2. [11 points] Abby and Brenda are alpacas running around in the xy-plane. Abby's position t minutes after she starts running is $(\cos(\pi t), 1)$ and Brenda's position t minutes after she starts running is $(\frac{t}{2}, e^{1-(t/2)^2})$. Both alpacas begin running at the same time.

a. [3 points] Do Brenda and Abby ever collide? If so at what time(s) does this occur?

Solution:
For Abby and Brenda to collide we must solve the equations $1 = e^{1-(t/2)^2}$ and $\frac{t}{2} = \cos(\pi t)$. For the first equation we must have $1 - (t/2)^2 = 0$ therefore $t = \pm 2$. Negative time doesn't make sense in this probelm so we only take $t = 2$.
Plugging 2 into the second equation both sides are equal. So Abby and Brenda collide when $t = 2$.

b. [5 points] Does Brenda or Abby ever stop moving at any time in the interval $[2.5, 4.5]$? If so, which alpaca stops and at what time(s) does this occur?

Solution:
$A'(t) = (-\pi \sin(\pi t), 0)$ so Abby stops moving whenever $\sin(\pi t) = 0$ so whenever t is an integer. Thus Abby stops when $t = 3$ or 4.
$B'(t) = (\frac{1}{2}, te^{1-(t/2)^2})$ the first coordinate can never be zero so Brenda is always moving.

c. [3 points] Write an integral which gives the distance traveled by Brenda in the first 5 minutes she is running. Please circle your answer.

Solution:
Using the parametric arc length formula we get $\displaystyle\int_0^5 (\frac{1}{4} + t^2 e^{2-2(t/2)^2})^{1/2}\, dt$.