MTH245 Linear Functions; Revenue, Cost & Profit

Three ways to understand functions: symbolically, graphically and numerically

Linear functions, everyone recalls: y = mx + b and how to graph, right?

In this class, everything is a story problem. What do m and b mean when we are looking at applications? m is the "marginal" or rate of change. b is the initial value.

Examples: A car is purchased for $20,000 and depreciates $1500 each year. A sales person is paid $800 a month plus 4% commission on sales. A car is 400 miles from the airport and is approaching it at 60 miles per hour.

All of these can be easily translated into y = mx + b formulas and then graphed using techniques from algebra. Let's try some less conventional approaches also.

Say a painting is worth $3000 when it was 3 years old and is worth $15,000 when it is 30 years old. We will assume it value is increasing at a constant rate. We could trot out our slope formula:
$\frac{y_2 - y_1}{x_2 - x_1} = \frac{15000 - 3000}{30 - 3} = \frac{12000}{27} = \$444.44$ *per year* then use $y - y_1 = m(x - x_1)$ to find b. We could also sketch and get an estimate from a graph. Another approach: How much is the price increasing every 3 years? 3(444.44) = 1333.33. So if it was worth 3000 when it was 3 years old, and it increased in value $1333.33 in the first 3 years it must have been worth 3000-1333.33 = $1666.67 initially. Giving us a model V(t) = 444.44t + 1666.67.

Business Applications: Revenue, Cost, Profit.

Note: Profit = Revenue – Cost. No one gets out of this class alive if they don't understand that.

We are going to sell tamales: Our expenses are $100 monthly operating fee and $.75 ingredients per tamale. We are going to charge $1.25 for each tamale. How many do we need to make/sell to start making a profit? If we do nothing, it will cost us $100 so we need to move some product.

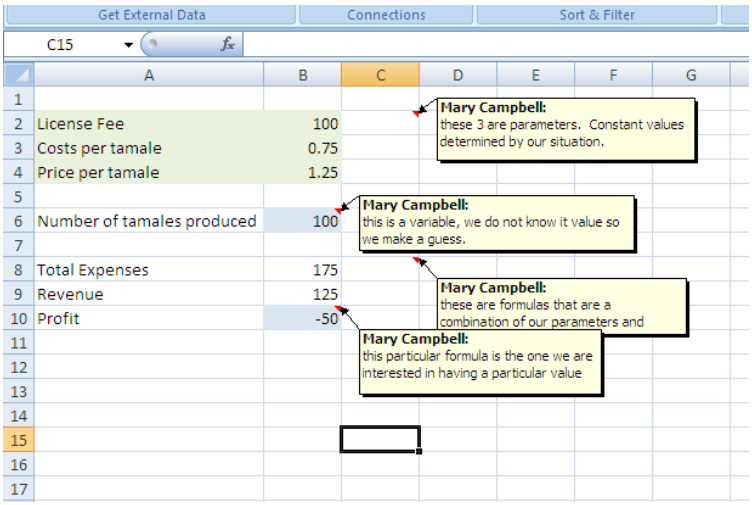
A common sense approach: take a guess. But first, what type of thing are we guessing? Dollars? Days? Tamales? If we are taking a common sense approach we still need to know what we are looking for. Let's say 100 tamales. Will we make a profit?
Costs: at $.75 per tamale, how much will we spend on ingredients for 100 tamales? $75, is that our only expense? Nope, we have that $100 operation fee so we are looking at $175 to get these tamales on the market. How much will we make once we have sold all of them? At $1.25, that would be $125. Now think carefully, have we lost $50 or do we have a profit of $50?

Profit = Revenue – Costs = 125 – 175 = -50. What does negative profit imply? We need to make more money…we are not covering our expenses. Of course to sell more tamales we have to make more tamales, where do we **break even**?

Ignoring the operating fee for the moment, the tamales cost us $.75 in ingredients and we sell them for $1.25, so we have an extra $.50 per tamale. If we need another $50 to cover our expenses, how many more tamales is that? 100 more. So we need to sell a total of 200 tamales to break even and then we start making a profit if we sell more than 200.

We could also use algebra: Costs: C(n) = 100 + .75n Revenue : R(n) = 1.25n
Profit = Revenue – Costs = (1.25n) – (100 + .75n) = .5n – 100
To break-even, profit = 0: 0 = .5n – 100 → n = 200 (Ex 2.2.2)

Let’s use Excel to solve the same problem



Now let’s use Excel to graph the same situation.