

Go over first-day handout.

Consider this scenario: A building was bought for \$120,000 and when the owner worked with his accountant, they set up a depreciation schedule. Let t be the number of years and W be the remaining worth. This depreciation schedule decreases the worth (the “book value”) of the building by \$8000 per year.

1. Make a table of values for $t = 0, 1, 2, 3, 4$.
2. Make a graph of this relationship. (Notice that it is a straight line.)
3. Write how you computed the values of W for $t = 0, 1, 2, 3, 4$ in such a way that illustrates the pattern of the relationship.
4. Use that pattern to compute the values of W for the next two values of t .
5. Use that pattern to say how you would compute the worth when $t = 12$. The point here is not to just compute the worth at $t = 12$, but to more clearly see the pattern.
6. Use the pattern to write a formula for W in terms of t . (Answer: $W = 120000 - 8000t$) (The point here is NOT to get the answer, but to understand how to build up the pattern to derive this. Mathematics is more about finding and summarizing patterns than about doing particular computations.)
7. Identify the slope and y-intercept. Remember the equation of a line, from algebra class. $y = mx + b$ where b is the y-intercept and m is the slope. Here, of course, we used W and t instead of y and x , but we can re-write our pattern with y and x . So that is $y = 120000 - 8000x$ or, since addition is commutative, $y = 120000 - 8000x = 120000 + (-8000x) = -8000x + 120000$. The point of this is to make clear that the slope is not just the first number you see in the equation, but it is the number multiplied by the variable, and the y-intercept is the number that is not multiplied by the variable. So here $m = -8000$ and $b = 120000$. And that’s true also if $W = -8000t + 120000$
8. Interpret the y-intercept. Look at the graph. Where does the line intersect the y-axis? At 120,000. So that’s the y-intercept. Sure enough – that’s what we see in the formula for the y-intercept. The interpretation is: “When $t = 0$, then $W = 120000$.” In the words of the story, “At the beginning of the process, the worth of the building is \$120,000.”
9. Interpret the slope. Look at the graph. We see that, as t increases by 1, then W decreases by 8000. That is, for each additional year, the worth decreases by \$8000. We can identify some particular points and see that. Of course, this isn’t a surprise, because our original story told us that. So, really, our original story told us the y-intercept and slope – they just told us in terms of the meanings rather than using the words.
10. Now we’re going to start over and do this just as we’d have done in algebra class, where we pick two points on the line – and do what?
11. It’s time to look at the “Review of Linear Relationships” handout. Look at the table of contents. What have we done so far? What is left to do? (Answer: What is left to do is “use two points to find the slope,” “use the slope and one point to find the y-intercept,” “put these together into the formula for the line.”)
12. Do you remember doing this from algebra class? What is the formula for the slope? (Use x and y here instead of t and W .) Use it and the points (2, 104000) and (4, 88000) to find the slope. Notice that we get -8000 again. (No surprise!!)

13. Since every point on the line has to fit the equation $y = mx + b$, now we can pick one point on the line and plug it in for x and y , and plug in m , so the only unknown is b . We solve for b . Use the point $(2, 104000)$ and solve for b . We get 120000 . (Again, no surprise!)
14. Put them together into $y = -8000x + 120000$ or $W = -8000t + 120000$.
15. Now we have almost completed everything in the table of contents.
16. Let's look at the graph of a line and, from the graph, estimate the slope and intercept, so we have an estimate of the formula for a line. (Draw a graph on the board which goes through points $(0,6)$, $(3,5)$, and $(6,4)$. But don't let students clearly see those points. Just get the line drawn.)
17. Now, from this graph, estimate the y -intercept. It is clearly 6.
18. Now, from this graph, estimate the slope. Do you remember learning that $\text{slope} = \frac{\text{rise}}{\text{run}}$? Look at that on this graph. Pick a couple of points on the line and draw the triangle that shows the "rise" and the "run." Since the points I drew were not obvious, we have to estimate. In class, I said the points were $(1,5.6)$ and $(5,4)$. So the rise is $5.6 - 4 = 1.6$ and the run is $1 - 5 = -4$. So the slope is approximately $\text{slope} = \frac{1.6}{-4} = -0.40$. Of course, the rise here actually goes down instead of up, since the line goes down. So we say that rise is negative, so that results in a negative slope. Our estimated formula is $y = -0.4x + 6$. The actual line I drew is $y = -0.333x + 6$. The y -intercept is correct, and the slope has the correct sign and is close. Look in the examples at the end of the handout for how to determine whether the estimate is close enough. This estimate is close enough.

Homework: Handout "Review of Linear Relationships", Exercise Set 1, with Practice Problems 1-9. These are scattered through pages 1-9. Do these homework problems and bring them to the next class. You won't turn them in yet – just ask questions and take notes. You'll turn in all your homework at the time of the test.

Quiz: Handout "Review of Linear Relationships", Exercise Set 2, with Problems 4.1, 4.2 and 4.3. Prepare these outside of class and turn them in at the beginning of the next class. We'll go over these in class. I will grade this very leniently. Just make a good attempt.

Note: This material is used in several of the modules we will do in this class. If you don't feel completely comfortable with this yet, that's OK. You'll have other opportunities in this class to demonstrate your skill in working with linear relationships.