Name: KEY

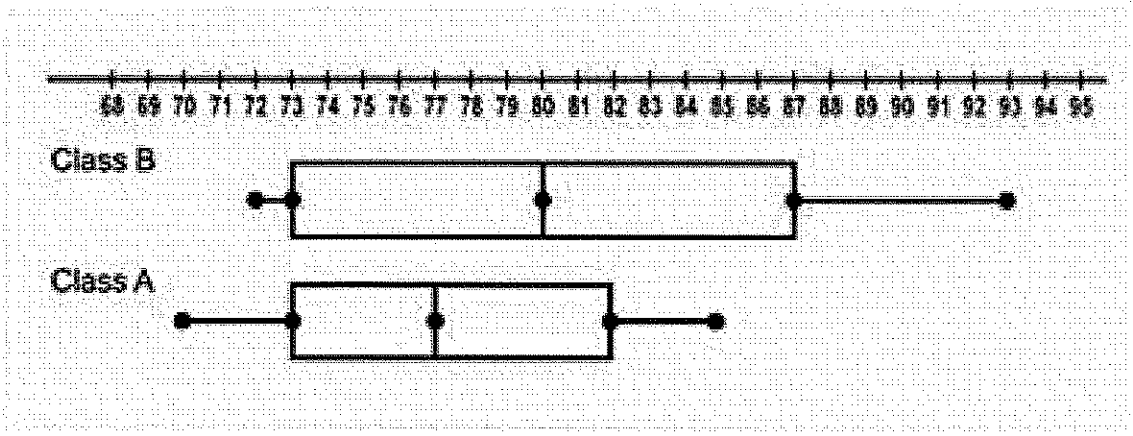
Date:

Unit 11, Day 5 Warm-up

Period:

Question 1

The box and whisker plot below shows the test results from two Algebra 1 classes taught by the same teacher. Use the plot to answer the questions below:



a) **What was the median test grade for class A?**

77

b) **What was the highest test grade for class B?**

93

c) **What test grade represents the 3rd Quartile for class B?**

87

d) **Classes A and B have an identical measure that occurs at 73. What is the name of that measure?**

Q1, lower quartile

e) **What is the Interquartile Range of Class A?**

82 − 73 = 9

f) **Which class has a greater range? Class A or Class B? Show your work.**

class B

B: 93 − 72 = 21

A: 86 − 70 = 16

21 > 16

Name: KEY **Date:**

Unit 11, Day 5 Notes **Period:**

Learning Targets

- I can calculate and interpret z-scores and standard deviations in a real world context

Vocabulary (or properties or formulas)

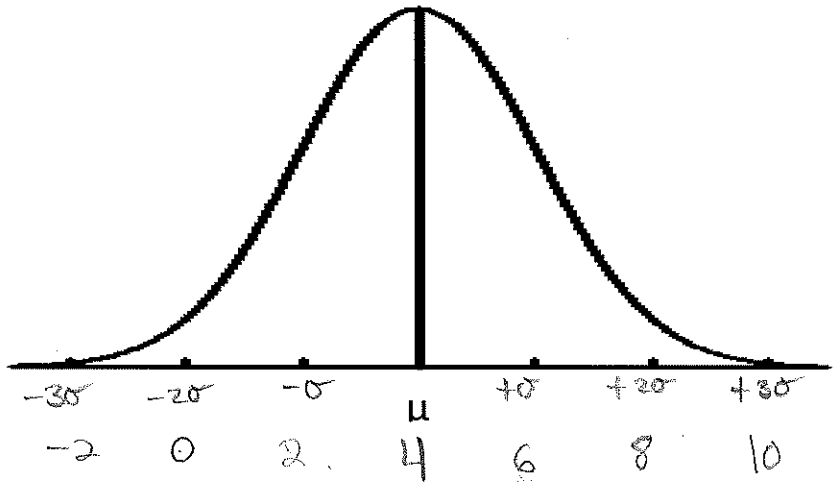
Standard Deviation	Mean	Data Element	Z-Score	Normal Curve

Introduction

Here are the ages of the dogs (in years) available for adoption at the Fairfax County Shelter last week:

7 4.5 3 2.6 .75 2.1 3.2 9 6 5.5 1.25

Again label the number line of the graph below with the approximate mean (4) and ±3 standard deviations to the right and to the left of the mean. The standard deviation is 2.



1. How many standard deviations away from the mean is the dog that is 7 years old? z = 1.5

You can usually figure #1 out intuitively. Let's slow down the thinking process. Think about what you are actually doing as you try to do the next question.

2. How many standard deviations away from the mean is a dog that is 7.4 years old? z = 1.7

Use the formula to answer question 2:

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{7.4 - 4}{2}$$

$$z = 1.7$$

Where can I find this formula, in the event that I forget?

SOL Formula sheet

Now find the z-scores for the next four dogs:

4.5	z = $\frac{4.5-4}{2}$	z = .5625
3	z = $\frac{3-4}{2}$	z = -0.5
2.6	z = $\frac{2.6-4}{2}$	z = -0.7
.75	z = $\frac{.75-4}{2}$	z = -1.625

Why find a z-score? How does it help us to compare data?

It allows us to compare data from different distributions and do so easily.

Consider this problem:

In 2009, Amy scored a 31 on the mathematics portion of her ACT. The mean score was a 21 and the standard deviation was ~~5.3~~ 5.

Stephanie scored a 720 on the mathematics portion of her 2009 SAT. The mean score that year was 515 and the standard deviation was ~~116~~ 95.

Whose achievement was higher on the mathematics portion? Z scores can help us find out!

Amy

$z = \frac{x-\mu}{\sigma}$

$z = \frac{31-21}{5}$

$z = 2$

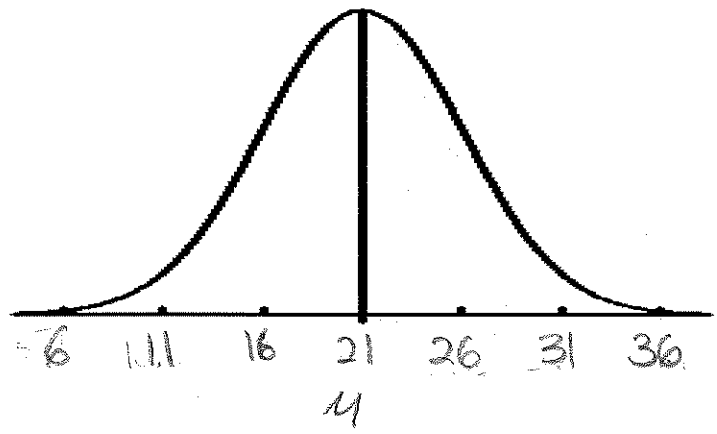
Steph

$z = \frac{720-515}{95}$

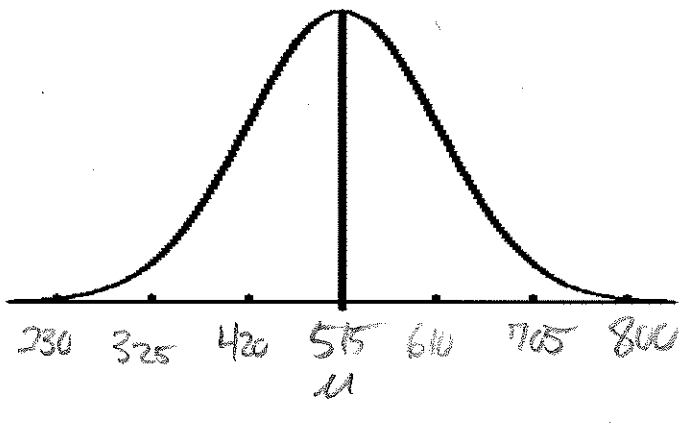
$z = 2.16$

Use the information above to create a normal curve for both the SAT and ACT?

Amy – ACT



Stephanie – SAT



Now that we understand how a z-score is used, let's look at some examples from the SOL.

On the Released 2014 SOL it looks like...

Example 1. Statistical information for a data set is given. • The mean is 18.1 • The z-score for 13.0 is -1.7 What is the standard deviation for this data set? A. 1.7 B. 3.0 C. 3.4 D. 5.1 $-1.7 = \frac{13 - 18.1}{\sigma}$ $\frac{-1.70}{-1.7} = \frac{-5.1}{-1.7}$ $\sigma = 3$	Example 2. The data set shown has a mean of 37 and a standard deviation of 6.3, rounded to the nearest tenth. $\{26, 29, 32, 33, 35, 36, 37, 39, 40, 44, 45, 48\}$ 33.22 — all greater How many of these data points have a z-score greater than -0.6? A. 3 B. 5 C. 8 D. 9 $-.6 = \frac{X - 37}{6.3}$ $-3.78 = X - 37$ $33.22 = X$	Example 3. A data set has a mean of 68.42 and a standard deviation of 7.91. An element in this set is 57. What is the z-score for 57? Round the answer to the nearest hundredth. z-score = -1.44 $z = \frac{57 - 68.42}{7.91}$ $z = -1.44$

Name: KEY **Date:**

Unit 11, Day 5 Practice **Period:**

Learning Targets

- I can calculate and interpret Z-scores and standard deviations in a real world context

1) A researcher is studying the amount of time high school students take to complete a test. The data collected for the study produced a mean of 80 minutes and a standard deviation of 8 minutes. What is the z-score for a time of 90 minutes and what does it represent?

$$z = \frac{90 - 80}{8}$$

$$z = 1.25$$

This means that the student takes more time than the average student, 1.25 standard deviations to be exact.

z-Score

The number of standard deviations an element is away from the mean

$$\text{z-score}\,(z) = \frac{x - \mu}{\sigma}$$

$\mu = mean\ of\ the\ data\ set$
$\sigma = standard\ deviation\ of\ data\ set$
$x = element\ of\ data\ set$

1. Statistical information for a data set is given. • The mean is 23.4 • The z-score for 21 is -1.5 What is the standard deviation for this data set? $-1.5 = \frac{21 - 23.4}{\sigma}$ $1.6 = \sigma$	2. Statistical information for a data set is given. • The standard deviation is 2.1 • The z-score for 13.0 is 1.2 What is the mean for this data set? $1.2 = \frac{13 - \mu}{2.1}$ $\mu = 10.48$
3. Statistical information for a data set is given. • The mean is 99 • The z-score for 83 is -1.2 What is the standard deviation for this data set? $-1.2 = \frac{83 - 99}{\sigma}$ $13.33 = \sigma$	4. Statistical information for a data set is given. • The standard deviation is 8.7 • The z-score for 64 is 0.6 What is the mean for this data set? $.6 = \frac{64 - \mu}{8.7}$ $\mu = 58.78$

5. Statistical information for a data set is given.

- The mean is 18.1
- The standard deviation is 5.6

What is the z-score for 16 in this data set?

$$z = \frac{16 - 18.1}{5.6}$$

$z = -.375$

6. The data set shown has a mean of 55.8 and a standard deviation of 13.2, rounded to the nearest tenth.

62.4

$\{31, 40, 42, 51, 55, 56, 56, 58, 62, 67, 72, 80\}$

less

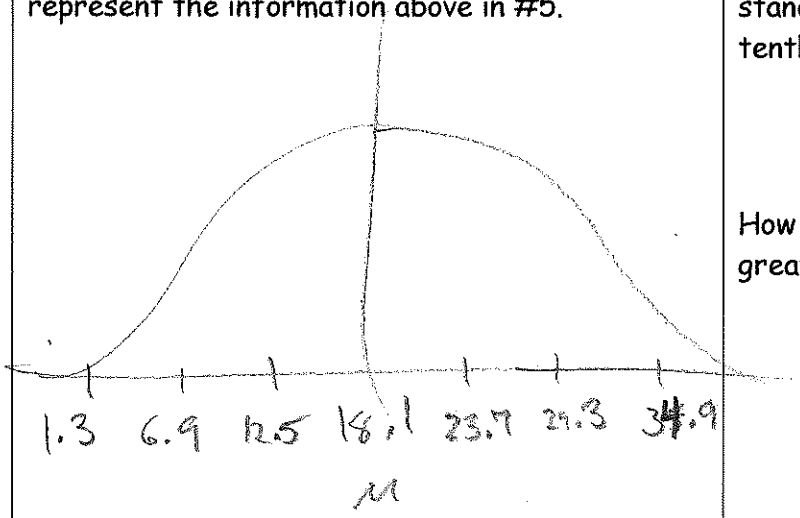
How many of these data points have a z-score less than 0.5? List your answers below.

$$.5 = \frac{X - 55.8}{13.2}$$

$X = 62.4$

9 points

7. Draw a sketch of the normal curve to represent the information above in #5.



8. The data set shown has a mean of 21.9 and a standard deviation of 5, rounded to the nearest tenth.

27.9

$\{15, 17, 17, 18, 23, 24, 26, 27, 30\}$

greater

How many of these data points have a z-score greater than 1.2?

$$1.2 = \frac{X - 21.9}{5}$$

$27.9 = X$

1 point

More Practice:

- **A normally distributed data set has μ = 22 and σ = 1.5.**
  - **What would be the value of an element of this data set with z-score = 2?**

$$2 = \frac{X - 22}{1.5}$$

$25 = X$

  - **What would be the value of an element of this data set with z-score = -3?**

$$-3 = \frac{X - 22}{1.5}$$

$17.5 = X$

Name: KEY **Date:**

Unit 11, Day 5 Exit Ticket **Period:**

Learning Targets

- I can calculate and interpret Z-scores and standard deviations in a real world context

Question 1

Sonja got a 92 on her math test. Her z-score was +2. The standard deviation for the exam was 4. What was the mean score for the exam?

A: 21

B: 84

C: 88

D: 90

$$2 = \frac{92 - \mu}{4}$$

$$8 = 92 - \mu$$

$$\mu = 84$$

Question 2:

A negative z-score means the —

A: mean is greater than the standard deviation of the data set

B: mean is less than the standard deviation of the data set

C: data point is less than the mean of the data set

D: data point is greater than the mean of the data set

Question 3:

A data set has a mean of 720 and a standard deviation of 6. Which is closest to the z-score for an element of this data set with a value of 709 ?

A: 11.00

B: 1.83

C: −11.00

D: −1.83

$$z = \frac{709 - 720}{6}$$