Math U141 Quiz F07 Prof. A. Iarrobino Name:_____
Please show all work for full credit!

1. The depth of a pollywog in inches below the surface of Houghton Pond is given by d(x) = $48x-4x^2$, x minutes after the beginning of its dive, until it returns to the surface.
A. When does the pollywog return to the surface?
B. What is its average vertical velocity between 60 and 90 seconds?

C. Determine the slope function d'(x) using a quick formula. **Ans.** d'(x)=_____.
D. Graph the depth d(x) as a function of time x. Also graph d'(x) on the same axes.
y=150

_|_____|_____|_____}_____|
x=0 x=4 x=6 x=10 x=12

E. For what value x_1 of x is d'(x)=0? What is the pollywog doing at time x_1? What special point is (x_1 ,d(x_1)) on the graph of the function d(x)?

F. a.Find the equation of the tangent line (TL) to y=d(x) at (7,140). **Ans.** _____.

b. For what value of x does this TL cross the x-axis? Explain what significance this has for the pollywog (interpret motion along the TL).

H*. What is a pollywog? (EC for either accuracy, or interesting answer (not just "tadpole").

2. Find the derivative functions $f'(x)$ for the following functions f(x)
2A. f(x)= $2x^6 - 3x^4 + 6x^{0.5} - 9$

2B. f(x)= $\sqrt[4]{x^7} - \frac{3}{\sqrt[5]{x^3}} + \pi x^e$

2C (chain rule) For f(x)= $(x^4 + 5x^2)^{-3}$ please write f(x) = g(u): specify the outside function g(x) and the inside function u(x), then find the derivative $f'(x)$.

2D. (chain rule) f(x)= $e^{-0.7x} - 5e^{-x^2} - 4e^2 + 2\sin(6e^x) + 3e^{\sqrt{x^2-4x}}$

3A. Assume that the function f(x) satisfies f(2)=4, $f'(2)$=-6, and f **"**(2)=8. Using approximation along the tangent line, estimate the value of f(2.05).

f(2.05)=_____.

Also, determine whether your estimate is too high or too low. **Ans.** _____
because _____**.**

3B. i.When f(x) is decreasing, the derivative $f'(x)$ is _____ .
ii. When the derivative $f'(x)$ is increasing the function f(x) is _____
and the second derivative $f''(x)$ is _____.

3C. For the function y=f(x) given on the board, draw the slope function, y=f **'**(x) marking points A' to F' on the slope function corresponding to A-F on the original function.

Table of derivatives:

Power rule: $(x^n)' = nx^{n-1}$, Extended power rule $(u^n)' = nu^{n-1} \cdot u'$

Chain rule $f(u)' = f'(u) \cdot u'$ or df/dt =(df/du)(du/dt)

Exponentials: $(e^x)' = e^x$, $(e^u)' = e^u u'$; $(b^x)' = b^x \cdot \ln(b)$, $(b^u)' = b^u \cdot \ln(b) \cdot u'$,

Logarithm: $(\ln x)' = 1/x$ $(\ln u)' = u'/u$

Trig: $(\sin x)' = \cos x$, $(\sin u)' = (\cos u) \cdot u'$, $(\cos x)' = -\sin x$ (radian measure assumed).

Other formulas: Average slope = $\frac{f(b)-f(a)}{b-a}$, Instantaneous slope = $f'(a)$

Exponential growth: $A = A_0 e^{kx}$