Math 120 KAUST | Worksheet 4 | September 12th, 2018

Name:

Answer the questions in the spaces provided. Don't hesitate to ask me or your peers for help, this is not a quiz.

1. You have a population of 3×10^6 yest cells, which grows exponentially until space becomes an issue (10^11 cells). After 2 hours, there are 4.79×10^6 cells.

   (a) How many cells are there after 5 hours? 10 hours? t hours?

$N(t) = N_0 \cdot b^t$

$N_0 = N(0) = 3 \cdot 10^6$

$N(t) = 3 \times 10^6 \cdot b^t$

$N(2) = 3 \times 10^6 \cdot b^2 = 4.79 \cdot 10^6$

$b = \sqrt{\frac{4.69}{3}} = 1.264$

$N(t) = 3 \times 10^6 (1.264)^t$

$N(5) = 9.68 \times 10^6$

$N(10) = 3.12 \times 10^7$

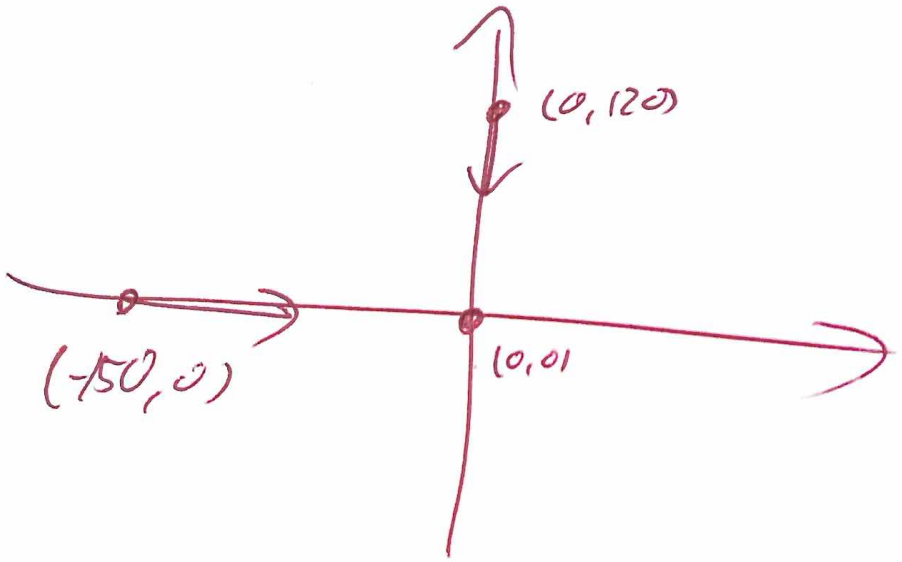
   (b) When does the exponential model break down? Discuss this with your neighbors and me.

Let $N(t) = 10^{11}$

Solve for t

2. Sven starts walking due south at 5 feet per second from a point 120 feet north of an intersection. At the same time Rudyard starts walking due east at 4 feet per second from a point 150 west of the intersection.

   (a) Choose coordinates a picture of the situation. Label the coordinates of both Sven and Rudyard's starting points, and use arrows to indicate their paths.



   (b) Write parametric equations of motion for Sven and Rudyard.

Rudyard

$x_R(t) = -150 + 4t$

$y_R(t) = 0$

Sven

$x_S(t) = 0$

$y_S(t) = 120 - 5t$

(c) Write a function $d(t)$ for the distance between Sven and Rudyard at time t.

$$d(t) = \sqrt{(150-4t)^2 + (120-5t)^2}$$

$$= \sqrt{41t^2 - 2400t + 36900}$$

(d) When are Sven and Rudyard closest together? What is the minimum distance between them?

Min @ $\frac{-b}{2a} = \frac{2400}{82}$

$d\left(\frac{2400}{82}\right) \approx 12.167$

3. Rosalie is organizing a circus performance to raise money for a charity. She is trying to decide how much to charge for tickets. From past experience, she knows that the number of people who will attend is a linear function of the price per ticket. If she charges 5 dollars, 1200 people will attend. If she charges 7 dollars, 970 people will attend. How much should she charge per ticket to make the most money?

Let x = price

Then $a(x)$ = attendance

↳ slope $\frac{970-1200}{2} = \frac{-230}{2} = -115$

Pt, $(5, 1200)$ & $a(x) = -115(x-5)+1200$

$= -115x + 1775$

Revenue = (price) × (attendance)

$= x \cdot (-115x + 1775)$

$= -115x^2 + 1775x$

Max @ $\frac{-b}{2a} = \frac{-1775}{-230} \approx 7.72$

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