

Exponential Functions: Monsters and Amoebas

Here's the situation:

Your spaceship has crashed on an unknown planet. You and your crew encounter a drooling, carnivorous alien monster. As you can guess, this is not good. It gets worse. While you are cowering in a cave, trying not to cry "mommy" in front of your crew, your science officer is able to chart the monster's growth over several hours' time. She comes back to you with her report (and minus one arm). The news is grim. With each hour that passes, the monster doubles in size (specifically, his height). The science officer also said that the monster's stomach was making those growly-hungry noises.

if we assume the monster is 1 foot tall at birth, what formula would describe the growth of the monster?

Well, let's figure it out. The best thing to do to figure out things like this is to make a chart of data. You can usually find a pattern that will lead to the formula.

| TIME (t) | HEIGHT IN FEET |
|----------|----------------|
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| | |

We can write $HEIGHT = 2^t$

Using function notation, our official formula is $h(t) = 2^t$
 h for height t is our input variable

Now, you can figure out the monster's height at any time.

How tall will one of these monsters be 6 hours and 30 minutes after it's born? Let's find out. The time (t) is 6.5, so we'll substitute that number into our formula:

$$t = 6.5$$

$$h(t) = 2^t$$

$$h(6.5) = 2^{6.5} \approx 90.5$$

After 6.5 hours, the monster will be about 90.5 feet tall. I'm sure you can only imagine the amount of drool something that big would produce . . . and how hungry it would be!

YOUR TURN

How tall would the monster be 4.7 hours after birth?

How tall would the monster be 3.2 hours after birth?

By the way, the function $h(t) = 2^t$ is called an "exponential function", since the variable is up in the exponent. The 2 is called the base of the exponential function.

Now, back to the story . . .

For some reason, your science officer starts yelling crazy things at you (while waving around her one arm) and quits. In desperation, you promote the crew cook, Stu, and send him out of the cave to do more exploring. Unfortunately, he finds a second species of drooling alien monster. Fortunately for Stu, it's an herbivore! Unfortunately for Stu, your uniforms are green. Days later, one of Stu's socks and clip board of growth data for the monster is found.

Here's what Stu had written:

SECOND ALIEN SPECIES IS 4 INCHES TALL AT BIRTH

| TIME (t) | HEIGHT IN FEET |
|----------|----------------|
| | |
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| | |

CONCLUSION: WITH EACH HOUR THAT PASSES, THE MONSTER TRIPLES IN HEIGHT AND MAY BE TASTY BROILED WITH ONIONS.

FORMULA FOR GROWTH: $h(t) = 4 \cdot 3^t$

YOUR TURN

How tall with this species of monster be after 2.5 hours?

How tall will it be after 4.2 hours?