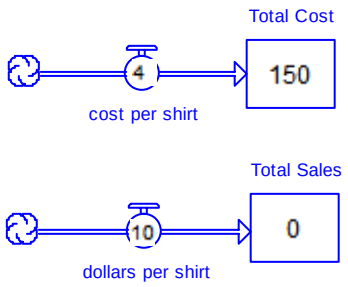
Visualizing Math with STELLA:
Algebra I Word Problems

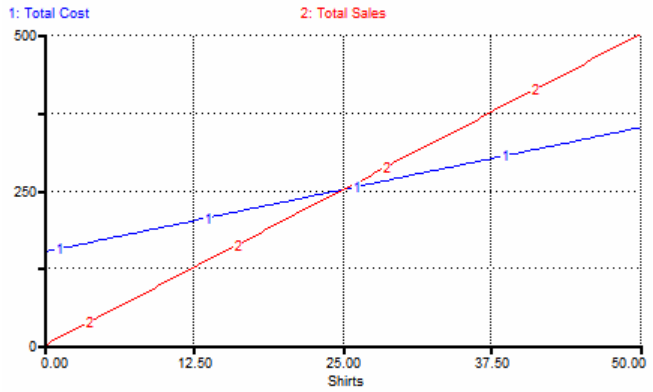
Word problems typically give students a lot of trouble. They have difficulty understanding what is important in the problem and in translating the words into mathematical equations. STELLA can help students solve these problems by allowing them to work closer to the problem.

Imagine your class is going to try to raise $400 by making school T-shirts. There is a $150 set-up charge for the T-shirt design that you have designed. Once the design is set, it costs $4 for each T-shirt. You feel it is possible to charge $10 for each T-shirt. How many T-shirts do you have to sell before you break even, i.e., make enough money to cover your costs?

There are two values building by a constant amount: Total Cost and Total Sales. The former starts at $150 and increases by $3 for each shirt. The second starts at $0 and increases by $10 for each shirt. This is shown in the simple diagram below:



If we graph Total Cost and Total Sales to see how they grow over time, we see:



As can be seen from the graph, the break-even point is when 25 shirts have been sold for a total of $250. Before this point, the class is losing money. After this point, the class is making $6 ($10 sale price less $4 cost) per shirt.

Exercises

1. From the graph, what is the amount of money the class makes if 50 shirts are sold (note the Total Cost graph is $350 at this point)? _____

Teacher Note: The answer is the difference between the two values at 50 shirts: $500 sales – $350 cost = $150.

2. What is the equation for the Total Cost line? _____

Teacher Note: The y-intercept is $150 (initial set-up charge) and the rate that it is increasing is $4 per shirt. This rate is the slope of the line. The equation is therefore $y = 4x + 150$.

3. What is the equation for the Total Sales line? _____

Teacher Note: The y-intercept is $0 (initial sales) and the rate that it is increasing is $10 per shirt. This rate is the slope of the line. The equation is therefore $y = 10x$.

4. How can we solve the equations to find the break-even point?

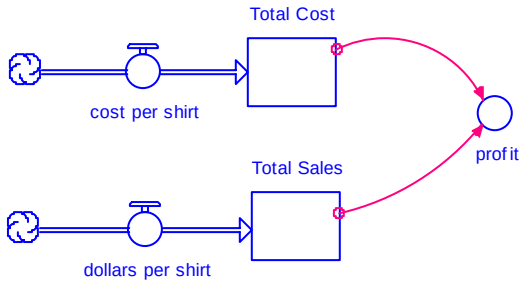
Teacher Note: The break-even point is the place where the two lines intersect. The two equations share a point at their intersection, i.e., they share an (x, y) pair. Thus, we can treat the y values as equal and set the equations equal to each other:

$10x = 4x + 150$	*[substitute y from second equation into first]*
$6x = 150$	*[subtract 4x from both sides]*
$x = 25$	*[divide both sides by 6]*

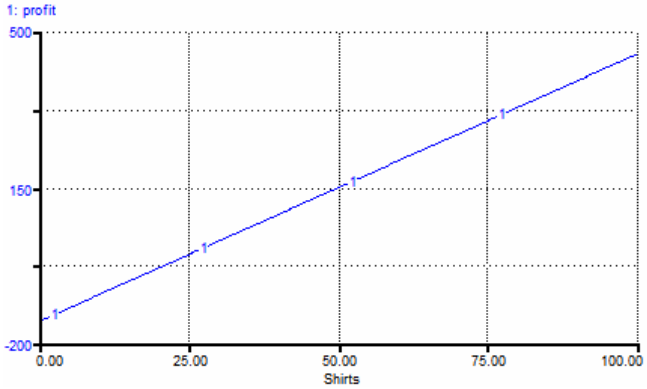
Note that the algebraic answer is also 25 shirts.

5. As a follow-up, how many shirts have to be sold to raise the desired $400? _____

Teacher Note: A simple change to the model allows us to easily determine this amount. The added variable profit is simply Total Sales – Total Cost.



We can then directly read from the graph of profit below that 92 shirts need to be sold to make $400.



About STELLA

Using STELLA modeling and simulation software, students can create a visual representation of word problems to better understand the translation into mathematical equations.

Thousands of educators and researchers have made STELLA the gold standard; using it to study everything from economics to physics, literature to calculus, chemistry to public policy. K-12, college, and research communities have all recognized STELLA's unique ability to stimulate learning.

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