

First Name: _____ Last Name: _____ Student ID: _____

Rates of Change

1. Given the function $f(x)=2x^3+3x^2-2x$:

- a. Find the average rate of change of the function $f(x)$ from $x=1$ to $x=2$.
- b. Find the average rate of change of the function $f(x)$ from $x=1$ to $x=1.1$.
- c. Find the average rate of change of the function $f(x)$ from $x=1$ to $x=1.01$.
- d. Find the average rate of change of the function $f(x)$ from $x=1$ to $x=1.001$.
- e. Using the results from parts b) to d), approximate the instantaneous rate of change of $f(x)$ at $x=1$

2. An object is fired upward into the air from a platform. The object's height above the ground is modeled by $h(t)=-5t^2+50t+1$ where h is the height in metres, and t is the time in seconds since the object was launched.

- a. Determine the average velocity between 4 seconds and 4.1 seconds. That is, determine the average rate of change of height between 4 seconds and 4.1 seconds. Include units.
- b. Determine the average velocity between 4 seconds and 4.01 seconds. Include units.

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c. Explain how you could approximate the instantaneous rate of change at $x=a$.

d. Approximate the instantaneous rate of change of the height of the object rounded to three decimal places, or, equivalently, the instantaneous velocity at which the object is moving, 4 seconds after it is launched.

3. The depth of water, D , in metres, at the end of a pier in Vacation Village, varies with the tides throughout the day and can be modeled by the equation $D(t)=1.5\cos[0.575(t-3.5)]+3.8$, where t is the time of day, measured in hours past 12 am.

a. Find the average rate of change of D from 2 hours to 2.5 hours.

b. Approximate the instantaneous rate of change at $t=2$ hours.

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4. Given the function, $f(x) = -x^2 - 6x + 7$:

a. Find the slope of the tangent at $x = -3$.

b. Find the equation of the tangent to the function $f(x) = -x^2 - 6x + 7$ at $x = -3$.

5. For the function $f(x) = \frac{1}{x^2}$, find the slope of the tangent at $(1, 1)$.