## Ch 17: Problem Solving and Data Analysis

### Ratios, Rates & Proportions:

-Basic Proportions

-Turn a ratio into a fraction

-Put an "x" next to it

1. A group of 315 students and teachers went on a field trip. The ratio of students to teachers was $\frac{20}{1}$. Out of all the teachers who attended the field trip, $\frac{2}{3}$ of them have brown eyes. Approximately how many of the teachers who attended the field trip do **NOT** have brown eyes?
   A) 5
   B) 10
   C) 100
   D) 200

-Per means "divide" (as does "for each" and "every")

2. An administrative assistant is trying to decide which size laptop he should buy. He has 2 options: a 13-inch rectangular model and a 15-inch rectangular model. The size of each model is measured along its screen's diagonal. The width of the 13-inch model's screen is 10 inches, and the width of the 15-inch model's screen is 11 inches. If the 13-inch model costs $1000 and the 15-inch model costs $1200, which model should the administrative assistant buy to maximize the area of the laptop per dollar?
   A) The 13-inch model
   B) The 15-inch model
   C) Both models have the same screen area per dollar
   D) Not enough information

**UNITS**

-Dimensional Analysis

-Average (Speed)= Total / Total

3. The New York City Marathon, which is approximately 42 kilometers long, took a runner 4 hours and 20 minutes to complete. What was the runner's average speed over the course of the marathon in meters per second? (1 kilometer = 1000 meters)
    A) 1
    B) 2.69
    C) 2.78
    D) 10

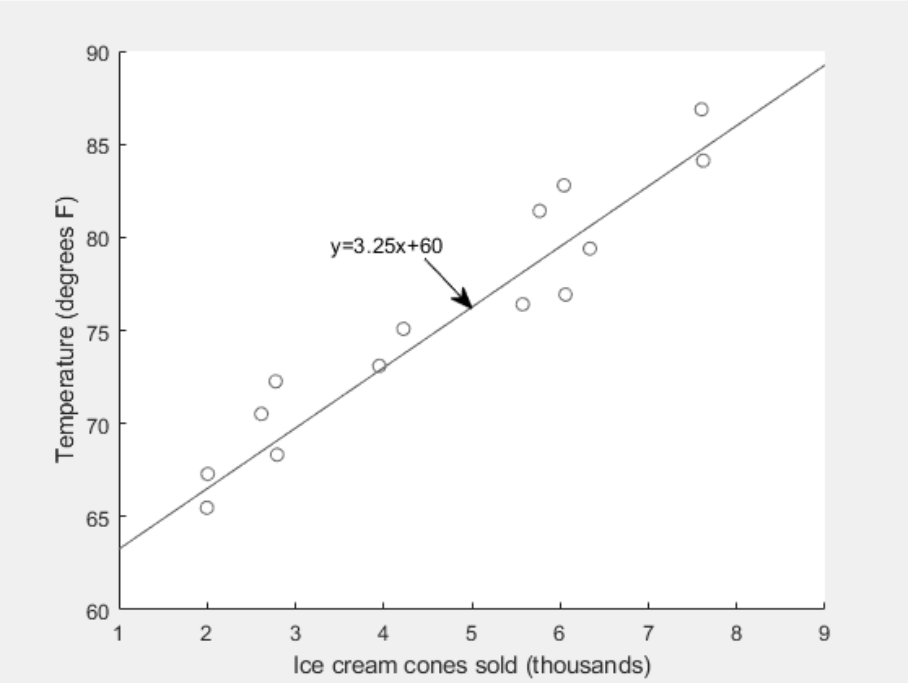
Ratios, Rates & Proportions

4. The government is considering a proposition to combine North Dakota and South Dakota into a new state called Dakota. North Dakota currently has a population of 700,000 people and a population density of 10 people per square mile. After the proposed combination, Dakota would have an area of 150,000 square miles and a population density of $\frac{32}{3}$ people per square mile. What is the present population density of South Dakota, in people per square mile?
    A) 10
    B) 10.75
    C) 11.25
    D) 12.5

5. A special fruit store typically sells pears for $2 per pound, which is equivalent to $\frac{5}{3}$ of the wholesale cost of pears. The store wants to run a promotion where they would sell a pound of pears for $\frac{4}{3}$ of the wholesale cost for pears, with the limitation that the customer must buy at least 2 pounds of pears. During this promotion, how much would the store charge for 2 pounds of pears in dollars?
    A) 1.6
    B) 2.5
    C) 3.2
    D) 5

## Scatterplots

6. The following plot outlines the ice cream sales vs temperature of Jeremiah's ice cream stand on any given day. According to the line of best fit, at what temperature in degrees F should the stand expect to sell 10,000 ice cream cones?




A) 90
B) 92.5
C) 95
D) 92500

## Linear and Exponential Growth

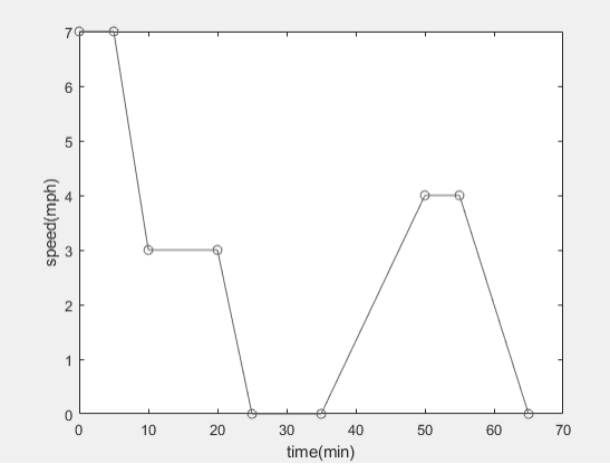
7. A colony of rabbits has an initial population (at $t = 0\ months$) of 7 rabbits. Every month, the size of the colony doubles. Which of the following functions represents the population of rabbits, $P(t)$, after $t$ months?
   A) $P(t) = 7 + 2t$
   B) $P(t) = 7 * t^2$
   C) $P(t) = 7 + 2^t$
   D) $P(t) = 7 * 2^t$

8. Johnny's old refrigerator broke, and he needs to buy a new one. However, he cannot afford to purchase a refrigerator outright. So, he takes out a $1000 loan from a store's consumer finance department with 7% simple interest per month. After 5 months, Johnny pays down $1000 of his outstanding loan. According to the agreement, how much more money does Johnny owe the store?
   A) $0
   B) $70
   C) $350
   D) $501

9. Johnny's old refrigerator starts working again! He decides to sell the refrigerator to some college students across the street for $800, to be paid over time plus interest. He decides that the students will pay him $800 at an annual interest rate of 10%, compounded once every 3 months. Which of the following equations gives the total amount, A, in dollars, that the students will owe Johnny after k months? Ignore any calculations made in #8.
   A) $A = 800(1 + 0.1k)$
   B) $A = 800(1 + 0.025)^k$
   C) $A = 800(1 + 0.025)^{\frac{k}{3}}$
   D) $A = 800(1 + 0.1)^{4k}$

## Key Features of Graphs

10. A cyclist is riding along a road when she hits a nail and pops one of her tires. She then stops to replace the broken tire. After fixing the tire, she reverses direction on the road, riding until she reaches home. The graph below displays the cyclist's speed in miles per hour versus time in minutes for the duration of this interval. During which time interval did the tire replacement most likely occur?




A) (0,5)
B) (10,20)
C) (25,35)
D) (50,55)

## Table Data

11. A college professor recently administered a final exam where a surprisingly large portion of his class failed. To try and understand why, the professor surveyed his class, asking students how long they studied for the test. The results of the survey can be seen the table below:

| | Passed the test | Failed the test | Total |
|---|---|---|---|
| Studied less than 2 hours | 2 | 38 | 40 |
| Studied at least 2 hours | 13 | 2 | 15 |
| Total | 15 | 40 | 55 |

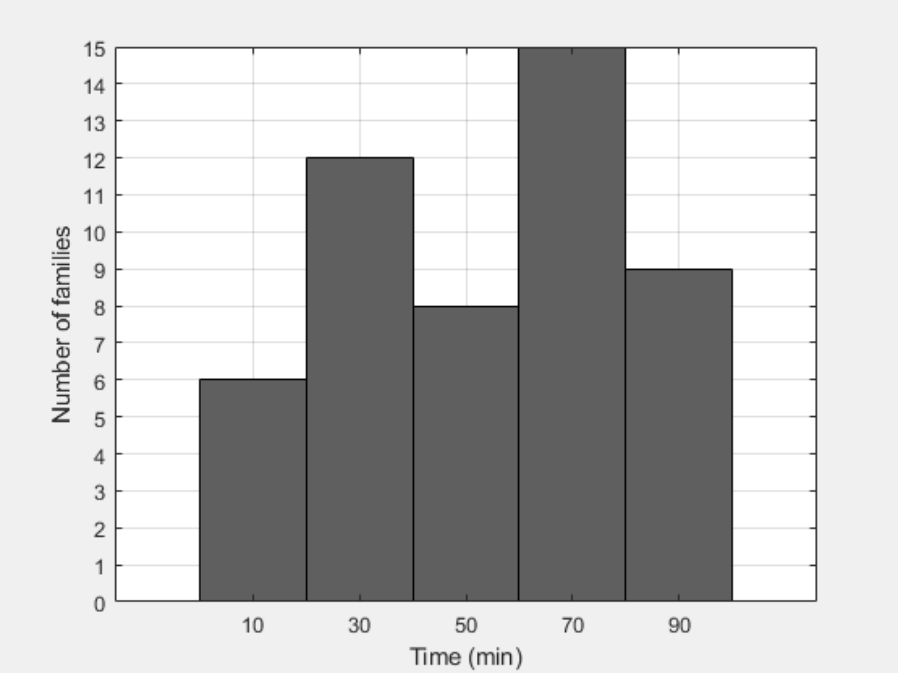
According to the data the professor collected, what is the probability that a student failed the test given that they studied at least two hours?

A) 8%
B) 13.33%
C) 25%
D) 60%

## Center, Shape & Spread of Distributions

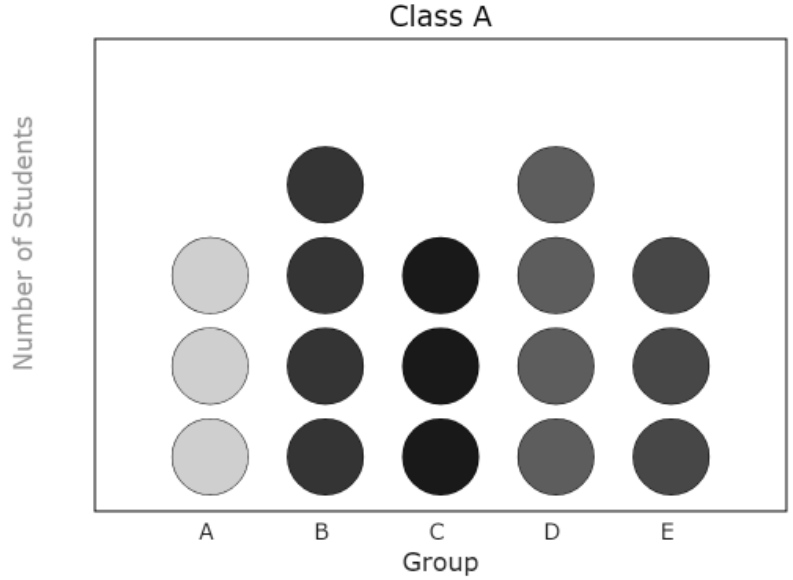
## (Mean, Median, Mode, Range & Standard Deviation)

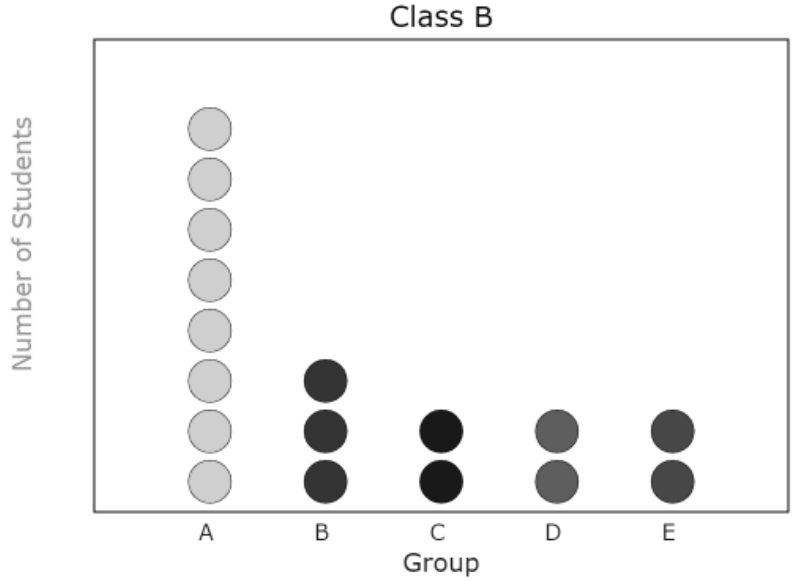
12. The following histogram represents the time that families in a certain town spend eating dinner on an average night. The first bar represents all families who spent at least 0 and no more than 20 minutes eating dinner, the second bar represents all families who spent at least 20 and no more than 40 minutes eating dinner, etc. Which of the following could possibly be the median and mean time spent, in minutes, eating dinner for the given families?




A) Mean = 50, Median =43
B) Mean = 65, Median =56
C) Mean = 45, Median =38
D) Mean = 40, Median =50

13. A teacher asked each of her two classes to form five separate groups, labeled A-E, of any size. The distribution of students within the groups is as follows:




Which of the following is a correct deduction about the relative standard deviations between the classes?

A) The standard deviation of group size in Class A is larger
B) The standard deviation of group size in Class B is larger
C) The standard deviation of group size is the same between classes
D) None of the above deductions can be made without additional information

## Data Inferences

14. A laptop company finds that, on average, its laptop batteries last 1000 days before needing to be replaced, with a margin of error of 100 days. Which of the following could be the number of days a laptop battery can last before needing to be replaced?

    A) 500
    B) 1000
    C) 1500
    D) All of the above

## Data Collection and Conclusions

15. An animal scientist wanted to test the effect of a hormonal drug on African ground squirrels. The scientist randomly picked half of the squirrels and administered the drug to them. The scientist then administered a saline solution (which in no way affects the squirrels) to the other half of the population to remove bias. After studying the behavior of the squirrels for several months, the scientist concluded that the hormonal drug greatly increases the aggression of African ground squirrels. Is this a valid conclusion? Why?

    A) Yes, as the sample was random and unbiased
    B) Yes, as the sample was random and biased
    C) No, as the sample was unbiased and not random
    D) No, as the sample was biased and not random

**Answers:**

**1. A 2. B 3. B 4. C 5. C 6. B 7. D 8. C 9. C 10. C 11. B 12. A**

**13. B 14. B 15. A**

**Explanations:**

1. **A.** If 315 students went on the trip, and there is a ratio of 20 students to 1 teacher, then $315\ students * \frac{1\ teacher}{20\ students} = 15.75$ teachers went on this trip. Now, in reality, it is impossible to have 15.75 people, but since we are in the middle of the problem, we CANNOT round up yet. Out of all of the teachers who went, $\frac{2}{3}$ had brown eyes. That means that $1 - \frac{2}{3} = \frac{1}{3}$ of the teachers did not have brown eyes. If we take the total number of teachers and multiply it by the number of teachers without brown eyes, we get $15.75 * \frac{1}{3} =$

$5.25$ teachers without brown eyes. Since we have finished the problem, we can round to get 5 teachers.

2. **B.** This question asks which laptop the assistant should purchase in order to maximize screen area per dollar. This means that we will have to calculate the screen area per dollar for each laptop. The screens are both rectangles, and the area formula for a rectangle is length times width. We are given the width and the diagonal of each laptop, and we can use width and the diagonal to calculate area. The width of the 13-inch model is 10 inches. We can use the Pythagorean Theorem to calculate the length of the model, with the width of the model acting as one leg of triangle and the diagonal acting as the other: $10^2 + L^2 = 13^2 \rightarrow L^2 = 13^2 - 10^2 \rightarrow L^2 = 169 - 100 \rightarrow L^2 = 69 \rightarrow L = \sqrt{69} \rightarrow L \approx 8.31$. That means that the screen area of the 13-inch model is $10 * 8.31 = 83.1$. Since the 13-inch model costs $1000, its screen area per dollar is $\frac{83.1}{1000} = 0.0831$. Doing the same for the 15-inch model, we get $11^2 + L^2 = 15^2 \rightarrow L^2 = 15^2 - 11^2 \rightarrow L^2 = 225 - 121 \rightarrow L^2 = 104 \rightarrow L = \sqrt{104} \rightarrow L \approx 10.2$. The screen area of the 15-inch model is thus $11 * 10.2 = 112.2$, and its screen area per dollar is $\frac{112.2}{1200} = 0.0935$. Since $0.0935 > 0.0831$, the 15-inch model maximizes screen area per dollar.