

# MAT128, Quiz 5 Key -- Spring, 2024

Name:

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[179]/TableForm=

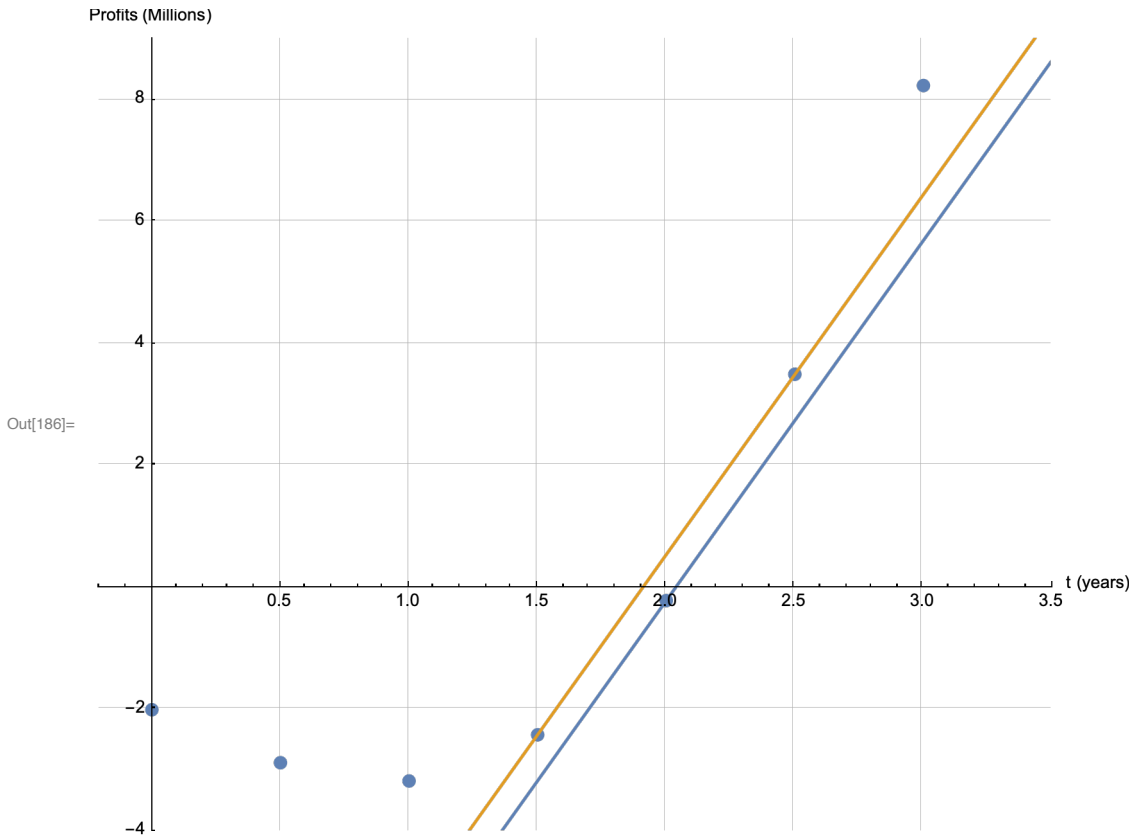
time t (years)	Profit (Millions)
0.	-2.
0.5	-2.86927120639537
1.	-3.16896691991602
1.5	-2.41119821742317
2.	-0.209317904491192
2.5	3.50365891946918
3.	8.24122110573389

$$m = (3.50 - (-2.41)) / (2.5 - 1.5)$$

Out[181]= 5.91

local linearization L(t) at (t=2):

Out[185]=  $-0.21 + 5.91(-2 + t)$



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?

local linearization evaluated at  $(t=1.75)$ :

Out[188]= -1.6875

I expect that -1.6875 million dollars is too low, because it appears that profits were concave up over that period; so the tangent line is perhaps below the actual “profit function” (even though we don’t know what that was there -- which is why we’re estimating it!)

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 (A: about 2.035 years in).

When does the local linearization  $L(t) = -0.21 + 5.91(t-2) = 0$ ?

Out[190]=  $\{t \rightarrow 2.03553299492386\}$

