

Name: _____ Hour: _____ Date: _____

Learning Targets

- Interpret a Type I error and a Type II error in context. Give a consequence of each error in a given setting.

Lesson 9.1: Day 2: Should Rockford switch to bottled water?



WOLVERINE



The Wolverine Worldwide (a shoe company in Rockford) improperly disposed of chemicals (PFAS), which have leaked into the ground water. The state of Michigan says that if more than 7% of households in a city exceed the safe limit, the city needs to switch to bottled water. A concerned citizen takes a random sample of 100 households and finds that 12 have unsafe water. Do the data provide convincing evidence that Rockford should switch to bottled water?

1. State appropriate hypotheses for performing a significance test. Use $\alpha = 0.05$.

2. (a) After conducting a significance test, a P -value of 0.025 is found. Interpret this value.

(b) Based on the P -value, should Rockford keep the current water or switch to bottled water? Explain.

(c) Let's suppose this decision is wrong. What would be a consequence of this error?

(d) If the water is safe, what is the probability that this error will occur?

3. (a) Now suppose the P -value was 0.217. In this case, would the city keep the current water or switch to bottled water?

(b) Let's suppose this decision is wrong. What would be a consequence of this error?

4. Are the consequences in question #2 or question #3 more serious? Explain.

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Lesson 9.1 Day 2 – Type 1 and Type 2 Errors

Important ideas:

Type I Error:

Type II Error:

Check Your Understanding

The manager of a fast-food restaurant wants to reduce the proportion of drive-thru customers who have to wait longer than 2 minutes to receive their food after placing an order. Based on store records, the proportion of customers who had to wait longer than 2 minutes was $p = 0.63$. To reduce this proportion, the manager assigns an additional employee to drive-thru orders. During the next month, the manager collects a random sample of 250 drive-thru times and finds that $\hat{p} = \frac{144}{250} = 0.576$. The manager then performs a test of the following hypotheses at the $\alpha = 0.10$ significance level:

$$H_0: p = 0.63$$

$$H_a: p < 0.63$$

where p = the true proportion of drive-thru customers who have to wait longer than 2 minutes to receive their food.

1. Describe a Type I error and a Type II error in this setting.

2. Which type of error is more serious in this case? Justify your answer.

3. Based on your answer to Question 2, do you agree with the company's choice of $\alpha = 0.10$? Why or why not?