

True/False - No explanation needed. (1pt for correct, 0pt - no answer, -1pt - incorrect)

1. Formulating the data likelihood and setting its derivative to 0 is always a good method to find the MLE. True/False
False. Sometimes we have to take the log of likelihood to facilitate taking its derivative.
2. We cannot apply the MLE method to the distribution with more than one parameter. True/False
False. Say, normal distribution.

Problems - Need justification. No justification means **zero**!

1. (10pts) Over all years, the MATH 10B midterm mean is 100 and the std is 20. This year, the instructor takes a sample of 25 students whose midterm mean is 112. He believes that students of this year are smarter than the average over years. Take the significance level $\alpha = 0.05$.
(a) Perform the hypothesis test of his belief and draw a conclusion, i.e. formulate hypotheses, state one-sided/two-sided test, calculate p-value, draw conclusion.
Hint: use $\bar{\sigma} = \frac{\sigma}{\sqrt{n}}$
 $H_0 : \mu = \mu_0 = 50$ vs $H_1 : \mu > \mu_0 = 50$, one-sided test
 $z\text{-score} = \frac{112 - 100}{20/\sqrt{25}} = 3$
 $p\text{-val} \approx 0.5 - 0.4987 = 0.0013 < \alpha = 0.05$, so rejecting the null H_0 . Conclusion: there is strong evidence supporting that this year students are smarter than the previous year ones.

(b) Calculate critical value and find the rejection region.
Critical value: $100 + 1.96 * 10/\sqrt{25} = 103.92$, rejection region is $[103.92, \infty)$