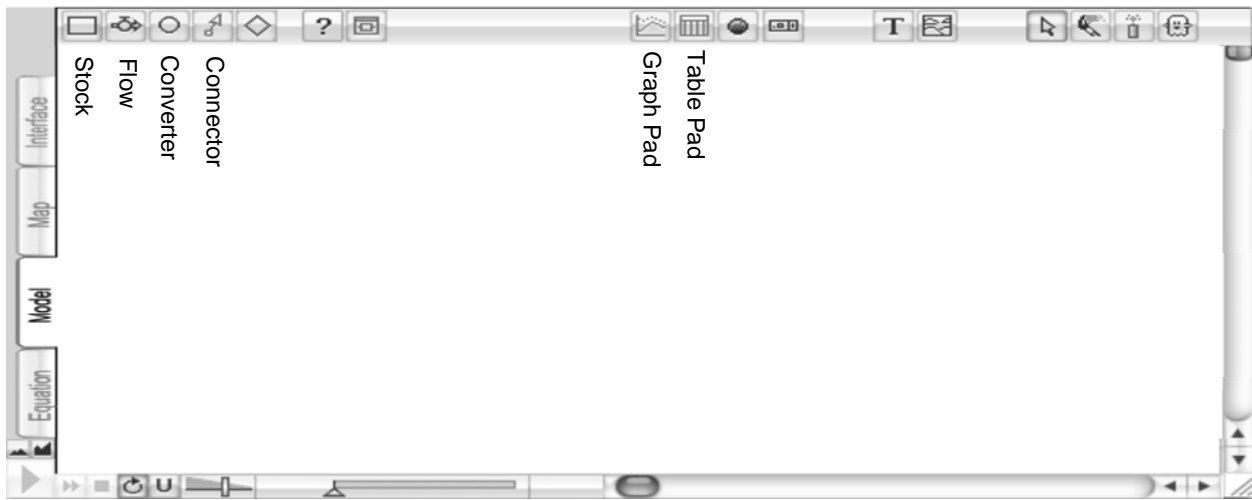




Visualizing Math with STELLA: Exponential Functions



The stock  represents the main idea of the model, the variable whose quantity increases or decreases over time. The flow  can be drawn with the arrow pointing toward the stock or away from the stock. The flow represents something that causes the stock value to increase (inflow) or decrease (outflow)

A Linear Model

1. Consider a boy, Victor, who earns \$10 a week for doing chores around the house. He already has \$50 from his grandmother as a gift for his birthday. He stores his money in a shoebox in his room. He is saving for an iPod nano (\$150), so he will not spend any of his money until he has enough to buy the iPod.

What is the main idea (variable) of the model (whose quantity will increase or decrease over time)? Money stored in the shoebox.

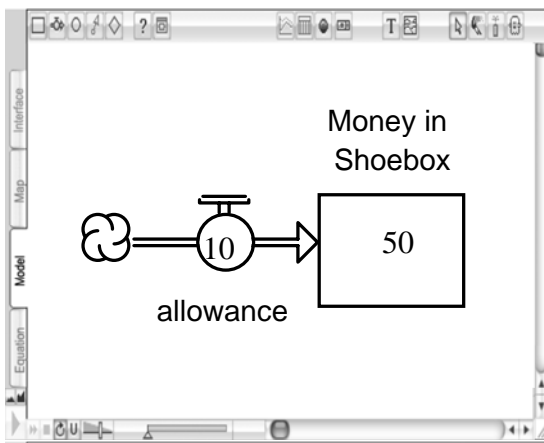
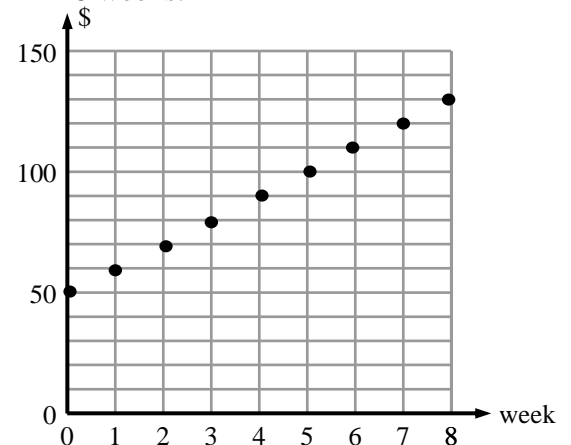
Will this quantity increase or decrease over time? increase So we will need an inflow or outflow)?

Draw the model diagram here. Be sure to label each icon and place the correct value/formula in each icon.

Now let's create a table of values for this situation.

Week	\$ in shoebox
0	50.00
1	60.00
2	70.00
3	80.00
4	90.00
5	100.00
6	110.00
7	120.00
8	130.00

Finally, graph the amount of money Victor has each week for 8 weeks.

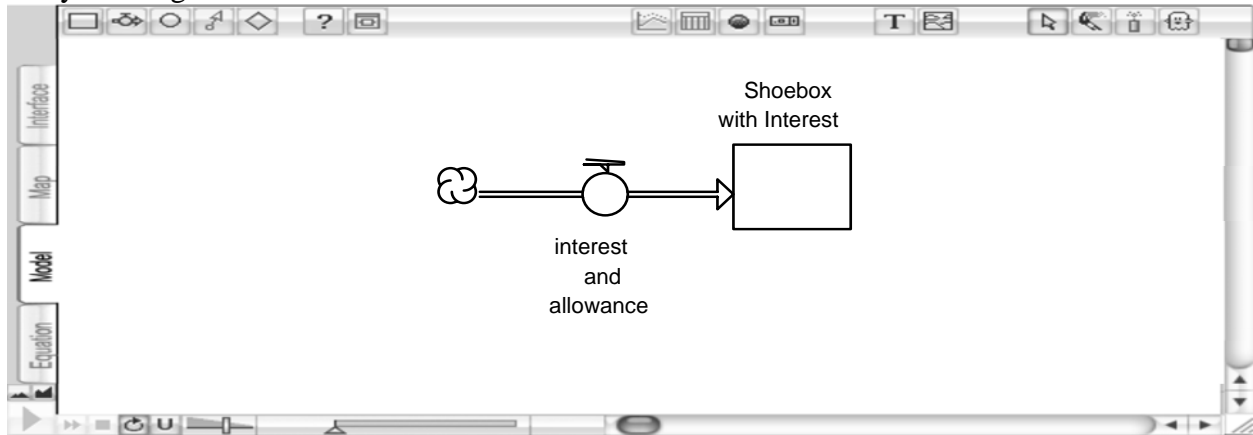


How many more weeks does he have to save to be able to buy his iPod? 2 more weeks

Exponential Models

2. Victor's twin sister, Victoria, who also wants an iPod, suggests to her parents that she would rather earn \$9 per week allowance but would learn the value of investing if her parents would be willing to give her 5% interest per week, until she earned enough for the iPod. Her parents, sensing that this would be a good lesson in finance, agree.

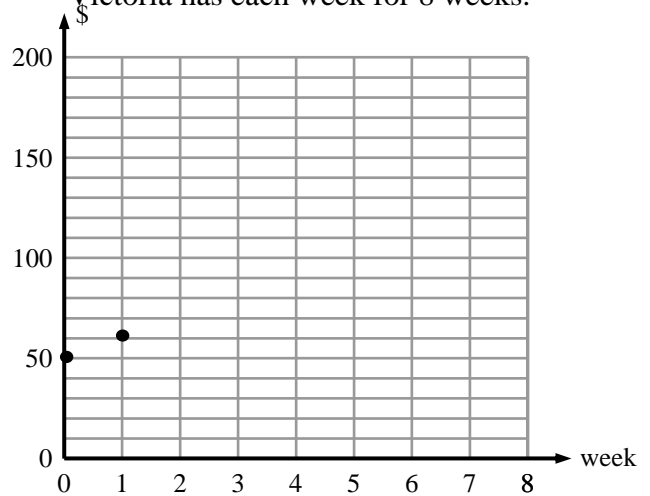
We know this is an inflow model, as Victor's was, but we have to consider the interest component. Let's modify the diagram below.



Let's create a table of values for this situation.

Week	\$ in Allowance	\$ in interest	\$ in shoebox
0	0	0	50.00
1	9	$50 \cdot 0.05 = 2.5$	61.50
2	9		
3	9		
4	9		
5	9		
6	9		
7	9		
8	9		

Again, graph the amount of money Victoria has each week for 8 weeks.



How much earlier can Victoria buy the iPod than Victor? _____

3. Let's consider another very typical scenario for a problem that might be studied in an algebra class.

The population in Malawi in 1995 was 11,300,000 and was growing at 5.45% per year, due to births, and also decreasing at 2.2% per year, due to deaths. We are interested in predicting the population of Malawi in the year 2095. Let's build a model to study this situation.

What would the stock represent? _____

Would there be an inflow? _____ If yes, what would it represent? _____

What type of structure (linear/exponential) should be used to represent this inflow? _____

Why? _____

Would there be an outflow? _____ If yes, what would it represent? _____

How should this part of the model be defined? (linear/exponential) Why? _____

Draw the model diagram here. Be sure to label each icon and place the correct value/formula in each icon.



If we simulate this model, will the population grow or decay? _____ How do you know? _____

Suppose a new progressive government is installed in Malawi that allows it to gain access to more state of the art medicines and health facilities, so that the death rate falls to half of what it was in 1995. How will this population change over time (compared to the previous simulation)? _____

Do you think the population could actually change as you predicted for the entire 100 years? _____ Why or why not? _____

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