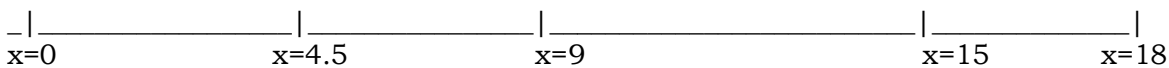


1. The depth of a pollywog in inches below the surface of Houghton Pond is given by $d(x) = 36x - 2x^2$, x minutes after the beginning of its dive, until it returns to the surface.

- A. When does the pollywog return to the surface? **Ans.** _____
 B. What is its average vertical velocity between 30 and 150 seconds? **Ans.** _____
 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.
 $y = 175$



- E. For what value x_1 of x is $d'(x) = 0$? **Ans.** $x_1 =$ _____.
 What is the pollywog doing at time x_1 ? **Ans.** _____
 What special point is $(x_1, d(x_1))$ on the graph of the function $d(x)$?
Ans. _____
 F. a. Find the equation of the tangent line (TL) to $y = d(x)$ at $(15, 90)$. **Ans.** _____.
 b. For what value of x does this TL cross the x -axis? **Ans.** _____.
 Explain what significance this has for the pollywog (interpret motion "along" the TL).
 G *. 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. $f(x) = 3x^5 - 2x^e + 7x^{0.3} - \frac{1}{x^2}$.

2B. $f(x) = \sqrt[5]{x^8} - \frac{3}{\sqrt[4]{x^7}} + 2$

2C (chain rule) For $f(x) = \sqrt{x^3 - 9x}$ 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) $f(x) = e^{-0.3x} - 5e^{-3x^2} - 2\pi + 2\ln(3x + 5)$

