EG02021 Mathematics

Feedback Quiz 2: Differentiation

Total Points 10

Name: ID:

1. **Limits: Algebraically**
   
   a) \( \lim_{x \to -4} \frac{x^2 - x - 20}{x + 4} \)

   b) \( \lim_{x \to \frac{\pi}{6}} (\cos x + \tan x) \)

**Instantaneous Rates of Change**

2. **Volume of a Cancer Tumor.** The spherical volume \( V \) of a cancer tumor is given by

\[
V = \frac{4}{3}\pi r^3,
\]

Where \( r \) is the radius of the tumor, in centimeters.

   a) Find the rate of change of the volume with respect to the radius.
   b) Find the rate of the change of the volume at \( r = 2.5 \text{cm} \)
3. **Population Growth.** The initial population in a bacteria colony is 8000. After \( t \) hours, the colony has grown to a number \( P(t) \) given by

\[
P(t) = 8000 \left( 1 + 0.39t + t^2 \right)
\]

a) Find the rate of change of the population \( P \) with respect to time \( t \). This is also known as the growth rate.

b) Find the number of bacteria present after 7 hr. Also, find the growth rate when \( t=7 \).

c) At what time is the growth rate 200,000 bacteria per hour?