Quiz 2

January 20, 2016

The population of a certain town grows at a rate of

$$P'(t) = 0.5t + \frac{t}{t^2 + 1}$$

people per year, t years after today. If the population now is 1,000, what will the population be in 2 years? (Round to the nearest person.)

$$P(2) - P(0) = \int_0^2 0.5t + \frac{t}{t^2+1}\, dt$$

$$= \int_0^2 .5t\, dt + \int_0^2 \frac{t}{t^2+1}\, dt$$

$$\quad u = t^2 + 1$$
$$\quad du = 2t\, dt$$
$$\quad dt = \frac{du}{2t}$$

$$= \frac{1}{4}t^2 \Big]_0^2 + \int_1^5 \frac{t}{u} \cdot \frac{du}{2t}$$

$$= 1 + \frac{1}{2} \int_1^5 \frac{1}{u}\, du$$

$$= 1 + \frac{1}{2} \Big[\ln|u|\Big]_1^5$$

$$= 1 + \frac{1}{2}(\ln 5 - \ln 1) \approx 1.81$$

So $\quad P(2) = P(0) + 1.81 \approx \boxed{1002}$