(3 pts.) 1. In each experiment below, determine whether the data are obtained independently or are paired. If the data are independent, please explain your reasoning. If the data are paired, indicate the common characteristic.

(1 pt.) a) A researcher investigating home-insurance costs obtained a random sample of 20 homes in the Northeast and another random sample of 20 homes in the South. The yearly insurance cost for each home was recorded. The data will be used to determine whether there is any difference in the mean yearly home-insurance costs between the Northeast and the South. – independent.

(1 pt.) b) An automobile manufacturer claims that using a lighter weight engine oil can actually increase a car's miles per gallon (of gasoline). A random sample of cars (and drivers) was selected, all who currently use a heavy weight oil in their engines. The miles per gallon for each car was recorded. The engine oil was drained, a lighter weight oil was used, and the miles per gallon was recorded again. The data will be used to determine if the mean miles per gallon has increased.

(1 pt.) c) A random sample of sixty 20-year-old males and a random sample of forty-five 70-year-old males were obtained. The length of each person's right ear was measured (in inches). The data will be used to determine whether the mean ear length of a 70-year-old male is greater than the mean ear length of a 20-year-old male.

(10 pts.) 2. Each employee hired at an electronics parts assembly line in Edmonton, Alberta, is given a general intelligence test. To determine which method of training is more effective, eight pairs of new hires were matched according to their exam scores. One set of employees was asked to read appropriate training manuals, while the other group watched interactive training videos. Each employee was then asked to assemble a part used in a locater-beacon transmitter, and the time (in minutes) to completion was recorded. The summary data are given in the following table.

Type of training	$\bar{x}$	n	s
Written Manual	5.0625	8	0.3068
Interactive Video	4.4750	8	1.0753
Manual – Video	0.5875	8	0.9687

(1 pt.) a) Should this situation be analyzed via a 2-sample independent or paired method? Please explain your answer.
(6 pts.) b) Is there any evidence to suggest the true mean time difference is different from 0? Assume normality and use α = 0.01. Remember to include the complete 4-step method in the hypothesis test.
(2 pts.) c) Calculate and interpret the appropriate confidence interval or bound.
(1 pt.) d) In practical terms, does the data imply that the true mean time difference is different from 0? This part uses the information from parts b) and c), however, if no addition reasoning is provided, you will receive 0 points.

(10 pts.) 3. A company that produces hospital furniture has two assembly lines dedicated to cutting and drilling wood for medical cabinets. Each computer-controlled process is designed to drill holes in a certain cabinet part with depth 12.7 mm. Random samples of drilled holes were obtained from the two assembly lines, the resulting hole depths (in mm) were recorded. Assume the underlying populations are normal. The summary data are given in the following table.

Line	$\bar{x}$	n	s
1	12.541	16	0.3776
2	12.818	16	0.2588
1 – 2	-0.256	16	0.4749

(1 pt.) a) Should this situation be analyzed via a 2-sample independent or paired method? Please explain your answer.

(6 pts.) b) Is there any evidence to suggest that Line 2 is producing holes with a greater population mean depth than Line 1? Use $\alpha = 0.01$. Remember to include the complete 4-step method in the hypothesis test.

(2 pts.) c) Calculate and interpret the appropriate confidence interval or bound.

(1 pt.) d) In practical terms, does the data imply that the true mean depth for line 2 is greater than the true mean depth for line 1? This part uses the information from parts b) and c), however, if no addition reasoning is provided, you will receive 0 points.

(3 pts.) 4. Many people consume protein shakes to help build muscle mass and eliminate body fat. In a recent study, the amount of protein in two competing drinks was compared. Independent random samples were obtained, and the protein content (in grams) in each drink was measured. The summary statistics and known variances are given in the following table.

Protein drink	Sample size	Sample mean	Population variance
Met-Rx	12	39.38	5.06
Pure Gro	24	39.01	6.01

(2 pts.) a) Determine and interpret the 99% confidence interval for the difference of the population mean protein content (Met-Rx - Pure Gro).

(1 pt.) b) Predict what your conclusion would be if you performed a hypothesis test to determine if the amount of protein in these two drinks was the same or not at a significance level of 1%. Justify your answer. If any part of the hypothesis test is provided in the answer you will receive 0 points.