09/4/15 Name: _____ Section ____

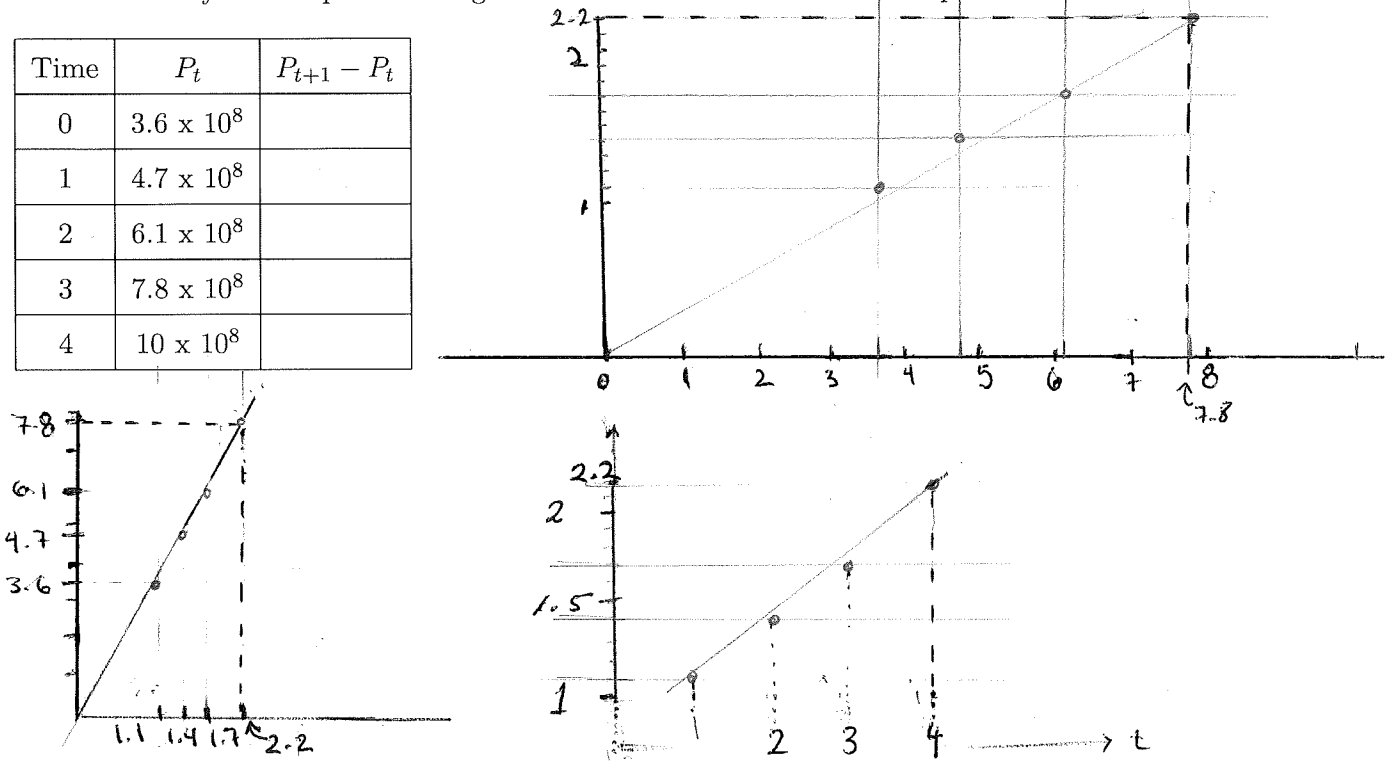
Practice Quiz 1 MATH 181

SHOW ALL YOUR WORK to avoid loss of points.

1. Sharon grew a culture of Bacillus in a growth medium. The culture grew exponentially for 12 hours, then went into stationary phase. Her experimental data, for the first 4 hours is show below.

a)Find the change in population at each time, select an appropriate line that best fits the data and use it to write a dynamic equation along with an initial condition for this experiment.

Time	P_t	$P_{t+1} - P_t$
0	3.6 x 10^8	
1	4.7 x 10^8	
2	6.1 x 10^8	
3	7.8 x 10^8	
4	10 x 10^8	



b) Find the solution to the equation and use it to estimate P_5 and P_{10}.

c) Sharon's lab partner, Brian, performed the same experiment. He also started with 3.6×10^8 cells, but added 1g NaCl/Litter to the growth medium. Due to the added salt, Brian's cells grew more slowly. They reached the same final density as Sharon's cells, but took 24 hours o reach their maximum density, while Sharon's reached their maximum density in 12 hours.

Think about the solution equation you determined in part a).

How would you expect this equation to change for Brian's cells? That is, if the equation for Sharon's cells is in the form $P = P_0 R^t$, the parameter P_0 in Brian's equation would be larger than, smaller than or the same as the parameter P_0 in Sharon's equation?

What about the R parameter in Brian's equation, would it be larger than, smaller than or the same as the parameter R in Sharon's equation?

2. The data below represents the population in a colony of bacteria measured every minute during the first 6 minutes. The model equation $B_t = 1.99(1.35)^t$ fits this data.

time	0	1	2	3	4	5	6
B_t	1.99	2.68	3.63	4.89	6.63	8.93	12.10

a) What percentage increase in the population each minute does the model for the equation assume?

b) According to this model when will the population reach double of its initial size?

** c) Suppose that a similar experiment using the same initial amount of bacteria was carried out in a growth medium with a different composition that led to the population growing slower, say it took 3 times the time to duplicate the initial amount, as in the experiment above, find an equation that would model this second experiment.

3. The plasma mezlocillin concentrations were recorded at five minute intervals following an injection of 5 gr. of mezlocillin into healthy volunteers, the collected data indicates that approximately a 22% of the initial amount of mezlocillin was removed by the kidneys every 5 minutes. Provide a dynamic equation and its solution that models the amount of mezlocillin at a given minute in the plasma for this experiment.

4. (problem 1.7.6) An intravenous infusion of penicillin is initiated into the vascular pool of a patient at a rate of 10 mg penicillin every 5 minutes. The patient's kidneys remove 20% of the penicillin in the vascular pool every five minutes. Set up and solve (including the equilibrium state) the dynamic equation corresponding to this situation.

**5. Consider the following experiment. A one-liter flask contains one liter of distilled water and some amount of salt. Repeatedly, 50 ml of solution are removed from the flask and discarded after which 50 ml of distilled water is added to the flask along with 1 gram of salt. The following equation provides a model to the situation. Deduce: the initial amount of salt and the equilibrium state of the amount of salt in the flask.

$$A_t = 20 - 17(0.95)^t$$