Douglass Houghton Workshop, Section 2, Tue 9/13/11

Worksheet Chocolate Frosting

1. As we know, Taylor has a Pomeranian dog. His name is Manny. In tribute to him, Taylor began collecting Pomeranian related items, such as Pomeranian T-shirts, a Pomeranian lunchbox, Pomeranian decals for her bike, and more. This year, after she had accumulated 40 Pomeranian-related items, she had had enough and wanted to move on to something else. But her (well-meaning) friends and relatives, observing the Pomeranians around her, assumed she wanted more, and started giving her things.

   Write equations for the number of Pomeranians Taylor will have t years from now, under the following conditions:

   (a) Taylor receives 5 new Pomeranian items every year.

   (b) In year t Taylor receives one new Pomeranian item for each pair of items she had in year $t-1$.

   (c) Taylor receives 1 Pomeranian next year, 2 the year after that, 3 the year after that, etc.

2. Last time we found formulas for Michael Phelps' dampness after regular towelling and split towelling. Assuming Michael's body is $1\,\mathrm{m}^2$, the towel is $T\,\mathrm{m}^2$, and he starts with 1 liter of water on him, we have

$$\begin{array}{l}\text{wetness after}\\ \text{regular toweling}\end{array} = \frac{1}{1+T} \qquad \begin{array}{l}\text{wetness after}\\ \text{“split” toweling}\end{array} = \frac{1}{(1+T/2)^2}.$$

   Let's see just how much this "splitting" idea will buy us.

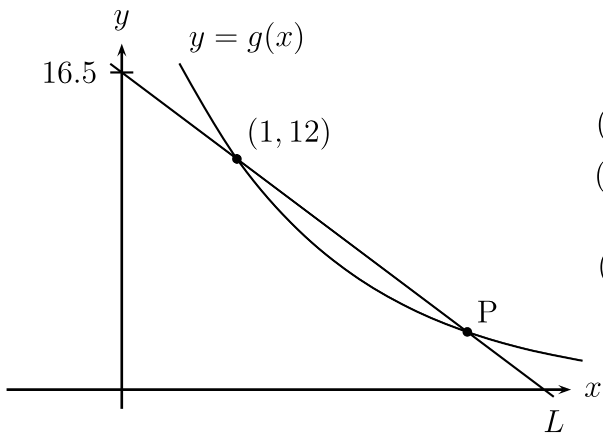
   (a) Suppose Michael splits his towel into 3 parts, and uses all three. How wet will he be? How about if he splits it into n parts?

   (b) Use calculators to fill in the table below with 4-decimal place numbers.

T	$n=1$	$n=10$	$n=100$	$n=1000$	$n=10000$
$1\,\mathrm{m}^2$					
$2\,\mathrm{m}^2$					
$4\,\mathrm{m}^2$					
$\frac{1}{2}\,\mathrm{m}^2$					

   (c) Consider the $1\,\mathrm{m}^2$ towel. How would you describe the effect of dividing it into more and more pieces? For instance, does dividing more always make Michael dryer? Might it make him wetter? Can he get as dry as he might possibly want with that one towel? Does it even matter how big his towel is?

3. Consider the following graph:

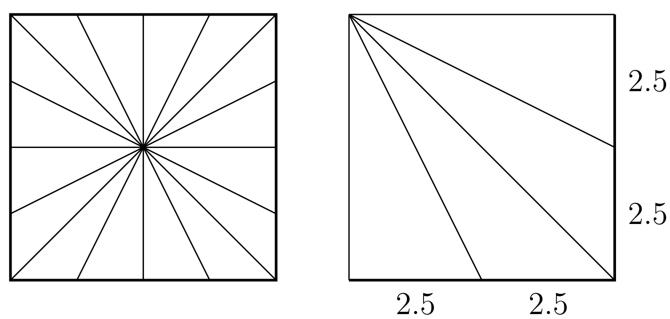


(a) Find an equation for the line L.

(b) Find the y-coordinate of the point P, given that its x-coordinate is 3.

(c) $g(x)$ is an exponential function. Find a formula for $g(x)$.

4. So we still have this square cake, 10 inches on a side and 2 inches high, frosted on the top and all four sides. It is a yellow cake with chocolate frosting. It's getting a bit drippy while we decide how to cut it. Last time we found two methods of cutting the cake for 16 people. One of them looked like the picture on the left.



The picture on the right is a blow-up of the lower right corner. At first we weren't convinced that this method of cutting worked, because there are pieces of two different shapes. But eventually we agreed that the two types contained the same amount of cake and the same amount of frosting.

(a) Cut the cake for 32 people, and prove that your method works.

(b) Cut the cake for 12 people.

(c) Explain how to cut the cake when the number of people is divisible by 4.

(d) Explain how to cut the cake for any number of people.

5. We're still sitting in this cabin, trying to figure out the temperature in Fahrenheit. We have a $33\frac{1}{3}$ RPM record player, a roll of duct tape, a Beatles album from 1967, a stopwatch, and some very cold feet. We know that if c is the temperature we read on the Celcius thermometer, then $f = \frac{9}{5}c + 32$ is the temperature in Fahrenheit. Last time we made these tables of Celsius vs. Fahrenheit and revolutions of a record versus time in minutes:

c	0	10	20	30
f	32	50	68	86

revolutions	0	10	20	30
time in min	0	.3	.6	.9