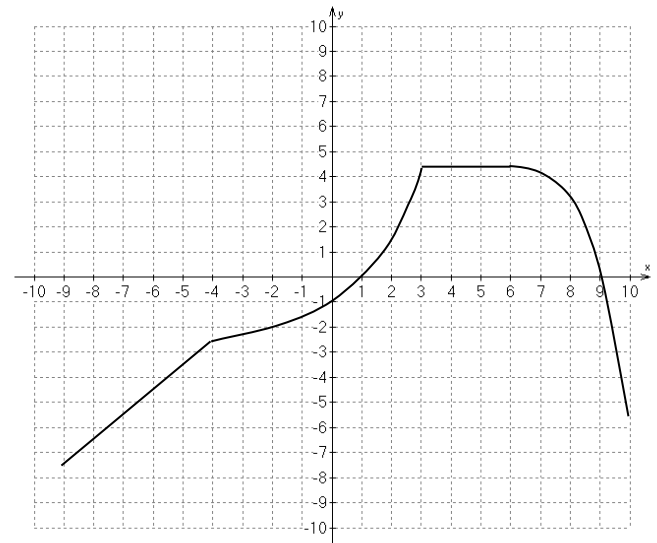


**ROUND ALL ANSWERS TO THE NEAREST TENTH UNLESS STATED OTHERWISE****Multiple Choice**

Identify the letter of the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1) The slope of a secant line on the graph of a function always gives
- a) an average rate of change                      c) the slope of a tangent line  
b) an instantaneous rate of change              d) a non-zero value
- \_\_\_\_\_ 2) For the graph of a function, an instantaneous rate of change is always given by
- a) the midpoint of a secant line                      c) the slope of a single secant line  
b) the  $y$ -value of a point of tangency              d) the slope of a single tangent line

Questions 3 through 5 refer to the graph of  $y = f(x)$  shown on the right.



- \_\_\_\_\_ 3) At  $x = 8$ ,
- a) the instantaneous rate of change of  $f(x)$  is positive.  
b) the instantaneous rate of change of  $f(x)$  is negative.  
c) the instantaneous rate of change of  $f(x)$  is a maximum.  
d) the instantaneous rate of change of  $f(x)$  is a minimum.
- \_\_\_\_\_ 4) On the interval  $-9 < x < -5$ ,
- a) the rate of change of  $f(x)$  is increasing.  
b) the average rate of change of  $f(x)$  is negative.  
c) the average rate of change of  $f(x)$  is equal to the instantaneous rate of change at any point.  
d) the instantaneous rate of change of  $f(x)$  at any point is zero.
- \_\_\_\_\_ 5) On the interval  $-4 < x < 3$ ,
- a) the rate of change of  $f(x)$  is positive.  
b) the rate of change of  $f(x)$  is increasing.  
c) both (a) and (b)  
d) neither (a) nor (b)

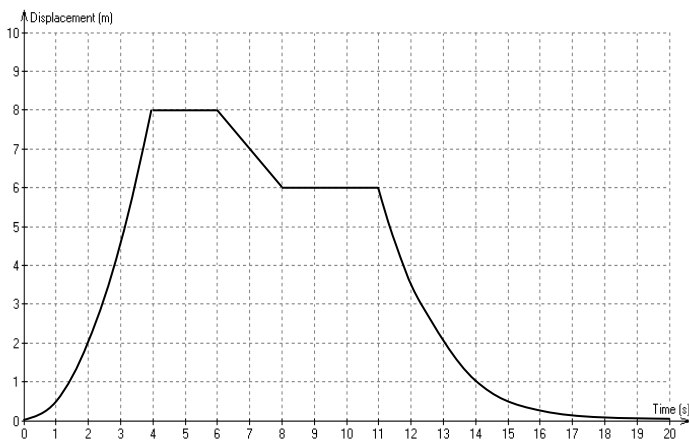
## Full Solution

- 6) For the function  $f(x) = 3x^4 - 5x^2 + 8$ , determine the **equation of the tangent line** at the point where  $x = 1$ .
- 7) A population of raccoons moves into a wooded area. At  $t$  months, the number of raccoons,  $P(t)$ , can be modeled using the equation  $P(t) = 100 + 30t + 4t^2$ .
- Determine the average rate of change of population over the first 5 months.
  - Estimate the rate of change in the raccoon population at exactly 2.5 months. Round your final answer to the nearest whole number.

- 8) For the function  $f(x) = 2x^3 + 3x^2 - 72x + 5$ , use secant slopes to verify that a local maximum or minimum occurs at the point  $(-4, 213)$ . State whether it is a maximum or a minimum that occurs at this point.

- 9) Consider the displacement-time graph shown below, where displacement is measured in metres and time is measured in seconds.

**DISPLACEMENT-TIME GRAPH**



**VELOCITY-TIME GRAPH**



- a) Determine the average velocity in the interval from 2 seconds to 10 seconds.

- b) Determine the instantaneous velocity at 7 seconds.

- c) Draw a clearly labeled corresponding velocity-time graph on the provided axes.

- d) For the displacement-time graph on the previous page, the first four seconds can be modeled by a quadratic function. Determine the instantaneous velocity at 2 seconds. (Hint: Look at the step pattern!)

10) Determine the average rate of change of the function  $f(x) = 2^x - \sqrt{x} + 5$  on the interval  $2 \leq x \leq 7$ . Round your **final answer** to the nearest tenth.

11) Elizabeth claims that she can find a point on the graph of  $y = \sqrt{x} + 3$  at which the instantaneous rate of change is 0. Is Elizabeth's claim correct? Explain.

12) For what values of  $x$  does the function  $f(x) = 3(x + 5)^2 + 7$  have

i) a positive instantaneous rate of change?

ii) a negative instantaneous rate of change?

iii) an instantaneous rate of change of 0?