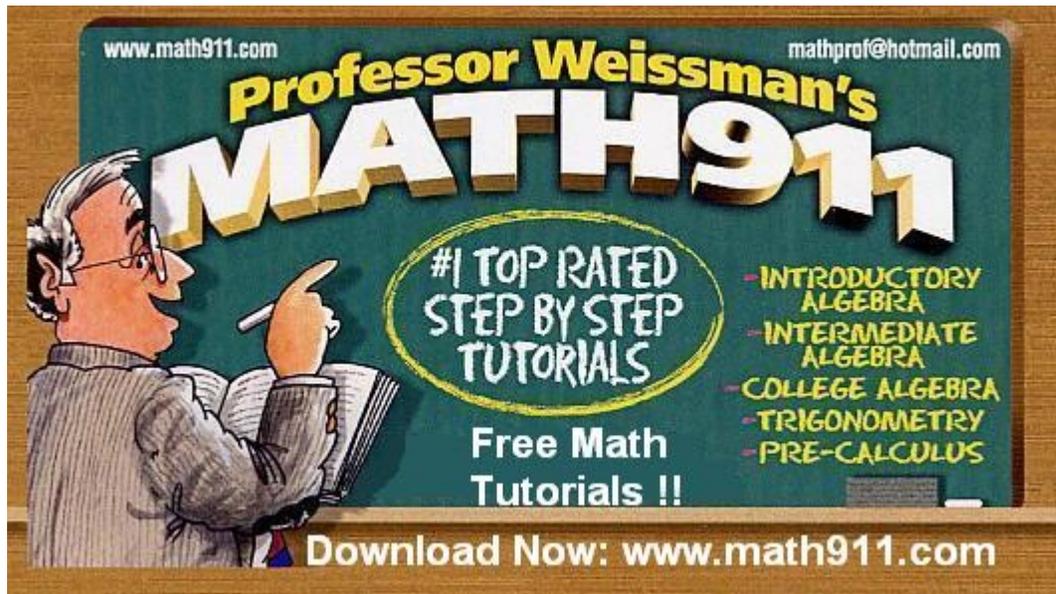
$-(9-2)$
 $-9+2$
 -7

Now...let's get a little bit more complicated!



Exercise Set 6

1. Evaluate each expression
- a. $+7 + 8$
 b. $-7 - 6$
 c. $-12 + 7$
 d. $+7 - 12$
 e. $-8 + 8$
 f. $10 - 11$
 g. $-1 - 2 - 3$
 h. $-1 - 2 + 3$
2. Separate into terms then evaluate.
- a. $-7 - (-7)$
 b. $8 - (+6)$
 c. $9 - (-9)$
 d. $(-12) - (-10)$
 e. $-(-4) + (-6)$
 f. $-(-10) - (+25)$
 g. $5 - (-6) - (+7)$
 h. $45 - (-55) - 100$
3. Simplify each problem 2 different ways
- a. $-(8-11)$
 b. $-(12-5)$
 c. $+(7-12)$
 d. $+(-4+11)$
4. Separate into terms, simplify each term then combine the results.
- a. $-(+7) - (8-10) + (12-1)$
 b. $10 - (-8) + (-2) - (8-10)$
5. For each example, translate then evaluate
- a. 7 less than 10
 b. 7 less than -15
- c. -5 increased by 15
 d. -5 increased by $+5$
 e. 7 increased by x
 f. 10 more than -15
 g. 10 more than -5
 h. 10 is more than -5
 i. -12 subtracted from 10
 j. The sum of -7 and 9
6. For each example, translate then evaluate. $x = -2$ and $y = 3$
- a. 7 less than x
 b. 7 less than -15
 c. x less than 7
 d. x increased by 7
 e. 7 increased by x
 f. 7 is less than x
 g. 7 less x
 h. the sum of -10 and x
 i. the sum of x and y
 j. the difference between x and y
 k. the difference between y and x
7. Decide if the number is a solution to the equation
- a. $x - 7 = 9$ $x = -2$
 b. $-10 = x - 5$ $x = -5$
 c. $7 - x = 8$ $x = -1$
 d. $1 = 6 + x$ $x = -5$
8. Evaluate each expression when $a = -3$, $b = -2$, $c = +1$
- a. $a + b$
 b. $a - b$
 c. $-a + b$
9. Evaluate
- a. 124 decreased by -100
 b. -50 minus 20
 c. the difference between 80 and -80 ?
 d. 127 less than -200 ?
 e. 50 less -30 ?
 f. -47 subtracted from -98



Jokes Set #6

A Math student is flying non-stop from Edmonton to Frankfurt with AirTransat. The scheduled flying time is nine hours.

Some time after taking off, the pilot announces that one engine had to be turned off due to mechanical failure: "Don't worry - we're safe. The only noticeable effect this will have for us is that our total flying time will be ten hours instead of nine."

A few hours into the flight, the pilot informs the passengers that another engine had to be turned off due to mechanical failure: "But don't worry - we're



still safe. Only our flying time will go up to twelve hours."

Some time later, a third engine fails and has to be turned off. But the pilot reassures the passengers: "Don't worry - even with one engine, we're still perfectly safe. It just means that it will take sixteen hours total for this plane to arrive in Frankfurt."

The Math student remarks to his fellow passengers: "If the last engine breaks down, too, then we'll be in the air for twenty-four hours altogether!"

Brain Teaser Set #6

Note: This brain teaser must be done IN YOUR HEAD ONLY and NOT using paper and a pen.

Take 1000 and add 40 to it.

Now add another 1000.

Now add 30.

Add another 1000.

Now add 20.

Now add another 1000.

Now add 10.

What is the total?



Answers to Exercise Set 6

- | | | | | |
|----------------|-----------------------------|------------------------|---------|--------|
| 1a. +15 | or $-8+11=+3$ | i. $10-(-12)$ or 22 | 7a. No | d. 327 |
| b. -13 | b. $-(+7)=-7$ or $-12+5=-7$ | j. $-7 + (9)$ or +2 | b. yes | e. 80 |
| c. -5 | c. $+(-5)=-5$ or $+7-12=-5$ | | c. yes | f. -47 |
| d. -5 | d. $+(+7)=+7$ or $-4+11=+7$ | 6a. $x-7$ or -9 | d. yes | |
| e. 0 | | b. $-15 -7$ or -22 | 8a. -5 | |
| f. -1 | | c. $7-x$ or $+9$ | b. -1 | |
| g. -6 | 4a. +6 | d. $x+7$ or $+5$ | c. +1 | |
| h. 0 | b. +18 | e. $7+x$ or $+5$ | d. +5 | |
| 2a. 0 | 5a. $10-7$ or $+3$ | f. $7 < x$ or $7 < -2$ | e. 0 | |
| b. 2 | b. $-15 -7$ or -22 | g. $7 -x$ or $+9$ | f. +1 | |
| c. 18 | c. $-5+15$ or $+10$ | h. $-10+x$ or -12 | g. -5 | |
| d. -2 | d. $-5+5$ or 0 | i. $x+y$ or $+1$ | h. -6 | |
| e. -2 | e. $7 + x$ | j. $x-y$ or -5 | 9a. 224 | |
| f. -15 | f. $-15 +10$ or -5 | k. $y-x$ or $+5$ | b. -70 | |
| g. 4 | g. $-5 +10$ or $+5$ | | c. 160 | |
| h. 0 | h. $10 > -5$ | | | |
| 3a. $-(-3)=+3$ | | | | |

Brain Teaser #6 Answer

Did you get 5000?

The correct answer is actually 4100.

Don't believe it? Check with your calculator!

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