MHF4U - Chapter 2 Test

Expectation Tested: demonstrate an understanding of average and instantaneous rate of change, and determine numerically and graphically, and interpret the average rate of change of a function over a given interval and the instantaneous rate of change of a function at a given point.

$/calculator
running m/s km/h

1. What is a real-world application of rates of change?

2. When is the rate of change zero, constant or changing?

3. Can you graph distance vs. time and speed vs. time?

4. What is the difference between instantaneous rate of change and average rate of change?

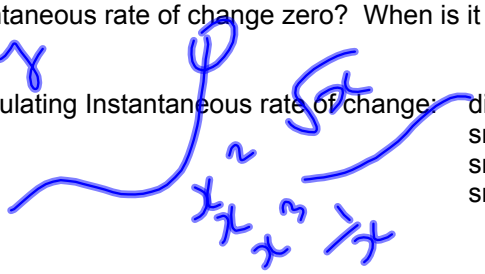
5. Average Rate of Change = slope of secant
tables, graph, equation

5.1	17
8.2	28

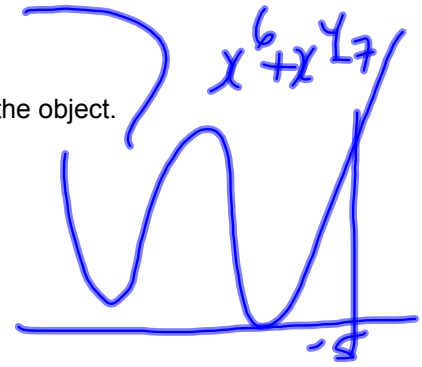
6. Instantaneous Rate of Change = slope of tangent

7. When is instantaneous rate of change zero? When is it the largest? When is it positive? When is it negative?

decreasing increasing



8. Methods of calculating Instantaneous rate of change:
difference quotient
small following interval
small preceding/following interval
small centered interval



The half life of a certain object is 4 hours. You start with 500mg of the object.
a) Determine the average rate of change in the first 12 hours.
b) When is the instantaneous rate of change the greatest?

$y = -2x^2 + 4x + 1$. Determine if there is a max or a min at x=1

2

$$f(x) = x^4 - 7$$

@ $x = 1$

$$\frac{\Delta y}{\Delta x} = \frac{f(1.01) - f(1)}{0.01} = \text{——} = 0$$

$$\frac{f(1) - f(0.91)}{0.01}$$

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a) Determine the average rate of change in the first 12 hours.
b) When is the instantaneous rate of change the greatest?

$y = a \cdot b^x$

$= 500 \cdot b^{x/4}$

$f(x) = 500\left(\frac{1}{2}\right)^{x/4}$

a) $\frac{\Delta f(x)}{\Delta x} = \frac{f(12) - f(0)}{12 - 0} = \frac{62.5 - 500}{12} = \frac{-437.5}{12} = -36.46 \text{ mg/h}$

$y = -2x^2 + 4x + 1$. Determine if there is a max or a min at $x = 1$

2

$m_T = \lim_{h \to 0} \frac{f(1+h) - f(1)}{h}$

$= \frac{-2h^2 + 3 - 3}{h}$

$= \frac{-2h^2}{h}$

$= -2h = 0$ since $h \to 0$

∴ there is a max or min

Part 2: Determine if it is a max or min

$(1+h)^2 = 1 + 2h + h^2$

$-2(1+h)^2 = -2 - 4h - 2h^2$

$4(1+h) = 4 + 4h$

$-2(1+h)^2 + 4(1+h) + 1 = -2h^2 + 3$

Sub in $h = -0.01$

$m_T = -2(-0.01)$

$= +\text{small}$

Sub in $h = 0.01$

$m_T = -2(+0.01)$

$= \text{small negative}$

∴ it is a maximum