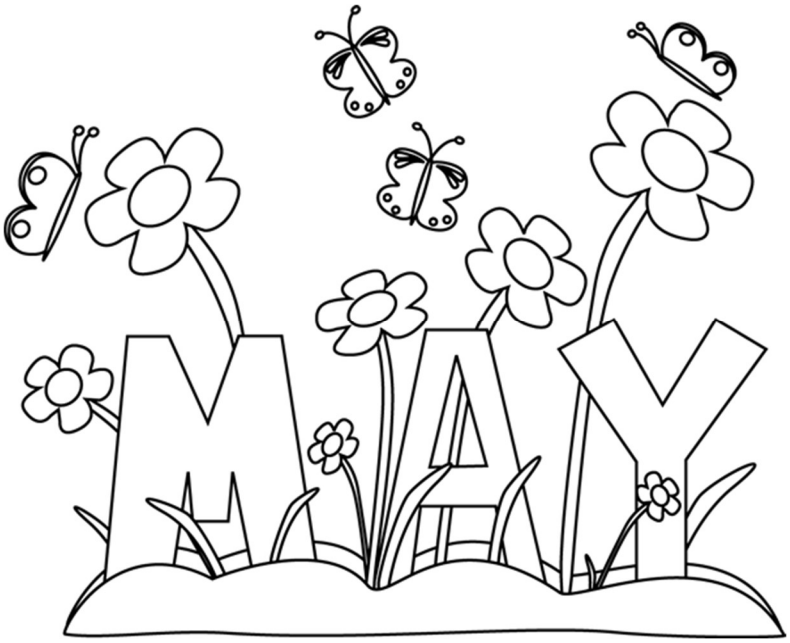
Algebra 2 Unit : Normal Curve and the Empirical Rule

I CAN:

- Calculate mean, median, mode, standard deviation and variance for a data set
- Draw and label a normal distribution curve for a data set
- Use the Empirical Rule to analyze a data set and solve problems
- Calculate z-scores and use z-scores to solve problems

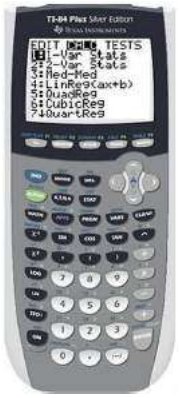


Monday	Tuesday	Wednesday	Thursday	Friday
10	11	12 Help Sessions	13 DAY 1 Measures of Center and Spread & The Empirical Rule	14 DAY 2 z-scores
17 DAY 3 More Practice and Review	18 DAY 4 Unit 6 Quiz	19 Help Sessions	20 Exam Review	21 Exam Review
24 Practice Exam	25 **1st and 2nd Period Exams** ALL STUDENTS WILL TAKE EXAMS REMOTELY	26 **3rd and 4th Period Exams**		

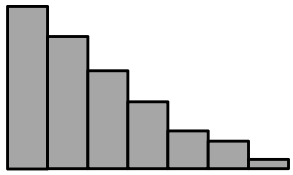
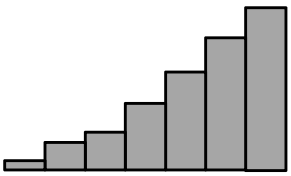
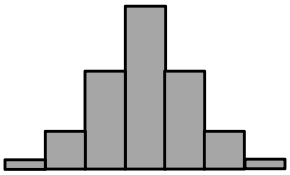
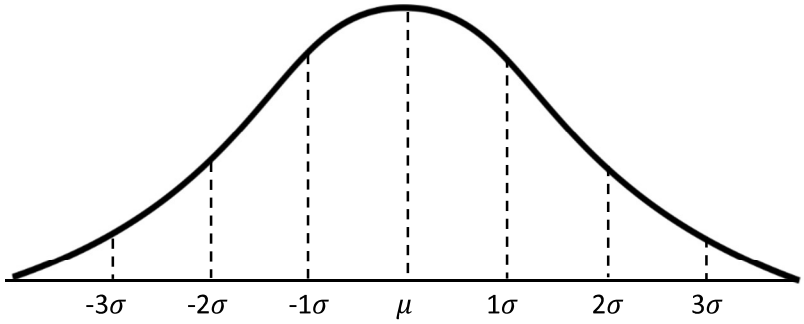
THIS PLAN IS SUBJECT TO CHANGE. PLEASE REFER TO CTLS DIGITAL CLASSROOM FOR UPDATES.

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
MEASURES OF CENTRAL TENDENCY	
	Mean (_____): _____ Median: _____ Mode(s): _____
	Directions: Find the mean, median, and mode(s) for each data set.
	1. {58, 53, 59, 51, 46, 35, 51, 58, 60} Mean = _____ Median = _____ Mode(s) = _____
	2. {21, 10, 27, 24, 15, 7, 19, 24, 31, 15, 11, 24} Mean = _____ Median = _____ Mode(s) = _____
MEASURES OF VARIATION	
Mean Absolute Deviation (MAD)	$MAD = \frac{\sum_{i=1}^{n} \lvert x_i - \mu \rvert}{n}$
	Directions: Find the mean absolute deviation for each data set.
	3. {85, 74, 88, 80, 92, 60} MAD = _____
	4. {14, 18, 16, 19, 21, 14, 15, 23, 21, 19} MAD = _____

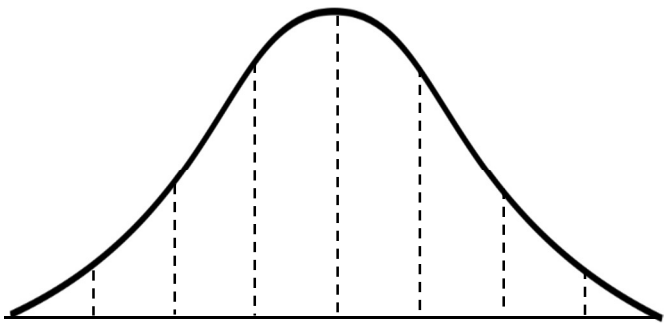
Variance (σ^2)		$\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}$
Standard Deviation (σ)		$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n}}$
What do the numbers mean?	• A **lower standard deviation** indicates that _____ _____ • A **higher standard deviation** indicates that _____ _____	
Examples	**Directions:** Find the variance and standard deviation for each data set.	
	5. {85, 88, 91, 96, 100} **Variance (σ^2) =** _____ **Standard Deviation (σ) =** _____	
Calculator Steps: • Hit **STAT, ENTER** • Enter the **data values** in **L_1** • Hit **STAT** • Arrow over to **CALC** • Choose **#1:1-Var Stats** • Hit **ENTER** • Scroll down to find σ • Square to find σ^2 	**6.** {3, 4, 7, 8, 11, 12, 12, 15, 19} **Variance (σ^2) =** _____ **Standard Deviation (σ) =** _____	
	7. {52, 47, 60, 55, 58, 53, 59, 63} **Variance (σ^2) =** _____ **Standard Deviation (σ) =** _____	
	8. {127, 81, 135, 100, 97, 115, 72, 152, 63, 164} **Variance (σ^2) =** _____ **Standard Deviation (σ) =** _____	
	9. {25, 27, 21, 32, 35, 29, 23, 26, 24, 25, 28, 31} **Variance (σ^2) =** _____ **Standard Deviation (σ) =** _____	

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Data Distribution	  
Normal Distribution	• A symmetrical _____-_____ _____ defined by the **mean (μ)** and the **standard deviation (σ)** of the data set. • The **area under the curve** represents _____, with the total area equal to _____.
The Empirical Rule	**In a normal distribution with mean μ and standard deviation σ:** • Approximately _____ of the data falls within 1σ of the mean. • Approximately _____ of the data falls within 2σ of the mean. • Approximately _____ of the data falls within 3σ of the mean. 

Directions: Draw and label normal distribution curves, then answer the questions.

1. The weights of the 50 football players are normally distributed with a mean of 178 pounds and a standard deviation of 8 pounds.



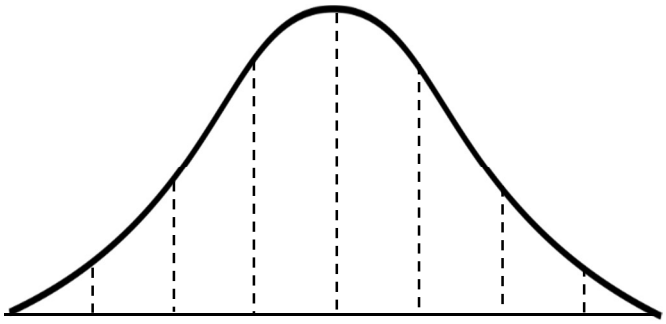
a) What percent of the players weigh between 178 lbs and 194 lbs?

b) What is the probability that a player weighs at most 170 lbs?

c) What is the probability that a player weighs less than 162 lbs or greater than 194 lbs?

d) How many players weight between 170 lbs and 186 lbs?

2. A set of 120 test scores are normally distributed with a mean of 82 and a standard deviation of 5.



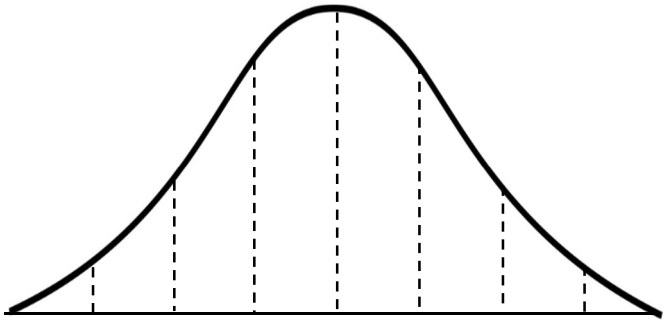
a) What percent of the scores are between 72 and 87?

b) What is the probability that a score is greater than 77?

c) What is the probability that a score is less than 82 or greater than 92?

d) About how many students scored outside two standard deviations of the mean?

3. The price of a gallon of regular gasoline at 75 gas stations across the state is normally distributed with a mean of $2.05 and a standard deviation of 4¢.



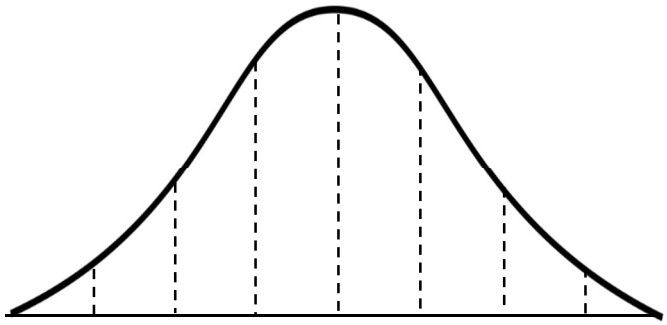
a) What percent of gas stations sell a gallon of regular gas for less than $1.97?

b) What percent of gas stations sell a gallon of regular gas for at least $2.17?

c) What is the probability that a gas station sells a gallon of regular gas for less than $1.97 or greater than $2.05?

d) About how many stations sell a gallon of regular gas for no more than $2.01?

4. Mrs. Fuller recently tested her 120 keyboarding students to see how many words per minute they can type. The results were normally distributed with a mean of 45 and a standard deviation of 6.



a) About how many students can type at least 39 words per minute?

b) About how many students can type within one standard deviation of the mean?

c) Students need to be in the top 2% in order to be eligible for the national typing competition. If Carla can type 56 wpm, is she eligible?

Name: _____ **Unit 11:** Probability & Statistics

Date: _____ **Bell:** _____ **Homework 5:** Measures of Center, Variation, and Normal Distribution

**** This is a 2-page document! ****

Directions: Find the mean, median, and mode of each data set below.

1. {11, 14, 11, 5, 17, 28, 3}

Mean = _____

Median = _____

Mode(s) = _____

2. {24, 29, 31, 16, 49, 52, 29, 35, 62, 29}

Mean = _____

Median = _____

Mode(s) = _____

Directions: Find the mean absolute deviation, variance, and standard deviation for each data set.

3. The following data shows the number of fish caught by a seven boy scouts on their camping trip: {1, 2, 2, 4, 5, 6, 8}

MAD = _____

Variance: σ^2 = _____

Standard Deviation: σ = _____

4. The following data shows the points scored by a football team during their first ten games of the season: {27, 32, 41, 9, 14, 20, 31, 33, 20, 13}

MAD = _____

Variance: σ^2 = _____

Standard Deviation: σ = _____

5. The following data shows the high temperature for the past eight days: {66, 46, 53, 50, 52, 47, 45, 49}

MAD = _____

Variance: σ^2 = _____

Standard Deviation: σ = _____

6. The following data shows the price of six different jars of pasta sauce at the grocery store: {$2.79, $1.99, $4.29, $2.49, $2.29, $3.49}

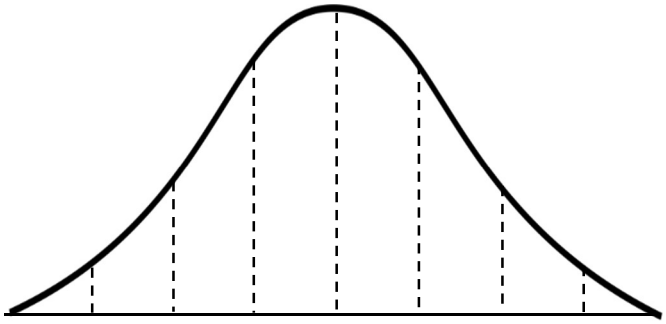
MAD = _____

Variance: σ^2 = _____

Standard Deviation: σ = _____

For questions 7 and 8, draw the normal distribution curve, then answer the questions.

7. A set of 125 golf scores are normally distributed with a mean of 76 and a standard deviation of 3.

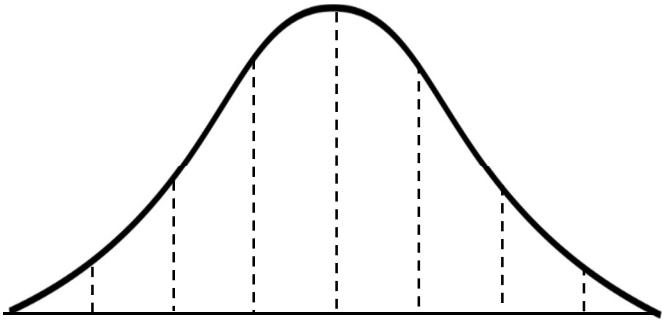


a) What percent of the scores are between 67 and 85?

b) What is the probability that a score is no more than 77?

c) About how many scores fell between one standard deviation of the mean?

8. The talk-time battery life of a group of cell phones is normally disributed with a mean of 5 hours and a standard deviation of 15 minutes.



a) What percent of the phones have a battery life of at least 4 hours and 45 minutes?

b) What percent of the phones have a battery life between 4.5 hours and 5.25 hours?

c) What percent of the phones have a battery life less than 5 hours or greater than 5.5 hours?

9. The number of hours that the employees at the grocery store worked last week is normally distributed with a mean of 24 and a standard deviation of 6. If there are 60 total employees, approximately how many worked at least 30 hours last week?

10. The grade point average (GPA) of the students at Lakeview High School is normally distributed with a mean of 3.1 and a standard deviation of 0.3. If there are 1800 students enrolled at the school, approximately how many have a GPA between 2.5 and 3.7?

Algebra 2 Name _____

Empirical Rule: 68 – 95 – 99.7

1. The distribution of heights of adult men is approximately normal with a mean of 69 inches and standard deviation of 2.5 inches. Draw a normal curve on which the mean and standard deviation are correctly located.

2. Use the curve for #1 and the Empirical Rule to answer the following questions:

a. What percent of men are taller than 74 inches?

b. Between what heights do the middle 95% of men fall?

c. What percentage of men are shorter than 66.5 inches?

d. What percentage of men are taller than 64 inches?

3. Scores on a Wechsler Adult Intelligence Scale (IQ test) for adults aged 20-34 years are approximately normally distributed with $\mu = 110$ and $\sigma = 25$.

a. Draw and label the curve. Use the curve to answer the following questions.

b. What percentage of people have a score higher than 110?

c. What percent have scores above 160?

d. What percent have scores below 135?

e. In what range do the middle 95% of all scores lie?

4. The length of human pregnancies from conception to birth varies according to a distribution that is approximately normal with mean 266 days and standard deviation 16 days.

a. Draw and label the curve. Use the curve to answer the following questions.

b. What percentage of pregnancies are longer than 282 days?

c. What percentage of pregnancies are shorter than 250 days?

d. How long do the top 2.5% of pregnancies last?

e. What percentage of pregnancies are between 234 and 282 days long?

5. The time it takes for a teen to returns a phone call is normally distributed with a mean of 3 days and a standard deviation of 1 day.

a. Draw and label the curve. Use the curve to answer the following questions.

b. What percentage of teens take between 2 and 4 days to return a call?

c. What percentage of teens take more then 5 days to return a call?

d. How fast do teens in the lower 2.5% return calls?

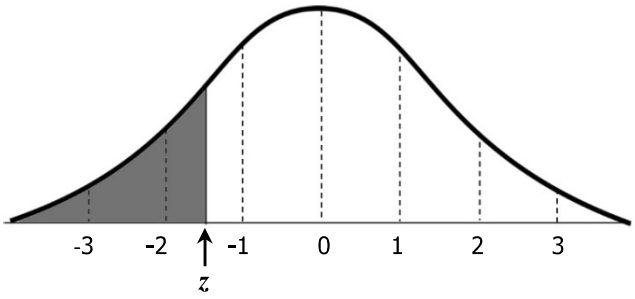
e. What percentage of teens take more than 2 days to return a call?

Name:	Date:
Topic:	Class:

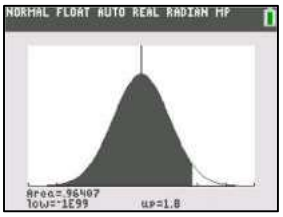
Main Ideas/Questions	Notes/Examples
Z-SCORES	• A value that shows how many _____ _____ a data value is from the _____. • When the z**-score is positive**, the data value is _____ the mean. • When the z**-score is negative**, the data value is_____ the mean. • When z **= 0**, the data value _____ the mean
Z-Score *Formula*	To find the z-score for a data value in a set that is normally distributed, use:  X = the data value μ = the mean σ = the standard deviation
EXAMPLES	**1.** A radar detector records the speeds of a group of cars that pass by. If the mean is 46 mph and the standard deviation is 2.8 mph, find the z-scores for each data value. **a)** 52 **b)** 42 **c)** 47
	3. The mean number of total miles ran last week by each member on the track team was 4 with a standard deviation of 1.2. If Clay's z-score was 2.5, how many miles did he run?
	4. A set test papers is normally distributed with a standard deviation of 5. If Riley scored an 83 with a z-score of -0.4, what was the mean?
	5. The heights of a group of trees is normally distributed with a mean of 14.3 feet. If the z-score for a 20-foot tall tree is 1.9, what is the standard deviation?

Standard Normal Distribution

- A normal distribution in which μ = _____ and σ = _____.
- The distribution is "standardized" by the ____-_____.



Calculator Directions



First, change your window dimensions:
Xmin: -4, Xmax: 4, Ymin: 0, Ymax: 0.5

To graph the curve and find the probability:

- **Step 1:** Find the z-score for each data value.
- **Step 2: Hit 2nd -> VARS**
- **Step 3:** Arrow over to **DRAW**
- **Step 4:** Select **1:ShadeNorm(**
- **Step 5:** Enter the **lower and upper bounds** for the z-scores
- **Step 6:** Scroll down and hit **DRAW**

Example: The golf scores in a tournament is normally distributed with a mean of 76 and a standard deviation of 2.6. Find each probability.

6. $P(z < 2.1)$	**7.** $P(X < 74)$
8. $P(z > -1.5)$	**9.** $P(X > 81)$
10. $P(-0.2 < z < 1.8)$	**11.** $P(77 < X < 83)$

Name: _____ **Unit 11:** Probability & Statistics

Date: _____ **Bell:** _____ **Homework 6:** Z-Scores & Standard Normal Distribution

**** This is a 2-page document! ****

1. The number of calories burned at the gym is normally distributed with a mean of 425 and a standard deviation of 51. Find the z-scores for each data value.

a) 268 **b)** 512 **c)** 450

2. The air pressure of each tire in a group is normally distributed with a mean of 39.2 pounds per square inch (psi) and a standard deviation of 2.5 psi. If a tire in this group has a z-score of -1.8, find its air pressure.

3. A set of math tests is normally distributed with a mean of 81 and a standard deviation of 5. If Adam's z-score was -0.6 and Leah's z-score was 2.2, how many points higher did Leah score than Adam?

4. The prices of various cereal boxes is normally distributed with a standard deviation of 0.5. If a box of Lucky Charms sells for \$4.29 and has a z-score of 1.6, what is the mean price of a box of cereal?

5. The number of homes sold each year by a realtor is normally distributed with a mean of 54. If the realtor sold 36 homes last year with a z-score of -2.4, what is the standard deviation?

6. The last math exam of the year was normally distributed with a mean of 85 and a standard deviation of 5. Xavier needed at least a 95 on this test to get an A for the year. His teacher gave him his z-score: 1.8. Did Xavier get an A for the year?

7. The 400-meter race times recorded in the boys track meet was normally distributed with a standard deviation of 3 seconds. If David finished the race in 51.2 seconds with a z-score of -2.6, what was the mean time?

Use for questions 8-14: The weights of dogs in a dog show is normally distributed with a mean of 58 pounds and a standard deviation of 17.2 pounds. Use a standard normal distribution curve to find each probability.

8. $P(z < -0.8)$

9. $P(z > 1.32)$

10. $P(-2.8 < z < -1.17)$

11. $P(X > 51)$

12. $P(35 < X < 62)$

13. $P(X < 102)$

14. $P(X > 85)$

15. The high temperatures in Virginia Beach during the month of July are normally distributed with a mean of 83° and a standard deviation of 6°. Find the probability that on a given day during the month, the temperature is greater than 92°.

16. The mean number of hours that the average person watches television each day is 4.18 hours with a standard deviation of 1.19 hours. Find the probability that someone watches between 3 and 5 hours per day.

17. The mean song length on Jack's iPad is 3 minutes and 3 seconds, with a standard deviation of 24 seconds. Find the probability that the next song to play is no more than 3 minutes and 45 seconds.

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z-scores Practice

1. The heights of men are normally distributed with a mean of 69 inches and a standard deviation of 2.8 inches. Find the z-score for a man who is 64 inches tall.

2. To be eligible for the US Marine Corps, a woman must have a height between 58 and 73 inches. The heights of women are normally distributed with a mean of 63.6 inches and a standard deviation of 2.5 inches. Find the z-score for a woman whose height is:

a. 58 inches b. 73 inches

3. Assume that body temperatures of normal healthy persons are normally distributed with a mean of 98.2° F and a standard deviation of 0.62° F. If we define a fever to be a body temperature above 100° F, what is the z-score of a fever?

4. On one measure of attractiveness, scores are normally distributed with a mean of 3.93 and a standard deviation of 0.75. What is the s-score for a rating of 2.75?

5. Scores on an anti-aircraft exam are normally distributed with a mean of 99.56 and a standard deviation of 25.84. Find the z-score for each exam score:

a. 110.00 b. 150.00

6. For a certain population, scores on the Miller Analogies Test are normally distributed with a mean of 58.84 and a standard deviation of 15.94. If subjects who score below 27.00 are to be given special training, what is the maximum z-score of subjects who will be given the special training?

7. Scores on the biology portion of the Medical College Admissions Test are normally distributed with a mean of 8.0 and a standard deviation of 2.6. Among 600 individuals taking this test, how many are expected to score between 5.4 and 10.6?

8. One classic use to the normal distribution is inspired by a letter to Dear Abby in which a wife claimed to have given birth 308 days after a brief visit from her husband, who was serving in the Navy. The lengths of pregnancies are normally distributed with a mean of 268 days and a standard deviation of 15 days. Given this information, what is the z-score of a pregnancy lasting 308 days?