Please show all work and **box your final answers**. If you need more room, you may use the backs of the pages. Calculators are allowed, but cellphones are not. Good luck!

1. Suppose the population of Rochester, NY is currently 800,000 and it is increasing at a constant rate of 40,000 per year.

(a) (4 points) Find an equation for the population of Rochester, NY t years from now.

$$P(t) = 800{,}000 + 40{,}000\,t$$

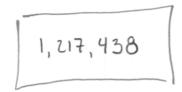(b) (4 points) When will the population of Rochester, NY reach 1,400,000?

$$800{,}000 + 40{,}000t = 1{,}400{,}000$$

$$40{,}000\,t = 600{,}000$$

$$t = 15$$

2. Suppose the population of Buffalo, NY increases by 4% each year and the population is currently 650,000.

   (a) (4 points) Find an equation for the population of Buffalo, NY t years from now.

$$P(t) = 650{,}000 \, (1.04)^t$$

   (b) (4 points) What will the population of Buffalo, NY be 16 years from now?

$$650{,}000 \, (1.04)^{16} = 650{,}000 \, (1.87298)$$

$$= 1{,}217{,}437.8$$

$$\boxed{1{,}217{,}438}$$

3. (4 points) If the value of a particular comic book increases at a monthly rate of 1%, by what percentage does it increase in a year?

$$(1.01)^{12} = 1.126825$$

$$\downarrow$$

$$12.68\%$$

4. (4 points) Suppose a population of bacteria doubles every 10 hours. If the population is currently 350, what will the population be in 24 hours?

$$P(t) = 350(2)^{t/10}$$

$$P(24) = 350(2)^{2.4} = 1,847.3$$

$$\downarrow$$

$$1,847$$