## Formulas HW 6: Herbie's Formula

Everyone, meet Herbie:



Herbie is a rainbow trout. One fine day, I outsmarted Herbie with a little baitfish fly that I tied, and I was stoked. I took this picture of Herbie, and then let him go, with a smile on my face. As soon as I did, though, I said to myself, "Damn! I forgot to measure him to see how *long* he was!" So that's what we'll do in this homework! And then we'll go even further!

The net in the picture is about 15 inches between the areas I marked with red asterisks (\*).

 (2 points) Use that information, and this picture, to figure out about how long Herbie was, to the nearest inch. I know this is tricky, but you can get close! He's clearly longer than 15 inches; try to get a pair of "between" estimate (like, "Herbie's probably between, oh, \_\_\_\_\_\_ inches and \_\_\_\_\_\_ inches long." Give them below!

Herbie is probably between \_\_\_\_\_ and \_\_\_\_\_ inches long.

So yay! A picture helped me remember how long("ish") Herbie was! But we're even going to go one better – we're going to approximate how much he **weighed**! This might seem weird – a picture can't give you pounds! But, as it turns out, most trout are similarly shaped, so we can get relatively close to their weight if we know two measurements: their **length**, and their **girth**. Length, as you just discovered, is the "nose to tail" distance. Girth would have to be found by passing a ruler around the fish at his fattest part, and measuring the "largest round" distance you could on the fish. In the picture at right, my hand is supporting this trout's girth (note: that isn't Herbie – but isn't it cool how similarly shaped the two trout are? That's what makes what we're about to do so rad).



Now, I never measure the girth of the fish that I catch on the river, for one main reason: I wanna get them back into the water, and swimming away happily, as soon as I can. But, over time, scientists have learned the following: for every 5 inches of length a trout has, it has about 3 inches of girth! And we can even state this more mathematically:

## girth of a trout = 60% of length of a trout

2. (2 points) Read the paragraph above that last equation and tell me where the "60" came from!

So, for example – if I catch a trout who's 10 inches long, that would mean he's got a 6-inch girth! And with this, we can go further!

3. (2 points) (w) Take your two numbers from #1, use that last equation, and tell me: between which two *girths* is Herbie? Show me how you get your values, and round off to the nearest tenth for each!



OK! Ready to approximate Herbie's weight? I know you are! The formula below, when you substitute in your numbers for the length and girth, will spit out a trout's (approximate) weight in pounds!

Weight of a "typically shaped" rainbow trout =  $\frac{\text{length } * \text{ girth}^2}{800}$ 

(let's weigh Herbie on the next page!)

4. (4 points) (w) Use this formula twice: once for your low estimates of girth and length, and once for your high ones, to figure out Herbie's weight (well, technically, you're figuring out what Herbie's weight is *between*)! Round your answers to the nearest tenth of a pound, and add them to the sentence below! Just like the last question – make sure to show me everything you do to get your answers!

Herbie probably weighs between	and		pounds.
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And that, my friends, is a badass fish. 🙂

More importantly – you just developed the idea of a <u>confidence interval</u> in statistics: usually, because of many factors, you can't get an *exact* value for something you're studying. So, instead, you establish low and high limits for what it could be, and state that what you're studying is *between* those limits.

5. (extra 3 points) (w) What's the unit on the "800" in the weight formula above? "(w)" here just means to explain how you arrived to the unit. Feel free to Google it up!