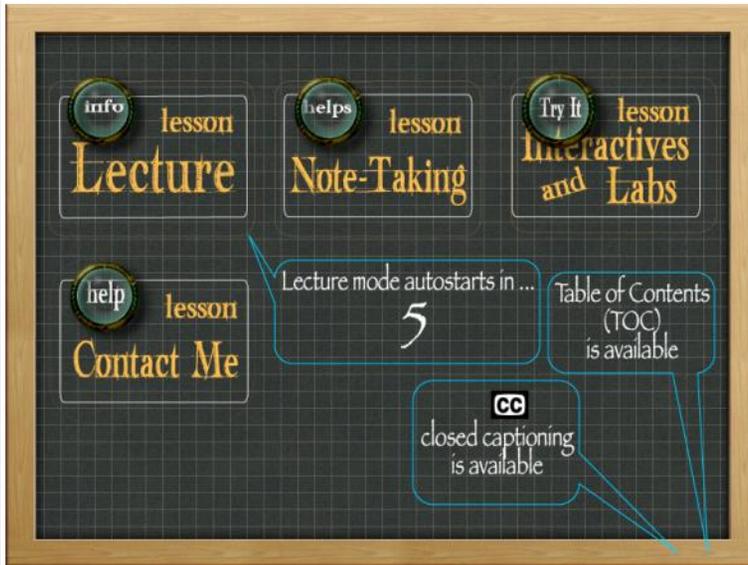


# Introduction to Absolute Value

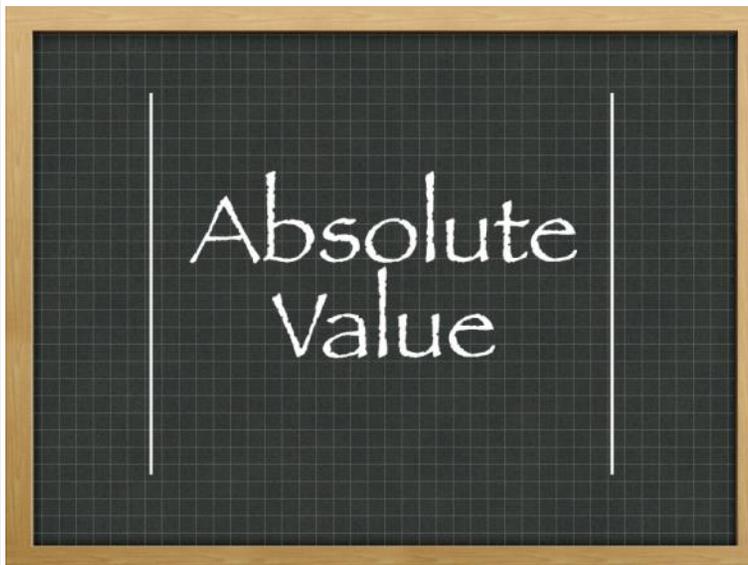
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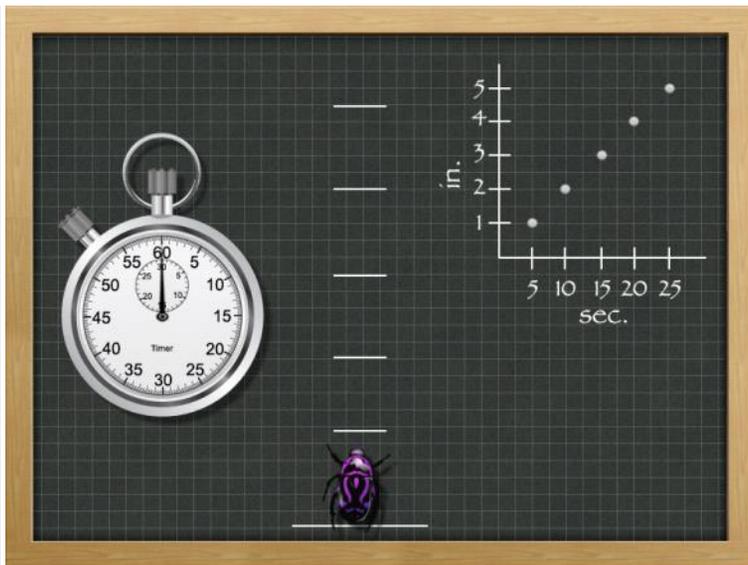
Slide

Notes



Title





### Linear Relationship (Review)

Ok, not your most common type of pet, but Tod has this really cool beetle he keeps in his terrarium. He likes to ask questions and his 'pet' is often part of finding his answers. He wanted to practice what he was learning in physics about velocity and speed so he decided he would clock his beetle's time covering a distance of five inches and graph the results.

Here is how he set it up. He created marks at 1 inch intervals and decided he would use the back of his beetle as what he would track. He created his graph with distance in inches on one side and time in seconds on the other side. He got his handy stopwatch out and gave his beetle some encouragement to move forward.

Watch as Todd's experiment results in a graph of the beetle's movement.

[25 Second silence]

Todd's graph shows that as time passed, the beetle traveled at a constant speed covering a distance of five inches going away from the start position. Notice the graph is a straight line under these conditions. This is a linear relationship.

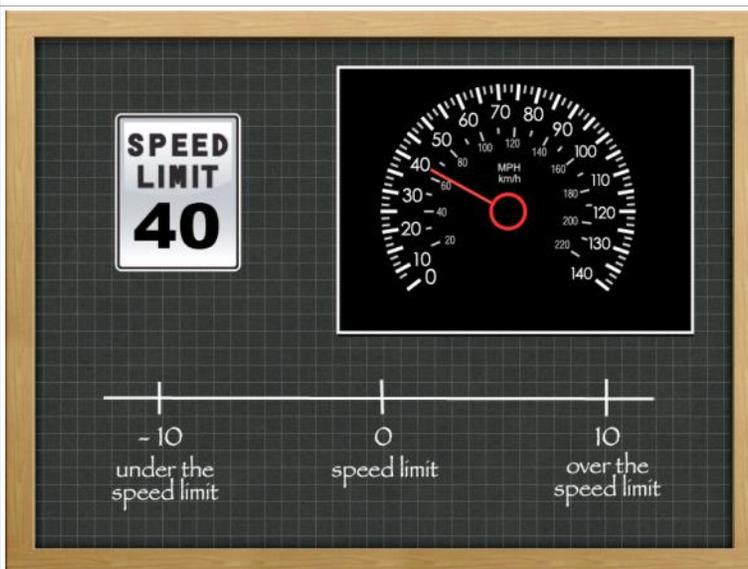


### Variance of Distance

The beetle's movement doesn't have to be a linear relationship though. What if Todd is pretty comfortable having his doughnut on the desk at the same time his beetle is there so long as the beetle stays further than 3 inches from the doughnut's position. It doesn't matter if the beetle is moving toward or away from the doughnut inside that range, Todd feels an urge to move either his pet or his breakfast.

This will be an absolute value relationship because the direction doesn't matter, only the distance.

Let's look at another example, lest you think it only applies to the concept of distance.

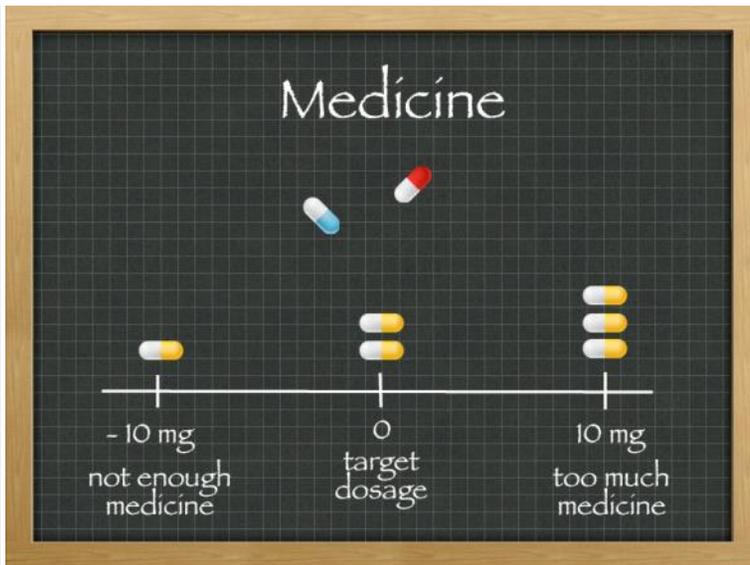


### Variance of Speed

The speed limit is 40 miles per hour in one straight stretch of road where some construction is happening. Everyone tends to focus on going to far above the speed limit to avoid a ticket. You have heard though that they will also give you a ticket if you are going so slow during rush hour that you are causing traffic to back up. If you go 10 miles under the speed limit they will ticket you on the other side of the construction zone too.

Let's create a line graph and set our target value to show our variance from 40. If we are going 40 miles an hour, we don't vary from the speed limit, so we will set the variance at 0 in the center. Ten miles over = trouble and 10 miles under = trouble.

See how it doesn't matter if you are going slower or faster. The key is how far away you vary from 40 miles an hour that matters. That is a lot like our distance from the doughnut issue. It is the variance from the target we are focusing on.

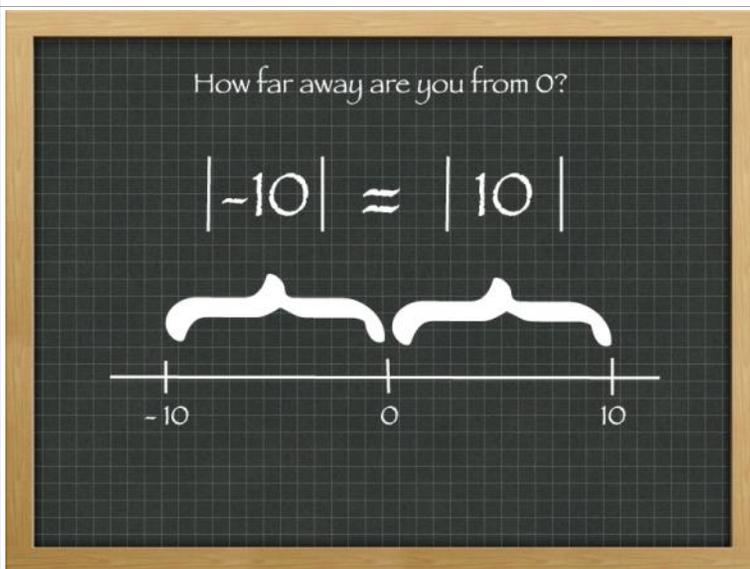


## Variance of Dosage

Taking medicine is the same type of relationship. Too much or too little variance from the correct dosage can get you in to trouble.

Let's say that if you take 10 milligrams too little, the medicine will not be effective to treat your condition.

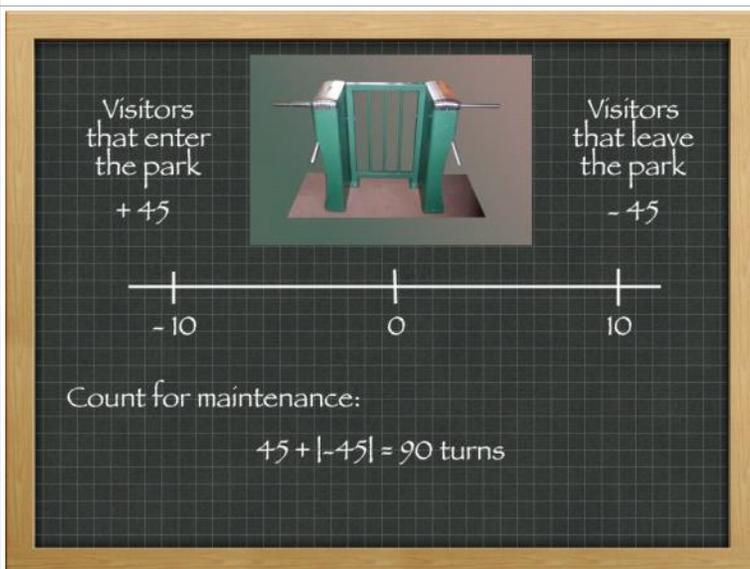
If you take 10 milligrams too much you get side effect. You have an allowed variance on either side of a target. So you see, distance, speed, dosage all come down to a variance.



## Absolute Value

We have a way to deal with this concept of variance from a target value in math. It is called absolute value. You indicate an absolute value relationship by making a straight line on either side of the number.

If it is a negative absolute value you don't need the sign. It isn't what direction from the target value that is important, just how far way you are from it. So when you see the absolute value of -10 you can strip off the negative so long as it is inside the straight lines. So the absolute value of -10 is 10. It is 10 units away from 0 which represents you target value.



## Other Uses of Absolute Value

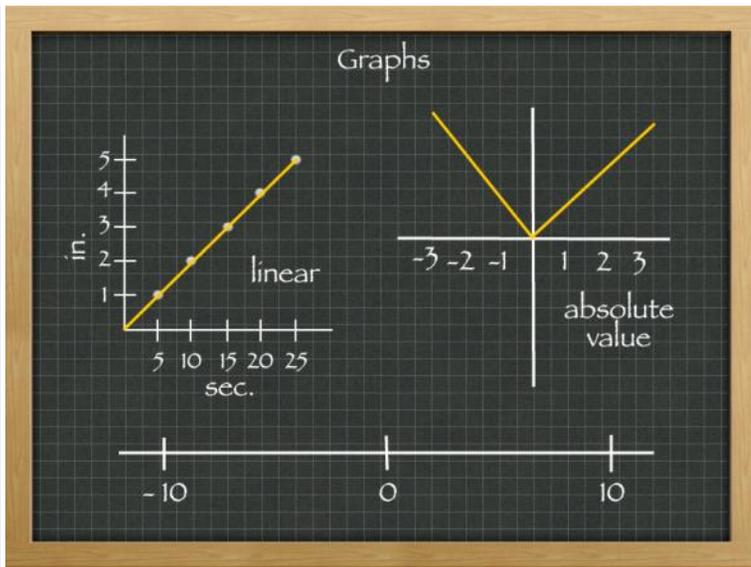
Turn styles are used at attractions and transportation hubs to count the number of visitors that pass through the gate.

One type of turn style will count a positive number for guests that pass through one direct to enter the area and a negative number for the guests as they pass through to leave. Administrators, planners, and security may find it helpful to be sure everyone leaves at the end of the day.

They will be looking to see if the positive number and the absolute value of the negative number match. If it does, then everyone should be out of the park. This is yet another example of how absolute value can help with variance, but here is an example where absolute value being summed is used ...

Maintenance men for the turn styles might need the absolute value for a different reason. Every turn, whether in or out, causes wear on the turn style. They may want to use the count to monitor when it is time for maintenance. They would want to add the positive number to the absolute value of the negative number to get a total number of turns. If at every ninety turns they maintained the style by greasing the mechanical parts, absolute value can help them know when they need to do so.

As you can see, there are many applications for absolute value in the real world.

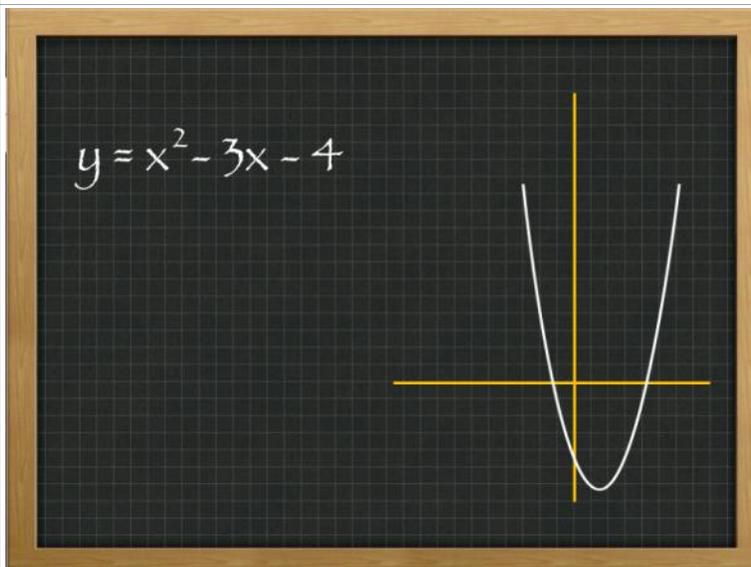


## Graphs

Todd was interested in graphing. He found he had a linear graph when he tracked his beetle. What does an absolute value graph look like?

You have seen a few examples of a number line type of graph, but let's take a look at a coordinate graph where you are showing the relationship of what is inside the absolute value, variable  $x$ , to what the answer, variable  $y$ . This is an absolute value graph. Notice how even if you have a negative number inside the absolute value lines, indicated here by the  $x$  axis having negative numbers, your 'y' value always stays positive. It makes an elbow sort of shape when it is graphed.

Notice how in the absolute value is sort of like a linear equation but it looked like the line just gets reflected back up on one side instead of being allowed to go below the  $x$ -axis? Keep this in mind as I show you another type of function.



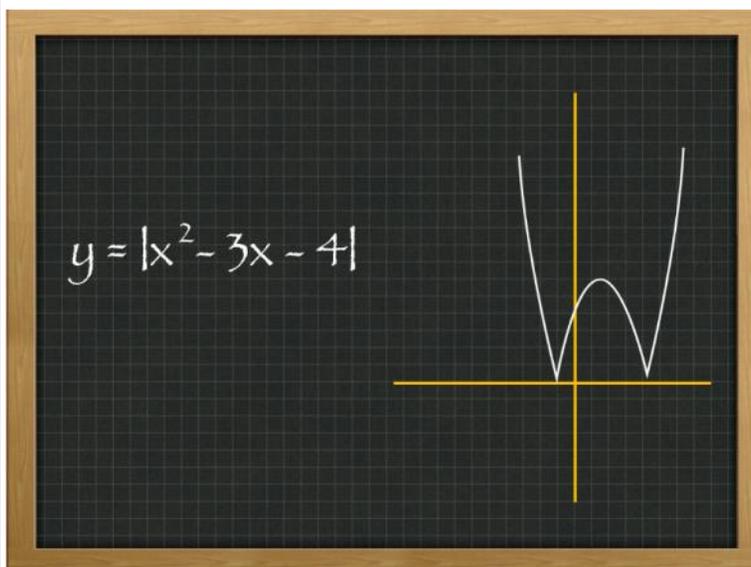
## Sneak Peak Ahead at Graphs

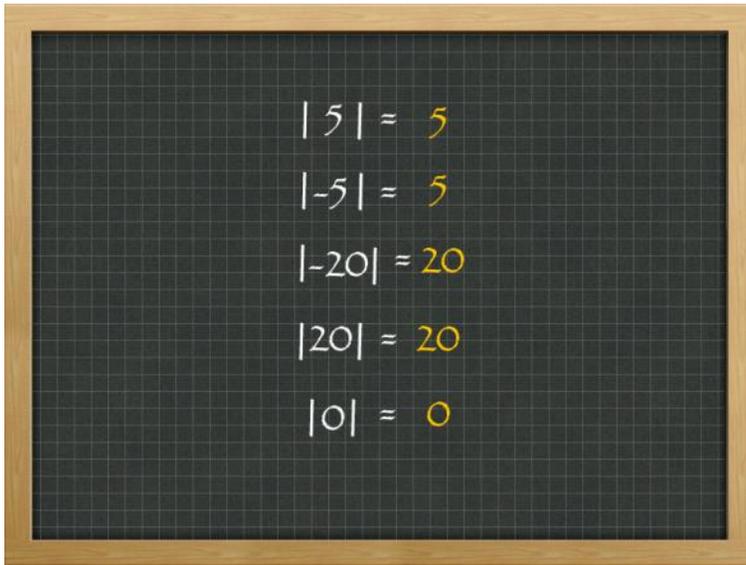
You won't need to know how to graph these yet, but I wanted to give you a sneak peak ahead at what combining absolute value with another type of relationship does to the shape of the line.

Take a look at this one. Here is the equation of a quadratic function. A happy, smiling sort of shape here with the  $x$  being positive.

Now, let's just slide in an absolute value around that quadratic equation and see what happens.

See the pattern? It looks almost like a portion of the line gets reflected? Cool isn't it?





## Examples

The absolute value of 5 is 5.

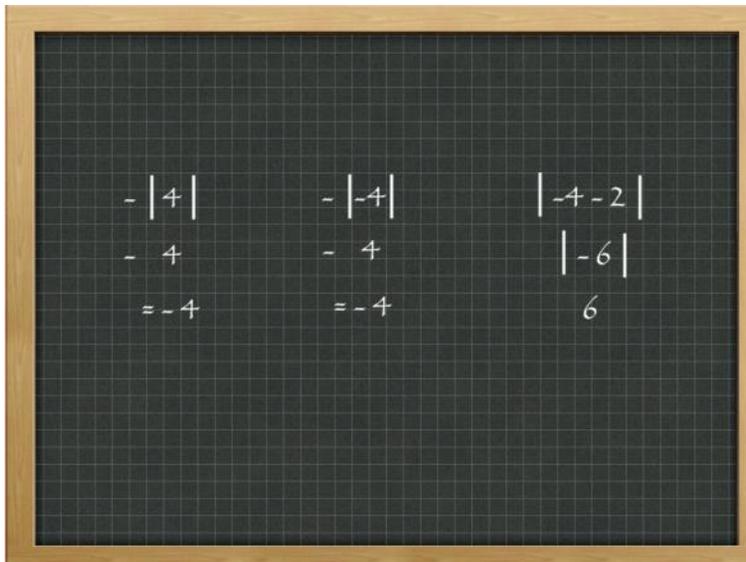
The absolute value of -5 is also 5. You are five away from zero in either case.

The absolute value of -20 is 20 and the absolute value of positive 20 is 20

Let's do a few trickier ones.

What is the absolute value of 0? It is zero.

What about if there is a negative outside the absolute value? Let's look at that next.



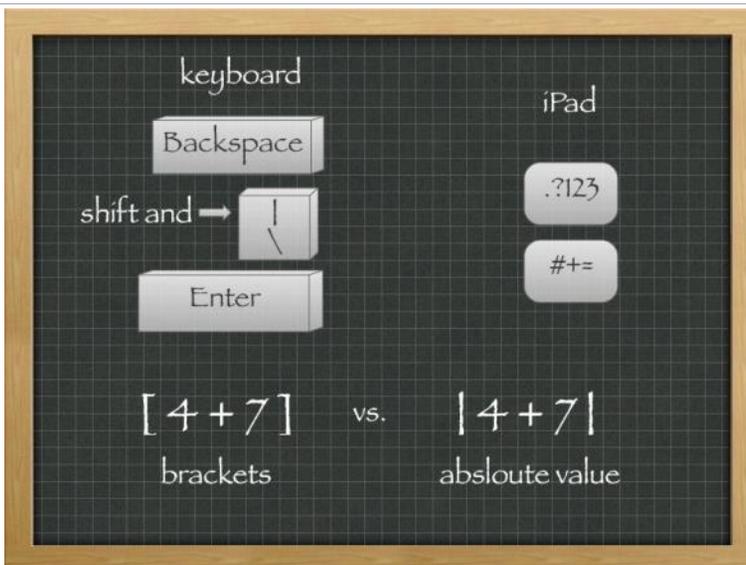
## Trickier Examples

Here we have an absolute value, but there is a negative sign outside of the lines. Don't let these confuse you. Just work with the absolute value portions independently of the sign. Then at the end of finding the absolute value you just place the sign in front.

The absolute value of 4 is 4. Now place the sign that was outside the absolute value.

The absolute value of -4 is 4. Now separate from the absolute value steps themselves, you place that sign that was outside of the absolute value.

Sometimes there will be equations inside of absolute value equations. Just simplify everything inside the absolute value first and then compute the absolute value.



## Absolute value and the Keyboard

On a keyboard you can create the lines that are used in absolute values by using the key labeled with a vertical line near the enter key on a traditional keyboard.

It is a bit more hidden on an iPad. Click the option for the number and symbol keyboard which has a ".?123" on it. Then click on the "#+= " button. You will see the line for absolute value just under the braces symbols.

Another thing to be careful of is to not confuse a bracket with the lines for absolute value. The difference is subtle. The bracket will have small corners while the absolute value will just be a vertical line.

Try It

Try it!

$$-|-3| - 5 + |-1|$$

Submit

Congratulations!  
You have finished this topic.