

$$\overline{38 + 2} = \overline{40}$$

Name: _____

Date: _____

MHF4U

Test – Unit 8: Rates of Change

Multiple Choice - Identify the choice that best completes the statement or answers the question. (7 marks)

1. The slope of which type of line represents the instantaneous rate of change of a function over an interval?

- a. tangent line b. horizontal line c. sine line d. secant line

2. The population of a town is modelled by $P(t) = -t^2 + 12t + 4$, where $P(t)$ is the size of the population in thousands and t is the number of years since 2000. What is the average rate of change in the population size from 2005 to 2010?

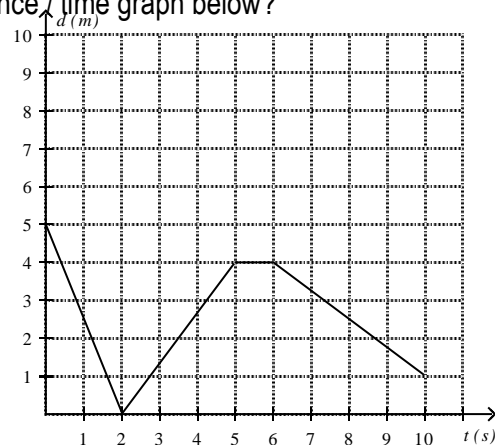
- a. 3 people/year c. 10 000 people/year
b. 3000 people/year d. 15 000 people/year

3. Which points would you use to determine the average rate of change of the function $g(x) = -x^2 + 3x - 4$ on the interval $-1 \leq x \leq 3$?

- a. (3, 4) and (-1, 0) c. (3, 0) and (-1, -8)
b. (3, -4) and (-1, -8) d. (-4, 3) and (-1, -1)

4. During which interval of time is the speed the greatest for the distance / time graph below?

- a. $0 \leq t \leq 2$
b. $2 \leq t \leq 5$
c. $5 \leq t \leq 6$
d. $6 \leq t \leq 10$



5. For what value of x does the maximum or minimum of $f(x) = x^2 + 8x + 12$ occur? Is the point a maximum or a minimum?

- a. -2; maximum b. -6; maximum c. -4; minimum d. 4; minimum

6. Which statement about $f(x) = 1000(1.3)^x$ is true?

- a. instantaneous rate of change is 0 for some value of x
b. instantaneous rate of change is the same for all values of x
c. instantaneous rate of change is negative for all values of x
d. instantaneous rate of change is positive for all values of x

7. Which function does not have a maximum value?

- a. $f(x) = x^2 + 9$ b. $g(x) = 9 - x - x^2$ c. $h(x) = -(x + 1)^2$ d. $k(x) = -4 + x - x^2$

8. What value for the function $y = 3 \cos(t - \pi) + 2$ gives an instantaneous rate of change of 0?

- a. 0 b. $\frac{\pi}{2}$ c. $\frac{\pi}{3}$ d. $\frac{\pi}{4}$

9. What is the average rate of change of the interval $[1, 3]$ for the function $f(x) = -\sqrt{3x^3 + 5}$? (3 marks)

10. What is the instantaneous rate of change for $x=3$ on the function $f(x) = \frac{x^2 - 2x + 3}{x - 5}$. (3 marks)

11. A profit, in dollars, of a manufacturer selling video games systems is given by the equation $P(x) = -0.05x^2 + 350x - 45000$ where x is the number of games sold.

- a) Determine the instantaneous rate of change at $x = 1000$ (3 marks)
b) Explain what this means for the company's profits at this point. (1 mark)

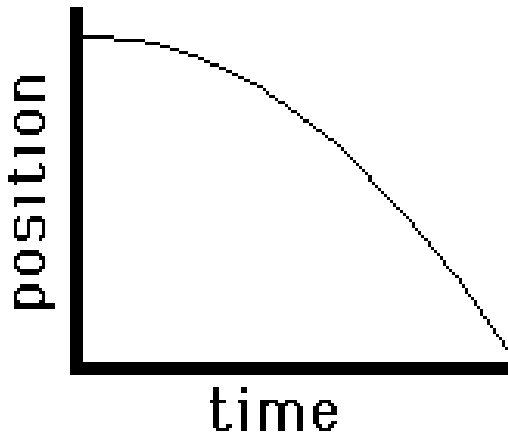
12. Find the equation of the tangent line at $x = 3$ on the function $f(x) = -4x^2 + 16x + 12$. (5 marks)

13. A certain radioactive substance decays exponentially. The percent, P , of the substance left after t years is given by the function $P(t) = 100(1.32)^{-t}$. Determine the instantaneous rate of decay at the instant the half life of the substance is reached. (4 marks)

14. Determine the value of k so that the average rate of change of the function $f(x) = \frac{8x}{x+1}$ on the interval $k \leq x \leq 7$ is $\frac{1}{2}$ (5 marks)

Determine the value of k so that the average rate of change of the function $f(x) = (x+5)(x+1)^2$ on the interval $k \leq x \leq 0$ is 1 (5 marks)

15. Harry says that is graph represents someone who is accelerating away from an object. Explain how he is partially right. What did he get wrong? (2 marks)



16. Draw a distance versus time graph that corresponds to the walk described below.

Adam starts 8 m away from the motion sensor and walks in a straight line toward the sensor at a constant rate of 2 m/s for 3 s. He immediately begins walking away from the sensor at a constant rate for 4 s until he is 5 m from the sensor. He stops for 1 s and then walks toward the sensor at a constant rate of 0.5 m/s for 2 s.

(4 marks)

