1. (6 pts) Given the following semi-annual profit data for your firm (in millions of dollars) over the last three years.

a. (4 pts) Use a centered difference to find the local linearization at 2 years (in point-slope form).

b. (2 pts) Plot the data, and your local linearization function (use a straight-edge).

Out[89]//TableForm=

time t (years)	Profit (Millions)
0.	-2.
0.5	-2.86927120639537
1.	-3.16896691991602
1.5	-2.41119821742317
2.	-0.209317904491192
2.5	3.50365891946918
3.	8.24122110573389

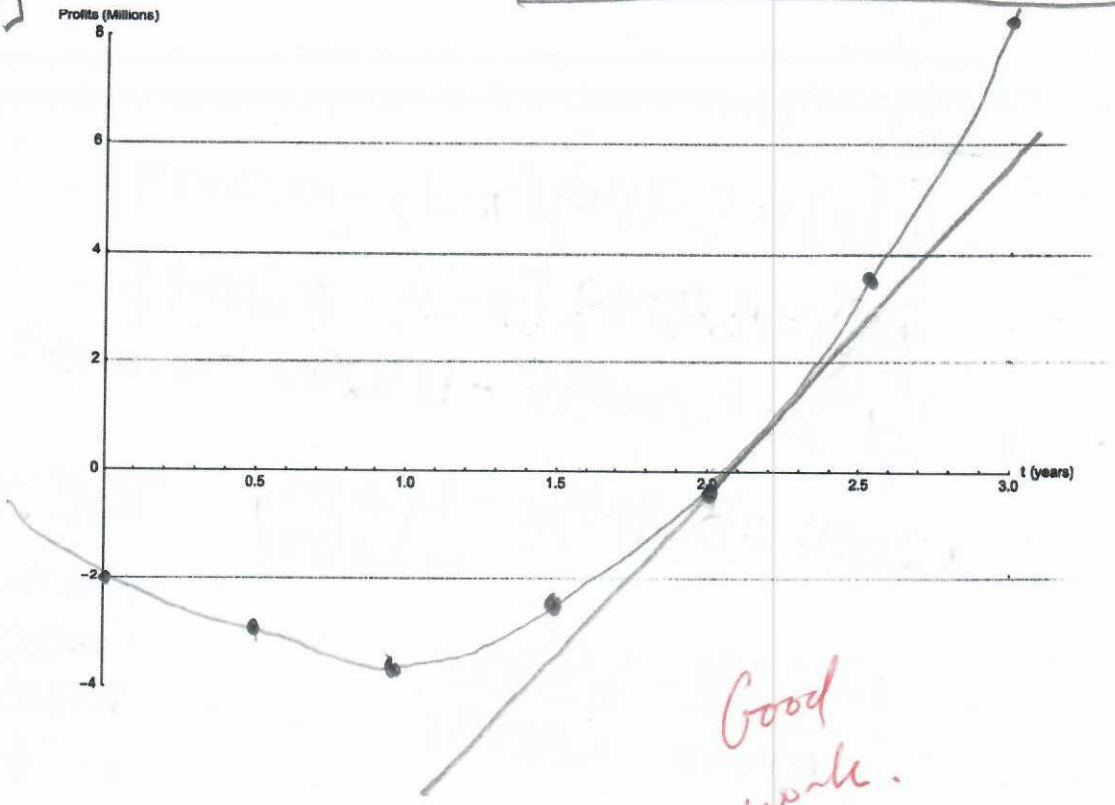
$L(x) = f'(a)(x-a) + f(a)$

$L(x) = f'(a)(x-2) - 0.209$

$\frac{3.5037 + 2.4112}{2.5 - 1.5} = 5.9149$

a] $L(x) = 5.9149(x-2) - 0.2093$

b]



Good work.

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when $t=2$

$f(x) \approx -0.209 + (x-2)(5.914) = L(x)$

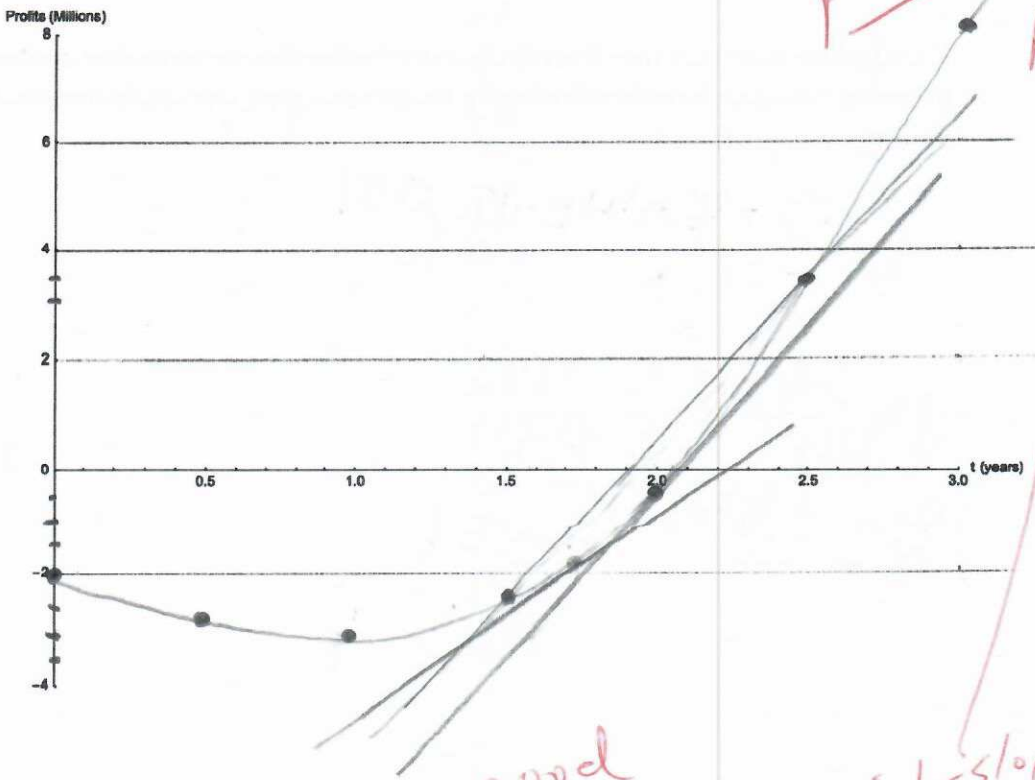
$f(x) \approx -0.209 + 5.914x - 11.828$

$f(x) \approx 5.914x - 12.037$

slope $= 5.914$

$\frac{(3.503 - (-2.411))}{(2.5 - 1.5)}$

point-slope



good

point-slope shows us the point of "tangency" $L(x) = 5.914(x-2) + (-0.209)$ + its rate of increase there

MAT128, Quiz 5 -- Spring, 2024

Name:

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centered difference

$\frac{-2.411 - 3.5}{1.5 - 2.5} = 5.9$

$y = f'(a)(x-a) + f(a)$

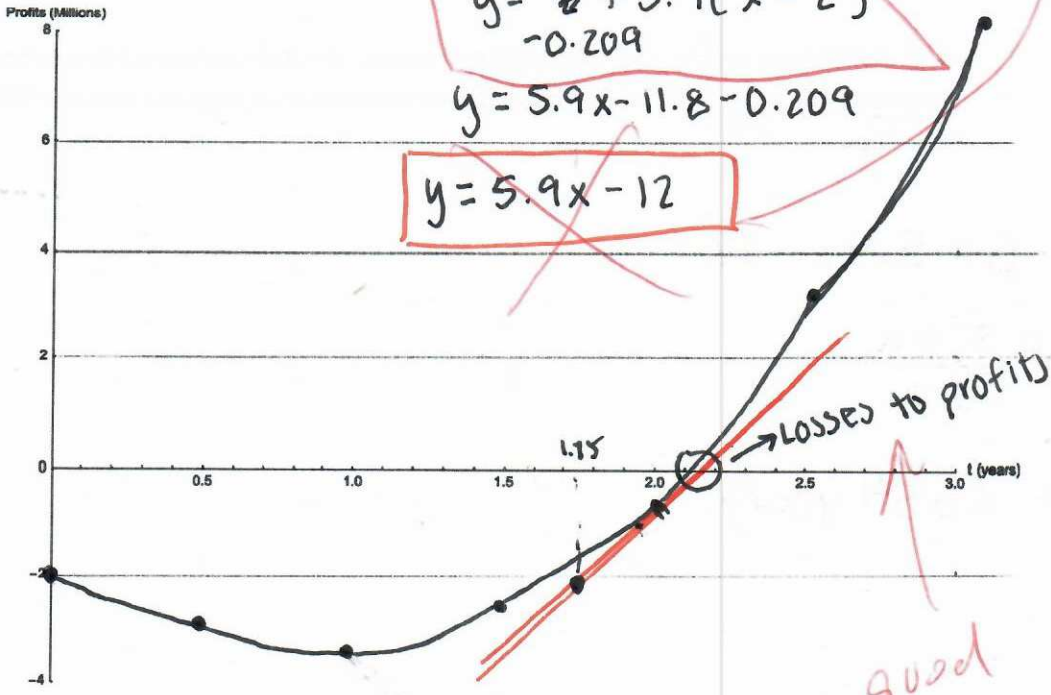
$f'(a) = 5.9$

$f(a) = -0.209$

$y = 5.9(x-2) - 0.209$

$y = 5.9x - 11.8 - 0.209$

$y = 5.9x - 12$



good picture

2. (2 pts) Use your local linearization to estimate the profits (losses, actually) at year 1.75. Do you suspect that this is an over- or under-estimate? Why?

$f(x) \approx 5.9149(1.75-2) - 0.2093$

$f(1.75) \approx -1.6880$ million dollars ✓

I suspect that this is an under-estimate because the function is concave up, leaving the tangent line (and therefore, its' values) below the actual values of the function.

overly negative

I guess you mean.

3. (2 pts) We can use the local linearization to estimate the moment when our firm crossed from losses to profits. Solve the local linearization for the t intersection, and so estimate the time at which the transition occurred.

$f(x) \approx 5.9149(x-2) - 0.2093$

$0 = 5.9149(x-2) - 0.2093$

$= 5.9149x - 11.8298 - 0.2093$

$+12.0391 = 5.9149x - 12.0391$
$+12.0391$

$\frac{12.0391}{5.9149x} = \frac{5.9149x}{5.9149x}$

$x = 2.0354$

The time at which the firm crosses from losses to profits is $t = 2.0354$ years.

Well done