

Name:

Quiz #5

Solve the following problems. Show all of your work and make it clear what your answer is.

1. Your prize-winning ant colony is in a state of emergency!!! The population is declining at a linear rate and there is nothing you can do about it. Population counts since the beginning of the year are recorded in the table below.

days since start of year	18	34	62	84
number of ants left	9328	8872	8074	7747

- (a) Find the linear equation that describes your ant colony population as a function of the number of days since the beginning of the year.

The equation is of the form $y = mx + b$ where x is the number of days and y is the number of ants left. First we compute m , using any two points, say the first two:

$$m = \frac{8872 - 9328}{34 - 18} = \frac{-456}{16} = -28.5$$

Next we compute b by plugging any point, say $(18, 9328)$ into the equation $y = -28.5x + b$.

$$9328 = -28.5(18) + b$$

$$9328 = -513 + b$$

$$9841 = b$$

So the equation is

$$y = -28.5x + 9841$$

- (b) How many ants did you have at your New Year's party (day #0)?

We plug $x = 0$ into the equation to find the number of ants at the beginning of this year.

$$y = -28.5(0) + 9841 = 9841$$

so there were 9841 ants at the party!!

- (c) When will your entire ant colony be dead?

The ant colony is dead when the population, y , equals zero, so we just plug in $y = 0$ and solve for x .

$$0 = -28.5x + 9841$$

$$28.5x = 9841$$

$$x = \frac{9841}{28.5}$$

$$x = 345.3$$

so the ant colony is entirely dead on the 345th day of the year, which this year happens to be December 10th, since 345 is 21 days before the end of the year.

- (d) The ant colony fair requires a minimum population of 1000. When will your ant colony become ineligible to defend its 1st prize at the ant colony fair?

To find when the colony is ineligible to compete, we plug in $y = 1000$ and solve for x .

$$1000 = -28.5x + 9841$$

$$28.5x = 8841$$

$$x = \frac{8841}{28.5}$$

$$x = 310.2$$

so the population reaches 1000 in the first 5 hours of the 310th day of the year, meaning that the colony is officially ineligible just after 5 a.m. on November 5th.