**Algebra 2 Trig Honors**                                   **Name:**
**Statistics Review**

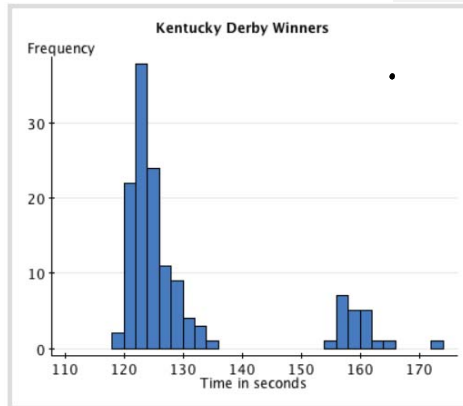*For the following problems, please round to the nearest thousandth.*

1. The Kentucky Derby is a famous horse race.

a. Describe the shape of the histogram
to the right (use two vocab words).

- Skewed right
- bimodal

b. What could potentially cause these
two distinct peaks?

- male/female horses   • steroid use
- ✷ track changed      • training methods changed
- weather



Kentucky Derby Winners

2. The data set below gives the numbers of home runs for the 10 batters who hit the
most home runs during the 2005 Major League Baseball regular season.

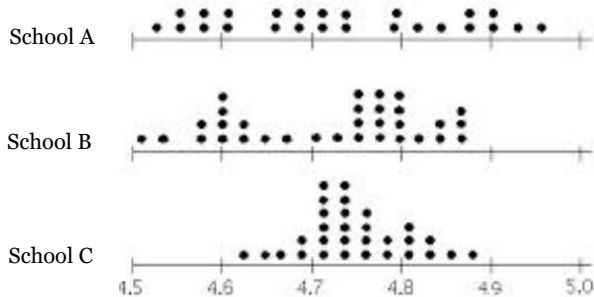51, 48, 47, 46, 45, 43, 41, 40, 40, 39

   a. Find the standard deviation.

$\mu = 44$        $\sigma = 3.821$

   b. Explain what this number means.

   The data is close to the mean.

3. The dot plots below represent the high school 1-mile run times (in minutes) of 3 local
high schools.  Which school would you expect to have the lowest standard deviation?
Explain your reasoning.



School C since
most of the data
is near the center.

4. Would you expect the distributions of these variables to be **uniform, unimodal, or bimodal**? **Symmetric or skewed?** *Explain why.*

a. Wing Span (measurement from fingertip to fingertip) of all upper classman at Hinsdale Central.

*Bimodal, symmetric*

b. Number of children per family at Hinsdale Central.

*Unimodal, skewed right*

c. Average calories consumed daily by Chicagoans.

*Bimodal, skewed left*

5. *Think!* Give an example of a histogram that could be multimodal. What would account for the different modes? Explain.

*Heights of 1st graders, 4th graders, and 7th graders.*

6. a. Find the following probabilities based on the normal distribution.

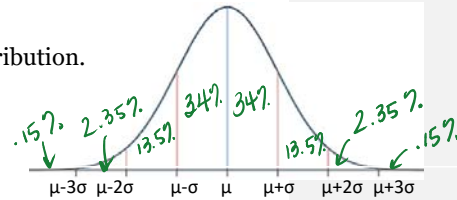a. $P(x \le \mu + \sigma)$          b. $P(\mu - 3\sigma \le x \le \mu + 2\sigma)$

*0.84*          *0.974*



.15%, 2.35%, 13.5%, 34%, 34%, 13.5%, 2.35%, .15%

μ-3σ  μ-2σ  μ-σ  μ  μ+σ  μ+2σ  μ+3σ

c. $1 - P(x \le \mu + 3\sigma)$          d. $P(x > \mu + \sigma)$

*1 − 0.9985*          *0.16*
*= 0.002 = P(x > μ+3σ)*

7. Find the following probabilities using the standard normal distribution.

a. P(z < -1.58)          b. P(z > 0.53)          c. P (-2.4 < z < 1.1)   d. P(|z| > 1.3)



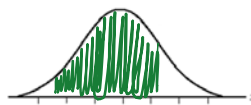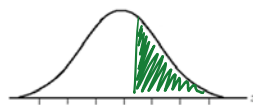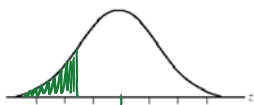*0.057*          *0.298*          *0.856*          *2·0.0968*
*= 0.194*
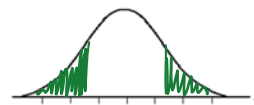
8  A shoe manufacturer collected data regarding men's shoe sizes and found that the distribution of sizes fits a normal curve.  If the mean shoe size is 11 and the standard deviation is 1.5, find:

a.  the percentage of men whose shoe size is less than 10.5.

$z = \dfrac{10.5-11}{1.5} = -0.33 \implies$   $P(x<10.5) = 0.3707$ %.

b. the probability that a man's shoe size is greater than or equal to 12.5.

$z = \dfrac{12.5-11}{1.5} = 1 \implies$   $84.134$%.   $P(x>12.5) = 0.159$

9.  You take both the SAT (Scholastic Aptitude Test) and the ACT (American College Test).  You score 650 on the mathematics section of the SAT and 29 on the mathematics section of the ACT.  ACT and SAT scores are both normally distributed.  For the SAT, the mean is 514 with a standard deviation of 118.  For the ACT, the mean is 21.0 and the standard deviation is 5.3. *Note\*\*\* (Percentile means what percent of people are at or below your score)*

a.  What percentile is your SAT math score?

b.  What percentile is your ACT math score?

$z = \dfrac{650-514}{118} = 1.153 \implies 0.875$

$z = \dfrac{29-21}{5.3} = 1.509 \implies 0.934$  11%

c.  On which test did you perform better? Explain your reasoning.

you performed better on the ACT because the percentile is higher.

10.  Battery lifetime is *normally distributed* for large samples.  The mean lifetime is 500 days and the standard deviation is 61 days.

a.  What percent of batteries have a lifetime that is greater than 600 days?

$z = \dfrac{600-500}{61} = 1.639$   $P(x>600) = 0.051$

b.  What percent of batteries have a lifetime between 200 and 500 days?

$z_1 = \dfrac{200-500}{61} = -4.918$   $z_2 = \dfrac{500-500}{61} = 0$   $P(200<x<500) = 0.500$

c.  Find the lifetime if the z-score is -1.7.

$-1.7 = \dfrac{x-500}{61}$   $x = 396.3$ days

d. Find the lifetime if the area under the normal distribution curve is 84.85%.

$84.85$% $\rightarrow z = 1.030 = \dfrac{x-500}{61}$   $x = 562.831$ days

e.  Find the number of days within 5% of the mean.

$45$% $\rightarrow 0.126 = \dfrac{x-500}{61}$   $55$% $\rightarrow 0.126 = \dfrac{x-500}{61}$

Between 492.335 and 507.665 days

11. The average scores on a statistics test are normally distributed with a mean of 75 and a standard deviation of 10. You randomly select a test score of x. Find $P(|x - \mu| > 15)$.

$$P(|x-\mu| > 15) = P(x - \mu > 15 \quad OR \quad x - \mu < -15)$$

$$= P\left(\frac{x-\mu}{10} > \frac{15}{10} \quad OR \quad \frac{x-\mu}{10} < \frac{-15}{10}\right)$$

$$= P(z > 1.5 \quad OR \quad z < -1.5)$$

$$= 2 \cdot P(z < -1.5) = 2 \cdot 0.069 = 0.134$$

12. Two years ago, a high school implemented a new policy that allows students to be exempt from final exams if they are missing fewer than five days of class. Administrators at the school want to investigate whether this policy has increased attendance rates for students.

    a.   Describe the population of interest and the parameter being investigated.

    b.  Determine whether a survey, observational study, or experiment would be most appropriate for conducting this investigation. Explain your choice.

    c.  Describe the process you would carry out to design and implement your study.
        i.   Survey – Describe the questions you would use, how you would ensure high quality survey items, and how you would select your survey participants
        ii.  Observational study – Describe how you would identify your participants, the process you would use to collect data
        iii. Experiment – Explain what your treatment would be, how you would assign participants to the treatment/control groups, and what response variable you would measure
    d.  If you were asked by the school administrators to present the results from your statistical study, how would you explain the sample statistic you found and what this indicates about the attendance policy?

13. A local bakery conducted a survey of its customers to determine which flavor of muffins they preferred. To gather data, every 5th customer was asked, "What's your favorite flavor of muffin?" and the response was recorded.

The results of this survey were:

a. Explain what information these results provide about the muffin preferences of people shopping at the bakery. Explain what information these results provide about the muffin preferences of people living in the town.

| Flavor | Frequency |
|---|---|
| Blueberry | 34 |
| Banana Nut | 17 |
| Oat | 20 |
| Chocolate | 15 |
| No Preference | 14 |

b. What are the strengths and weaknesses of the survey process used by the bakery?

c. If you were hired by the bakery to conduct a second statistical study, what type of study would you use? Describe the process you would carry out to design and implement your study.

14. A group of friends wants to know what proportion of students at their high school would prefer a year round school calendar.

Match each item with its appropriate vocabulary term, using the following list: **Population, Parameter, Sample, Statistic**

| Statement | Vocabulary Term (from list) |
|---|---|
| The proportion of students in the high school who prefer a year-round school calendar. | Parameter |
| The 2,837 students at the high school. | population |
| The 100 students, randomly selected to respond to a survey about their school calendar preference. | Sample |
| 23% of students surveyed stated that they would prefer a year-round school calendar. | Statistic |

15. A survey found the proportion of students who attend dances at Hinsdale Central High School to be 0.72 with a margin of error at the 95% confidence level of 0.11. Express the 95% confidence interval for the true proportion. $[0.72 - 0.11, 0.72 + 0.11] = [0.61, 0.83]$

16. [112.6, 247.3] expresses the 80% confidence interval for the number of fish in randomly sampled aquariums.

$$\frac{112.6 + 247.3}{2} = \boxed{179.95}$$

    a. Calculate the sample mean.

    b. Calculate the margin of error. $\boxed{67.35}$

    c. Give an example of a confidence level that would more confidently contain the true mean. $> 80\%$

    d. Which of the following is most likely the true mean number of fish for all aquariums?
       i. 417
       ii. 7
       (iii.) 113
       iv. 857

    e. Does the true population mean have to lie in the interval? No!

17. Random samples of different sizes are collected to determine the proportion of students in the United States who bring their lunch to school. The results are as follows:

| | | Sample proportion | Sample standard deviation |
|---|---|---|---|
| Sample 1 | 20 samples of size 25 | $p_1$ | $s_1$ |
| Sample 2 | 20 samples of size 100 | $p_2$ | $s_2$ |
| Sample 3 | 100 samples of size 25 | $p_3$ | $s_3$ |

    a. How does $s_1$ compare to $s_2$?

$$s_1 > s_2$$

    b. If you had one best estimate for the true population proportion, what would it be?

$p_1 \approx p_2 \approx p_3$    But $p_2$ comes from more sampling

18. Explain what the 95% confidence interval means two different ways.

$\frac{95}{100}$ or $\frac{19}{20}$ samples of same size would contain the true mean.

19. Write the null and alternative hypotheses you would use to test the following situation.

Then, identify how you would test the null hypothesis with a one or two-tailed test.

A local politician claims that 70% of his town's residents favor a tax increase.

$H_0$: $p = .70$         $H_A$: $p \neq 0.70$         Test: 2 tail

20. For each statement, identify whether it could be tested using a hypothesis test. Explain your reasoning.

   a. It's a medical fact that male babies are more common than female babies, with a historical rate of 51.7% of babies born male. Recently, some have suggested that the discrepancy between the rate of male and female births has declined.
   Yes!   $H_0 : p = 0.517$   $H_A: p < 0.517$

   b. Alg 2/Trig Honors teachers claim that they have the best students in the school.
   NO! what is best?

   c. A new education company claims that 80% of students who use their study techniques perform better on final exams.
   Yes!   $H_0 : p = 0.80$   $H_A: p \neq 0.8$

21. Suppose you are conducting a study with the following hypotheses:         $H_0$:  $\rho = 0.60$

$H_A$:  $\rho \neq 0.60$

If your test produced a test statistic of 0.72, what would you conclude?

Since $Z = .72 \rightarrow 0 < |z| < 2$ accept the null.

22. In 2005, the U.S. Census Bureau reported that 68.9% of Americans owned their homes. Following the economic downturn of 2007, many economists became concerned that this proportion would substantially decline. A 2012 survey found that 65.5% of respondents owned their homes.

≈ 131/200

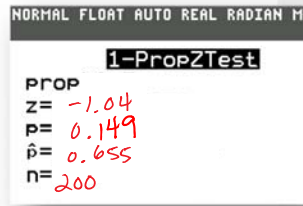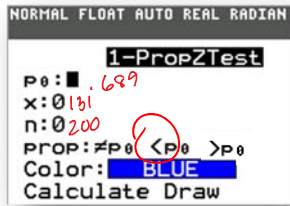a) State the null and alternative hypotheses; identify whether to use a one or two-tailed test.

H₀: $p = .689$  H_A: $p < .689$  Test: one tail

b) Use your calculator to find the z-score for this sample proportion.
Complete the tables below:

NORMAL FLOAT AUTO REAL RADIAN

1-PropZTest
p₀:■ .689
x:0 131
n:0 200
prop:≠p₀ <p₀ >p₀
Color:  BLUE
Calculate Draw

NORMAL FLOAT AUTO REAL RADIAN MP

1-PropZTest
prop
z= -1.04
p= 0.149
p̂= 0.655
n= 200

c) State your conclusion

SINCE $z > -2$ , accept the null &
conclude 68.9% own homes.

23. How would you respond to your friend who states, "The best investment you can make is to buy your own home." ?

Right on !!