Quiz 2 9/17

Name KEY id _____ sec'n H (8:00)

Please write legibly. Use back of the sheet if necessary.

1. A colony of bacteria grows in such a way that the population at time t hours is given by $P(t) = 2000e^{\frac{t}{10}}$.
a) What is the population at time t = 2?
b) At what t is the population = 3000?

2. A point moves on a line so that its position at time t is $s(t) = t^2 + t$.
a) What is its average velocity for the time interval [2, 2.1]?
b) What is its instantaneous velocity at time t = 2?

(1) a) $P(2) = 2000e^{\frac{2}{10}} = \boxed{2000e^{\frac{1}{5}} \approx 2442.81}$

b) $3000 = P(t) = 2000e^{\frac{t}{10}}$

Solve for t.

$\Rightarrow \frac{3000}{2000} = e^{\frac{t}{10}} \Rightarrow \frac{3}{2} = e^{\frac{t}{10}} \Rightarrow \ln\frac{3}{2} = \frac{t}{10} \Rightarrow \boxed{t = 10\ln\frac{3}{2} \approx 4.05}$

(2) a) avg. velocity $= \frac{s(2.1) - s(2)}{2.1 - 2} = \frac{6.51 - 6}{.1} = \frac{.51}{.1} = \boxed{5.1}$

b) inst. velocity $= \boxed{5}$

(It is the limit of the avg. velocities. So calculate the avg. velocities for [2, 2.01], [2, 2.001], ... and you'll see the limit is heading toward 5.)

Quiz 2 9/17

Name KEY id _____ sec'n A (9:00)

Please write legibly. Use back of the sheet if necessary.

1. A colony of bacteria grows in such a way that the population at time t hours is given by $P(t) = 2000e^{\frac{t}{10}}$.
   a) What is the population at time t = 3?
   b) At what t is the population = 4000?

2. A point moves on a line so that its position at time t is $s(t) = t^2 + t$.
   a) What is its average velocity for the time interval [3, 3.2]?
   b) What is its instantaneous velocity at time t = 3?

① a) $P(3) = \boxed{2000e^{\frac{3}{10}} \simeq 2699.72}$

b) $4000 = P(t) = 2000e^{\frac{t}{10}}$

Solve for t.

$\Rightarrow \frac{4000}{2000} = e^{\frac{t}{10}} \Rightarrow 2 = e^{\frac{t}{10}} \Rightarrow \ln 2 = \frac{t}{10} \Rightarrow \boxed{t = 10 \ln 2 \simeq 6.93}$

② a) avg. velo. $= \frac{s(3.2) - s(3)}{3.2 - 3} = \frac{13.44 - 12}{.2} = \boxed{7.2}$

b) inst. velo. $= \boxed{7}$

(It is the limit of the avg. velocities. So calculate the avg. velocities for [3, 3.02], [3, 3.002], ... and you'll see that the limit is heading toward 7.)

Quiz 2 9/17

Name KEY id _____ sec'n F (12:00)

Please write legibly. Use back of the sheet if necessary.

1. A colony of bacteria grows in such a way that the population at time t hours is given by $P(t) = 2000e^{\frac{t}{10}}$.
   a) What is the population at time t = 3?
   b) At what t is the population = 5000?

2. A point moves on a line so that its position at time t is $s(t) = t^2 + t$.
   a) What is its average velocity for the time interval [6, 6.1]?
   b) What is its instantaneous velocity at time t = 6?

① a) $P(3) = \boxed{2000e^{3/10} \simeq 2699.72}$

b) $5000 = P(t) = 2000e^{\frac{t}{10}}$

Solve for t.

$\Rightarrow \frac{5000}{2000} = e^{\frac{t}{10}} \Rightarrow \frac{5}{2} = e^{\frac{t}{10}} \Rightarrow \ln\frac{5}{2} = \frac{t}{10} \Rightarrow \boxed{t = 10\ln\frac{5}{2} \simeq 9.16}$

② a) avg. velo. $= \frac{s(6.1) - s(6)}{6.1 - 6} = \frac{43.31 - 42}{.1} = \frac{1.31}{.1} = \boxed{13.1}$

inst. velo. $= \boxed{13}$

(It is the limit of the avg. velocities. So calculate the avg. velocities for [6, 6.01], [6, 6.001], ... and you'll see that the limit is heading toward 13.)