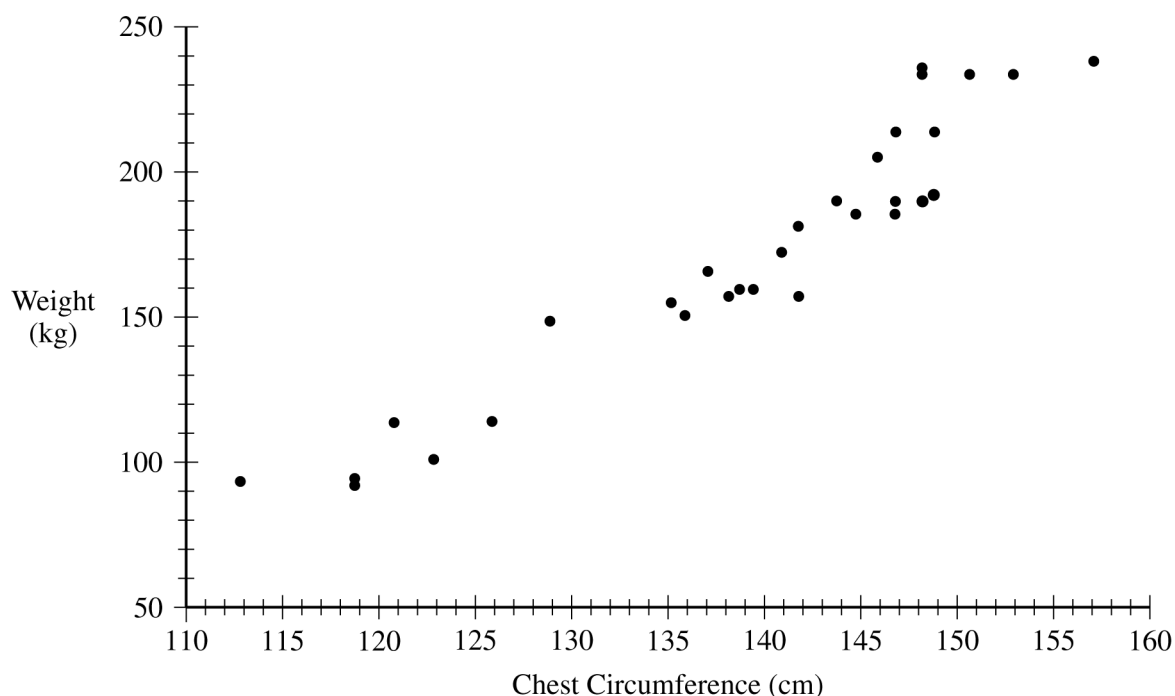


Begin your response to **QUESTION 5** on this page.

5. Wildlife biologists are interested in the health of tule elk, a species of deer found in California. An important measurement of tule elk health is their weight. The weight of a tule elk is difficult to measure in the wild. However, chest circumference, which is believed to be related to the weight of a tule elk, can easily be measured from a safe distance using a harmless laser. A study was done to investigate whether chest circumference, in centimeters (cm), could be used to accurately estimate the weight, in kilograms (kg), of male tule elk. For the study, wildlife biologists captured 30 male tule elk, measured their chest circumference and weight, and then released the elk. The data for the 30 male tule elk are shown in the scatterplot.



- (a) Describe the relationship between chest circumference and weight of male tule elk in context.

**GO ON TO THE NEXT PAGE.**

Continue your response to **QUESTION 5** on this page.

Following is the equation of the least-squares regression line relating chest circumference and weight for male tule elk.

$$\text{predicted weight} = -350.3 + 3.7455(\text{chest circumference})$$

- (b) The weight of one male tule elk with a chest circumference of 145.9 cm is 204.3 kg.
- (i) Using the equation of the least-squares regression line, calculate the predicted weight for this male tule elk. Show your work.
- (ii) Calculate the residual for this male tule elk. Show your work.

**GO ON TO THE NEXT PAGE.**

Continue your response to **QUESTION 5** on this page.

The equation of the least-squares regression line relating chest circumference and weight for male tule elk is repeated here.

$$\text{predicted weight} = -350.3 + 3.7455(\text{chest circumference})$$

(c) Interpret the slope of the least-squares regression line in context.

(d) The sambar, another species of deer, is similar in size to the tule elk. The slope of the population regression line relating chest circumference and weight for all male sambars is 4.5 kilograms per centimeter. A wildlife biologist wants to determine whether the slope of the population regression line for male tule elk is different than that for male sambars. Let  $\beta$  represent the slope of the population regression line for male tule elk. The wildlife biologist conducted a test of the following hypotheses using the sample of 30 tule elk.

$$H_0: \beta = 4.5$$

$$H_a: \beta \neq 4.5$$

The test statistic was calculated to be 3.408. Assume all conditions for inference were met.

(i) Determine the  $p$ -value of the test.

**GO ON TO THE NEXT PAGE.**

Continue your response to **QUESTION 5** on this page.

- (ii) At a significance level of  $\alpha = 0.05$ , what conclusion should the wildlife biologist make regarding the slope of the population regression line for male tule elk? Justify your response.

**GO ON TO THE NEXT PAGE.**

Begin your response to **QUESTION 6** on this page.

**STATISTICS**

**SECTION II, Part B**

**Suggested Time—25 minutes**

**1 Question**

**Directions:** Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

6. A jewelry company uses a machine to apply a coating of gold on a certain style of necklace. The amount of gold applied to a necklace is approximately normally distributed. When the machine is working properly, the amount of gold applied to a necklace has a mean of 300 milligrams (mg) and standard deviation of 5 mg.
- (a) A necklace is randomly selected from the necklaces produced by the machine. Assuming that the machine is working properly, calculate the probability that the amount of gold applied to the necklace is between 296mg and 304mg.

**GO ON TO THE NEXT PAGE.**

**Question 5: Multi-Focus****4 points****General Scoring Notes**

- Each part of the question (indicated by a letter) is initially scored by determining if it meets the criteria for essentially correct (E), partially correct (P), or incorrect (I). The response is then categorized based on the scores assigned to each letter part and awarded an integer score between 0 and 4 (see the table at the end of the question).
- The model solution represents an ideal response to each section of the question, and the scoring criteria identify the specific components of the model solution that are used to determine the score.

Model Solution	Scoring
<b>(a)</b> The scatterplot reveals a strong, positive, roughly linear association between the chest circumference and weight of tule elk. There are no points that seriously deviate from the straight-line pattern of the points in the plot.	<p><b>Essentially correct (E)</b> if the response provides a description that includes at least three of components 1-4 and component 5:</p> <ol style="list-style-type: none"> <li>Direction of association (positive or increasing)</li> <li>Strength of association (strong)</li> <li>Form of association (linear or approximately linear)</li> <li>Unusual features (no points with large discrepancies from the straight-line pattern exhibited by most of the points on the plot)</li> <li>Context (association between chest circumference and weight of tule elk)</li> </ol> <p><b>Partially correct (P)</b> if the response satisfies only one or two components out of components 1-4 and component 5  OR  if the response satisfies at least two out of components 1-4 but does not satisfy component 5.</p> <p><b>Incorrect (I)</b> if the response does not meet the criteria for E or P.</p>

**Additional Notes:**

- To satisfy component 4 it is sufficient to simply indicate that there are no unusual features or no outliers.
- To satisfy component 5 it is minimally sufficient for the response to refer to the association or relationship between chest circumference or measurement and weight without explicitly mentioning tule elk.
- The quality of communication in part (a) should be considered if holistic scoring is required.

Model Solution	Scoring
<p>(b) (i) The predicted weight of a male tule elk with a chest circumference of 145.9 cm is <math>-350.3 + 3.7455(145.9) \approx 196.17</math> kg.</p> <p>(ii) The residual for a male tule elk with a chest circumference of 145.9 cm with an actual weight of 204.3 kg is <math>204.3 - 196.17 \approx 8.13</math> kg.</p>	<p><b>Essentially correct (E)</b> if the response satisfies the following two components:</p> <ol style="list-style-type: none"> <li>1. Provides the correct value of 196.17 kg in part (b-i) with work shown</li> <li>2. Provides the correct value of 8.13 kg in part (b-ii), or a value consistent with the predicted weight calculated for component 1, with work shown</li> </ol> <p><b>Partially correct (P)</b> if the response satisfies only one of the two components required for an E  OR  the response gives both correct values with no work shown.</p> <p><b>Incorrect (I)</b> if the response does not meet the criteria for E or P.</p>

**Additional Notes:**

- An arithmetic or transcription error in a response can be ignored if correct work is shown.
- A response that includes an undefined or incorrect variable to identify work shown (e.g.,  $x$  or  $\hat{p}$ ) does not satisfy component 1.