Name: _____________ MCV4U - Unit 5 Assignment - RATES OF CHANGE 13K 25A 13C 10T

1. Determine the derivatives of the following functions

a) [3K] $k(x) = (3x^5 + 2x)(3\cos x)$

b) [3K] $m(x) = -e^{2x} \cos 3x$

c) [3K] $h(x) = \sqrt{7 + \sqrt{x^5}}$

d) [4K] $f(x) = \frac{(2x-1)^2}{\sqrt{x-1}}$

2. The height of the tides at a certain spot in Nova Scotia can be found by the equation $h(t) = 5\sin(0.5t + 2) + 6$, where t is the time in hours (using a 24 hour clock) and h is the height in metres. What is the rate of change of height at a time of 07:00 h? [4A 2C]

3. Determine the equation of the tangent to the curve $y=e^{-x}$ at the point where $x = -1$. [3A 1C]

4. RockHard Productions holds weekly events in an arena with a seating capacity of 15 000 spectators. With ticket prices at $12, the average attendance is 11 000 fans. A market survey indicates that for every dollar that ticket prices are lowered, the average attendance will increase by 100 fans. How should the production company set ticket prices to maximize their revenue? [5A 3C]

5. Carbon-14 is a radioactive substance produced in the Earth's atmosphere and then absorbed by plants and animals on the surface of the earth. It has a half-life of approximately 5730 years. Using this known piece of information, scientists can date objects such as the Dead Sea Scrolls. The function $N = N_0e^{-\lambda t}$ represents the exponential decay of a radioactive substance. N is the amount remaining after time t in years, N_0 is the initial amount of the substance and λ is the decay constant. Find the rate of change of an initial amount of 1 gm of carbon-14 found in the scrolls, if the decay constant is given as $\lambda = 1.21 \times 10^{-4}$. [3A 1C]

6. Given the curve $y = x\sqrt{x}$ at what point on the curve is the tangent parallel to the line $3x - y + 6 = 0$? [3A 1T 1C]

7. A car is parked with the windows and doors closed for five hours in a hot summer day in Toronto. The temperature inside the car in degrees Celsius, C, is given by C = $2\sqrt{t^3}$ + 25, with t representing the number of hours since the car was first parked. Find the time t at which the instantaneous rate of change of the temperature is equal to the average rate of change from t = 1 to t = 4 [4A 4T 1C]

8. Determine a quadratic function $f(x) = ax^2 + bx + c$ if its graph passes through the point (2,19) and it has a horizontal tangent at (−1,8). [3AT 2C]

9. Suggest a function that would have a derivative of $f'(x) = 12x^2 + 4x - 10$. Explain how you arrived at your answer. [2T 2C]