

"Sometimes it's a little better to travel than to arrive."

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In class work 14 has questions 1 through 3 with a total of 8 points. This assignment is due at the end of the class period (9:55 AM). This assignment is printed on **both** sides of the paper.

1. The human population P of Long Pine, Nebraska is an exponential function of the years T after the year 2000. Specifically, the population in the years 2000 and 2010 are given in the table

| Year | T | P |
|------|-----|-----|
| 2000 | 0 | 341 |
| 2010 | 10 | 305 |

Figure 1: Human population of Long Pine, Nebraska for the years 2000 and 2010.

- 2 (a) Find the exponential function that matches the given data.

Solution: We just need to match to the general result in the QRS. That gives

$$P = 341 \times \left(\frac{305}{341} \right)^{T/10}.$$

Converting this to the form $P = 341e^{-0.011157... \times T}$ *isn't* required by the problem statement; so LIB.

- 2 (b) Using your exponential function from part 'a,' when will the population of Long Pine be 280?

Solution: We need to solve $280 = 341 \times \left(\frac{305}{341}\right)^{T/10}$ for T .

$$\begin{aligned}
 \left[280 = 341 \times \left(\frac{305}{341}\right)^{T/10} \right] &= \left[\frac{280}{341} = \left(\frac{305}{341}\right)^{T/10} \right] && (\div 341) \\
 &= \left[\log\left(\frac{280}{341}\right) = \log\left(\left(\frac{305}{341}\right)^{T/10}\right) \right] && (\log \text{ of left and right}) \\
 &= \left[\log\left(\frac{280}{341}\right) = \frac{T}{10} \log\left(\frac{305}{341}\right) \right] && (\log \text{ property}) \\
 &= \left[T = 10 \times \frac{\log\left(\frac{280}{341}\right)}{\log\left(\frac{305}{341}\right)} \right], && (\text{divide}) \\
 &= [T \approx 17.7 \text{ years}].
 \end{aligned}$$

2. Find the solution to the linear equations

$$5x + 8y = 14,$$

$$2x - 2y = 3.$$

Solution: Let's use our matrix method. Ordering the unknowns as x (first column) and y (second column), our system in matrix form is

$$\begin{bmatrix} 5 & 8 & 14 \\ 2 & -2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 14 \\ 3 \end{bmatrix}$$

The second equation is $2x - 2y = 3$. So $y = \frac{1}{2}$. Pasting that into the first equation gives $5x + 4 = 14$. So $x = 2$.

Should we check our work? Sure.

$$[5x + 8y = 14] = \left[5 \times 2 + 8 \times \frac{1}{2} = 14 \right] = [10 + 4 = 14] = \text{True!}$$

And one more time

$$[2x - 2y = 3] = \left[2 \times 2 - 2 \times \frac{1}{2} = 3 \right] = [4 - 1 = 3] = \text{True!}$$

2 3. Find the solution to the linear equations

$$x + y + z = 14,$$

$$y - z = 10,$$

$$2z = 8.$$

Solution: Ha! Let's be lazy and start at the bottom and work up! That gives $z = 4$; so $y - 4 = 10$. So $y = 14$. And finally $x + 14 + 4 = 14$. So $x = -4$.