

Homework 9.5: Margin of Error

Name: Key!

Math 3

Fill in the blank for each of the following questions.

1. If you use the sample proportion \hat{p} from a simple random sample of size n to estimate an unknown population proportion p , then the **margin of error** for 95% confidence is roughly equal to 0.04

$$ME = 1.96 \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

2. When constructing a 95% confidence interval for proportions, what would be the approximate margin of error for a sample size of smokers and non smokers if 200 are polled and 18 smoked? 0.04

$$\hat{p} = \frac{18}{200} = 0.09 \quad ME = 1.96 \sqrt{\frac{0.09(1-0.09)}{200}} = 0.04$$

3. By increasing the sample size, the margin of error becomes smaller (larger/smaller) and the length of the confidence interval narrows (widens/narrows).

For #4 - 8: A doctor noticed that many female patients were Vitamin D deficient. She would like to determine what proportion of her patients are deficient. She chooses a random sample of 45 medical files of female patients and finds that 37 of these patients are Vitamin D deficient. $\hat{p} = 37/45 = 0.82$

4. What is the margin of error for a 95% confidence interval? 0.11

$$ME = 1.96 \sqrt{\frac{0.82(1-0.82)}{45}} = 0.11$$

5. Construct the 95% confidence interval. 0.71 to 0.93

6. Make a 95% confidence statement about the percent of the doctor's female patients are Vitamin D deficient.

With 95% confidence, the population proportion falls w/in 0.71 and 0.93 w/ female patients who are vitamin D deficient.

7. The doctor is unhappy with the confidence interval. It is so wide that she does not feel that she has a good estimate of the proportion of patients with Vitamin D deficiency. What could she do to narrow the interval?

Widen her sample size.

8. If she increases the number of patient files in her sample to 180, what will happen to the margin of error?

It should stay approximately the same.

For #9-11: George Sanchez is running for mayor of a city with a voting population of approximately 250,000. He has only one opponent. Three months before the election, George pays a polling company to survey voters to find what proportion of all voters plan to vote for him.

9. The polling company surveys 500 voters and finds that 236 voters plan to vote for George. Construct a 95% confidence interval for the proportion of all voters who intend to vote for George.

$$\hat{p} = 236/500 = 0.472 \quad ME = 1.96 \sqrt{\frac{0.472(1-0.472)}{500}} = 0.04$$

$$95\% \text{ CI: } 0.432 \text{ to } 0.512$$

10. Make a confidence statement about the percent of all voters in the city who plan to vote for George.

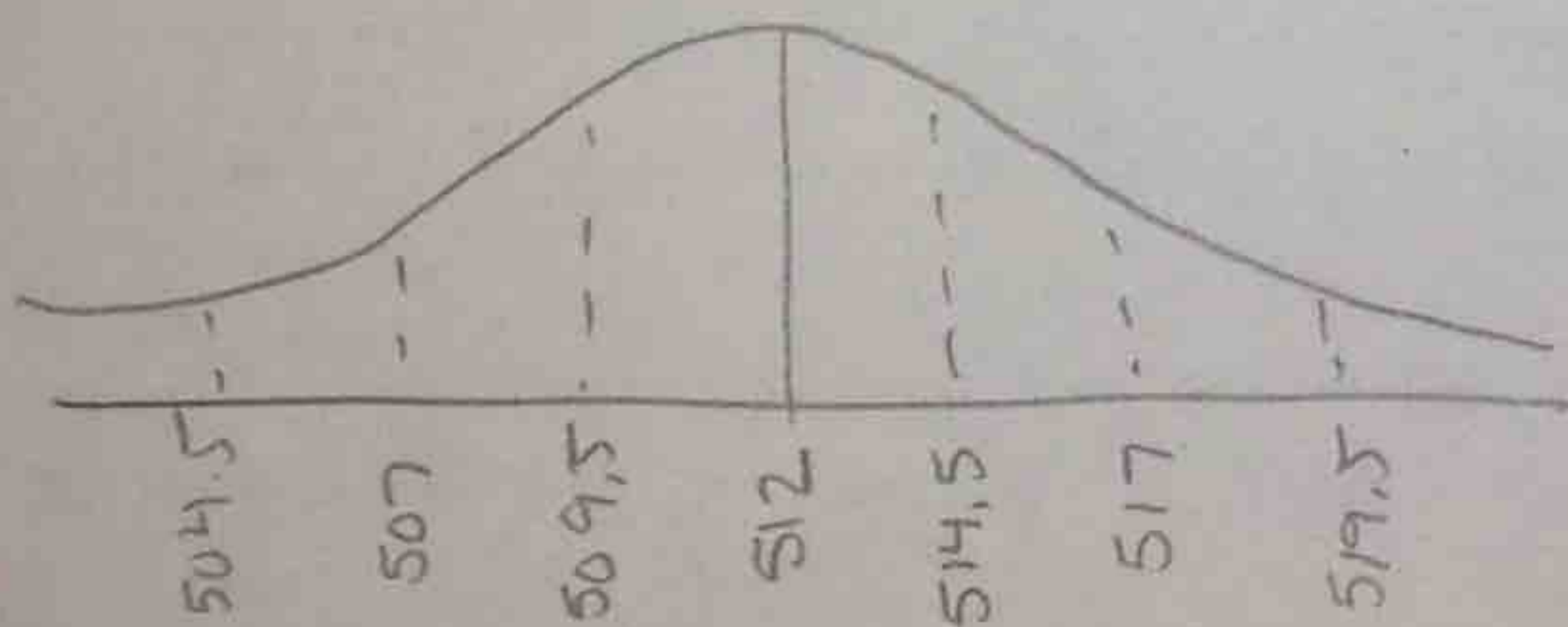
with 95% confidence, 43.2% to 51.2% of the voting population plan on voting for George.

11. As the day of the election drew closer, the polling company increased the sample size. For the polling company, this increase means more money. George knows little statistics. Explain to him why increasing the sample size is important to him.

Increasing the sample size will narrow the confidence interval so George has a better idea of how many ppl voted for him.

Normal Distribution Review:

12. Given an average mean of 512, with a standard deviation of 2.5. Draw a normal curve and find the z scores of 492, 550, and 511.

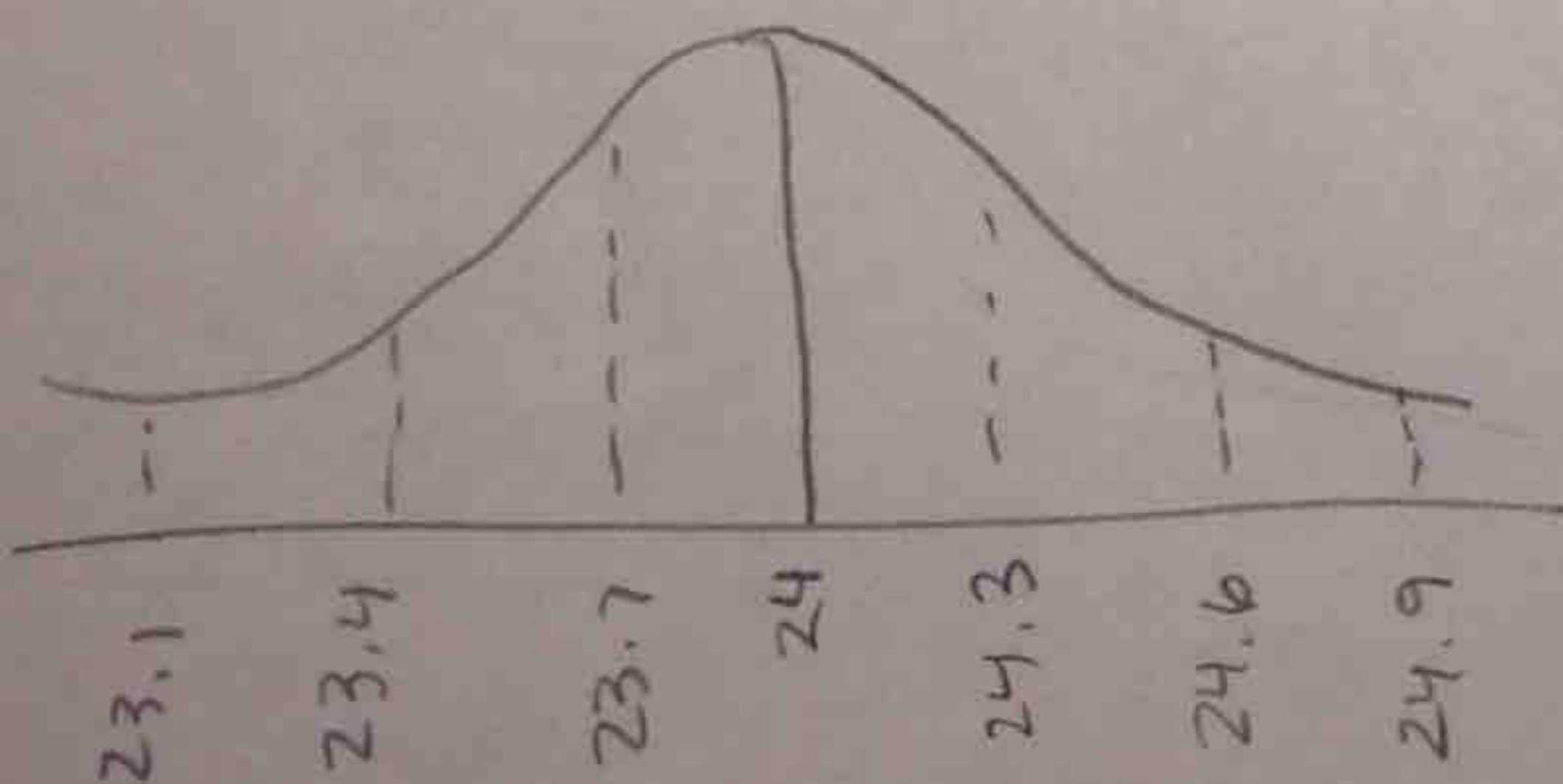


$$z_{492} = \frac{492-512}{2.5} = -8$$

$$z_{550} = \frac{550-512}{2.5} = 15.2$$

$$z_{511} = \frac{511-512}{2.5} = -0.4$$

13. Given an average mean of 24, with a standard deviation of .3, draw a normal curve and find the z scores of 20, 23.7, and 26.



$$z_{20} = \frac{20-24}{0.3} = -13.\bar{3}$$

$$z_{23.7} = \frac{23.7-24}{0.3} = -1$$

$$z_{26} = \frac{26-24}{0.3} = 6.\bar{6}$$