

### Answer on Question #56782 – Math – Calculus

One model of earth's population growth is  $P(t) = \frac{64}{1 + 11e^{-0.08t}}$ , where  $t$  is measured in years since 1990, and  $P$  is measured in billions of people. Which of the following statements are true?

Check all that apply.

- (1) In 1990, there were 5.33 billion people.
- (2) The population of Earth will grow exponentially without bound.
- (3) The population of Earth is increasing by a steady rate of 8% per year.
- (4) The carrying capacity of Earth is 64 billion people.

#### Solution

First statement:

$$P(0) = \frac{64}{1 + 11} = 5.33$$

True.

Second statement:

$$\lim_{t \rightarrow \infty} \frac{64}{1 + 11e^{-0.08t}} = \frac{64}{1 + 0} = 64$$

False.

Third statement:

$$P(t + 1) = \frac{64}{1 + 11e^{-0.08(t+1)}} = \frac{64}{1 + 10.15e^{-0.08t}}$$

$$1.08 \cdot P(t) = \frac{64 \cdot 1.08}{1 + 11e^{-0.08t}} = \frac{69.12}{1 + 11e^{-0.08t}}$$

$$P(t + 1) \neq 1.08 \cdot P(t)$$

False.

Fourth statement:

As it was shown in the proof of the second statement, it's true.

**Answer:** True; False; False; True.