Can I calculate percentiles of any value of a distribution?

Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question

Week 2, Lesson 1

1. Warm-Up
2. Percentiles & Z-Scores
3. ICA
4. Independent Work

Percentiles & Z-Scores

Can I calculate percentiles of any value of a distribution?

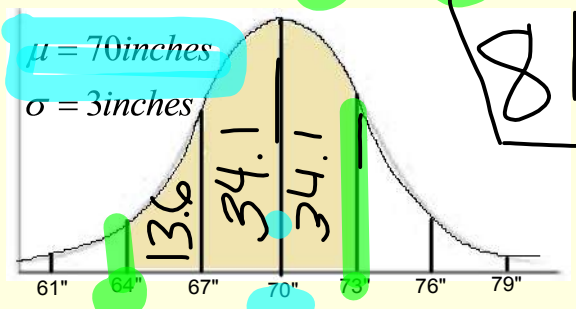
Summary:

19

Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up

Warm Up:

1. Given the following information, what percentage of men are between 64" and 73"?



81.8%

2. The chest measurements of 18 year old male footballers are normally distributed with a mean of 95 cm and a standard deviation of 8 cm.

00:01 00

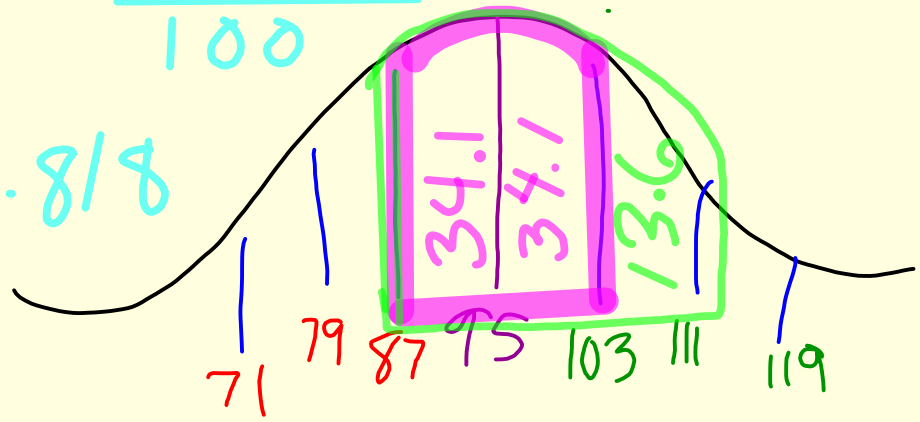
a) Find the percentage of footballers with chest measurements between 87 cm and 103 cm.

68.2%

b) Find the probability that the chest measurement of a randomly chosen footballer is between 87 cm and 111 cm.

81.8%
100

.818



Standard 4.1

Percentiles & Z-Scores

Percentile

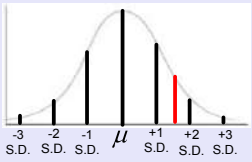
Number (value) that represents a percentage position in a list (range) of data.

For example, if the performance of an entity is at 43rd percentile, then it performs better than 43 percent of all entities within its group.

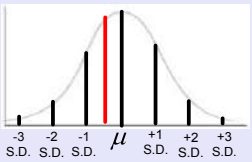
Z-Scores

a statistical measurement of a score's relationship to the mean in a group of scores.

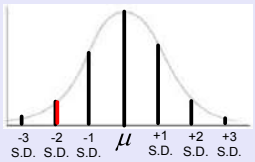
ex- *z*-score: 1.5



ex- *z*-score: -.5



ex- *z*-score: -2



Data Values to Percentiles

We can actually find which percentile a value represents besides the ones that land *EXACTLY* on a standard deviation

e.g.- You scored a 21 on your ACT test. In what percentile did you score?

Calculator

Menu → Run•Math → OPTN → F5:STAT → F3:DIST → F1:NORM → F2:Ncd

NormCD(*low*, *high*, σ, μ,)

Convert answer to a *percent*

Example

For instance, In 2012, the mean value of an ACT score of a student accepted to an Arizona University was 19.7 with a standard deviation of 4.5. What percentile did *you* fall in? If yo do not know your ACT score, pretend that you scored a 17

NormCD(Lower, Upper, SD, Mean) =

NormCD(0, 17, 4.5, 19.7) = 0.274

27th percentile

What percentage of students scored between an 15 and a 24?

NormCD(15, 24, 4.5, 19.7) = 0.682

68.2%

Summary

1. The height of male students in a university is normally distributed with mean 170 cm and standard deviation 8 cm.

a. Find the percentage of male students whose height is:

- between 162 cm and 170 cm
- between 170 cm and 186 cm

b. Find the probability that a randomly chosen student from this group has a height:

- between 178 cm and 186 cm
- less than 162 cm
- less than 154 cm
- greater than 162 cm

2. A bottle filling machine fills an average of 20,000 bottles a day with a standard deviation of 2000. Assuming that production is normally distributed and the year comprises 260 working days, calculate the approximate number of working days on which:

a. under 18,000 bottles are filled

b. over 16,000 bottles are fillled

c. between 18,000 and 24,000 bottles (inclusive) are filled

3. The mean average rainfall of Claudona for August is 48 mm with a standard deviation of 6 mm. Over a 20 year period, how many times would you expect there to be less than 42 mm of rainfall during August in Claudona?

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Right Side...

Write a summary that explains the difference between percentage and probability?

Left Side...

In order to successfully solve the problems we discusses in class, what are the key words that you are looking for?

Percentile ND Week 2 L1 HW.docx

While I was on break how much did I forget?

Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question

Week 2, Lesson 2

1. Notebook Set up
2. Percentile Continued....
3. ICA
4. Independent Work

Percentile Continued....
While I was on break how much did I forget?

Summary:

21

Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm

Warm-up: Answer the following questions.

1. The time taken to assemble a car in a certain plant is a random variable having a normal distribution of 20 hours and a standard deviation of 2 hours. What is the probability that a car can be assembled at this plant in a period of time

   a) less than 19.5 hours?

   b) between 20 and 22 hours?

2. Your phone costs an initial $150 to get and then $75 a month. How much will it cost you to turn your phone on for 11 months.

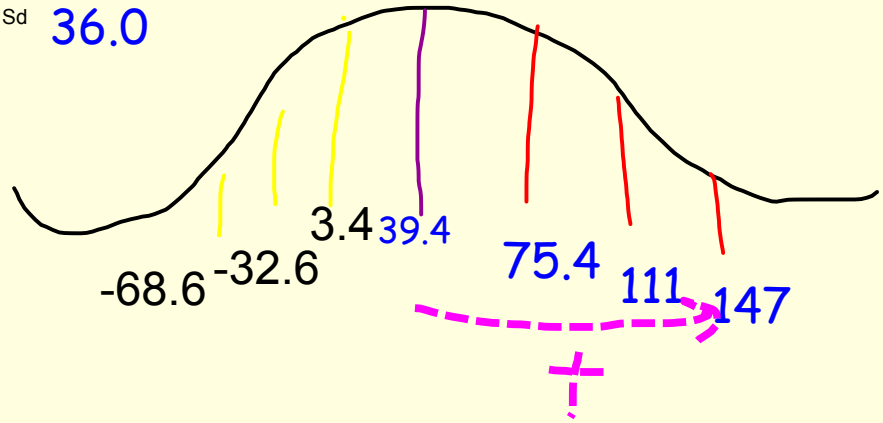
   y=150+75(x) y=75(x)+150

   y=75(11)+150= $975

3. Jeff counted how many people left their trash behind as they left lunch. He noticed that every day the students left less and less trash as they "grew up" and realized that it their responsibility to clean up after themselves. The data is as follows: 108, 97,90,67,68,54,23,21,10,9,9,9,9,9,8

mean 39.4

Sd 36.0



QUIZ TIME!!

Math Studies 3 QUIZ (2.6 and 4.1)

Name: _____ Date:_____ Period:___

Write an equation modeling the following situation, then use the equation to solve the problem.

1. Buffalo National Park camp sites charge a $300 renters fee, plus $25 per day. How much would it cost to camp at that site for 5 days?

   a. Equation:

   b. Solution:

2. LA Fitness charges $99 initiation fee, plus $25 per month. How much would it cost you to have a membership there for 11 months?

   a. Equation:

   b. Solution:

3. Sal has been studying for all of his classes lately. He has seen how it pays off with his great test scores. Make a standard deviation graph for his following test scores.

   95%, 96%, 98%, 89%, 100%, 110%, and 98%

   a. Mean:

   b. Standard Deviation:

   c.

Percentile Continued.....

Facts

We can also take any percentile and find out which data value represents that percentile

e.g.- "If your ACT results said you scored in the 75th percentile, what was your ACT score?"

When finding a data value, we are given the probability and we are asked to calculate the corresponding measurement.

Hence, this is the inverse of finding percentiles, and we use the inverse normal function on our calculator.

Calculator

Percentiles to Values

Menu → Run•Math → OPTN → F5:STAT → F3:DIST → F1:NORM → F3:InvN

InvNormCD $(area, \sigma, \mu,)$

Example 1

The I.Q. score is measured on a scale where the mean is 100 points with a standard deviation of 10 points. After taking an I.Q. test, a person was told they were in the 40th percentile. What was their I.Q. score?

$$invNormCD(\ .40,10,100) = 97.5$$

Example 2

M&Ms claim to have a mean of 42 candies in each bag with a standard deviation of 2.5 candies. What is the 80 th percentile of m&m bags?

invNormCD(.80, 2.5,42) =44.1

Summary:

There were 3 different classes taking the exact same test. Look at their test results. Before any calculations, which class do you think had the highest test score at the 90th percentile?

Ms. Carroll	Mr. Caballero	Mr. Henderson
$\mu = 82$	$\mu = 87$	$\mu = 75$
$\sigma = 2.5$	$\sigma = 2$	$\sigma = 6.2$

Now using your calculator, can you find the answer?

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Right Side...

Write a summary that explains what you found difficult in today's lesson.

Left Side...

With your group, explain one part of the lesson you found confusing.

If a person in your group shared something you understood, try and explain it.

Percentile ND Week 2 L2 HW.docx

Can you determine if two variables affect each other?

Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question

Week 2, Lesson 3

1. Warm-up
2. Linear Regression
3. ICA
4. Independent work

Linear Regression

Can you determine if two variables affect each other?

Summary:

23

Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up

Warm-up: Answer the following questions.

1. 40 cars were clocked on a radar gun. The mean speed was 52 mph, with a standard deviation of 4 mph. What driven speed represents the 75th percentile?

InvCD(.75,4,52) = 54.7

2nd Vars InvNorm(.75,52,4) =54.7

2. The length of life of an instrument produced by a machine has a normal distribution with a mean of 12 months and standard deviation of 2 months. Find the probability that an instrument produced by this machine will last

6.209664339E-03

a) less than 7 months.

normCD(0,7,2,12)=.00621

b) between 7 and 12 months.

normCD(7,12,2,12)=.494

Calculator

How do you think the following are correlated?

Age of puppy Weekly # of accidents	Hrs. of batting practice Batting average	Hrs. of exercise Hrs. of video games

We can use linear regression to see if two continuous data sets are linearly correlated.

"Linear regression" is the exact $y = mx + b$ equation of the

Line of best fit

_____

Step 1

Enter in data → STAT → Fill in L1 & L2 with Data

Step 2

Find LinReg → F1:GRPH → F1:GPH1 → F1: CALC → F2: X → F1: ax+b

Correlation Coefficient:

measures the strength of association between two variables

r value- the closeness of the linear relationship between the defined variables

r value	Correlation
Between -0.9 and -1	*Negative* and *very* strong
Between 0.9 and 1	*Positive* and *very* strong

r^2 Value- a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression.

$0 \leq r^2 \leq 1$ Higher values indicate that the model fits the data better.

e.g.- "68.3 % of the variation in the son's height can be explained by variation in the fathers height"

Summary:

Class Activity

Compare the r values for the two given relationships

Length of foot and *length of forearm*

Foot and Forearm LinReg File.xlsx r value:

Shoe size and *Height*

Shoe Size Height LinReg File.xlsx r value:

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Right Side...

What is the difference between the r and r^2 value?

Left Side...

Explain what you found difficult about today's lesson?

Linear regression W2 L3 HW.docx

How can the X^2 test of independence help you determine independence?

Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question Essential Question

Week 2, Lesson 4

1. Warm-up
2. The X^2 Test
3. ICA
4. Independent work

The X^2 Test

How can the X^2 test of independence help you determine independence?

Summary:

25

Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up Warm-up

Warm-up: Answer the following questions.

1. Explain why linear regression would not work if the data being collected was comparing how tall someone is (in inches) to if they sat in the front or back row of the classroom.

2. To investigate whether speed cameras have an impact on road safety, data was collected from several cities. The number of speed cameras in operations was recorded for each city, as well as the number of accidents over a 7 day period.

Number of speed cameras (x)	7	15	20	3	16	17	28	17	24	25	20	5	16	25	15	9
Number of car accidents (y)	48	35	31	52	40	35	28	30	34	19	29	42	31	21	37	32

a. Determine the linear regression model $y = -0.968x + 49.8$

b. State the r and r^2 values $r = -0.828$

$r^2 = 0.686$

Not all data can be evaluated with standard deviation or linear regression.

Categorical data needs to be measured using the *x^2 (chi squared) test of independence*

x^2 is used to test if two categories are independent or not

Hypothesis:

H_o : The two categories are INDEPENDENT
(they are unrelated)
H_a : The two categories are NOT INDEPENDENT

x^2 Test

$$\sum \frac{(f_o - f_e)^2}{f_e}$$

Degrees of Freedom

$$(row-1)(column-1)$$

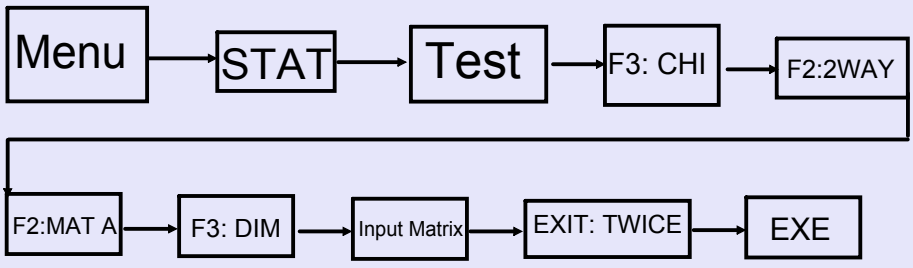
Critical Values:

Degrees of Freedom (df)	Significance level 10%	5%	1%
1	2.71	3.84	6.63
2	4.61	5.99	9.21
3	6.25	7.81	11.34
4	7.78	9.49	13.28
5	9.24	11.07	15.09
6	10.64	12.59	16.81
7	12.02	14.07	18.48
8	13.36	15.51	20.09
9	14.68	16.92	21.67
10	15.99	18.31	23.21

A critical value determines the "cut off point" for a test

-If x^2 exceeds the critical value, we *REJECT* the null hypothesis (H_o)
-If x^2 does NOT exceed the critical value, we *FAIL TO REJECT* the null hypothesis (H_o)

Calculator



Summary:

https://www.youtube.com/watch?v=LE3AJyY_cu8

Class Activity

1. A teacher wanted to run a social experiment. She placed a bowl of candy at the back of the room and recorded the actions of each student who walked in the room. 38 students were observed. She conducted this experiment at the 5% significance level and recorded her data in the table below.

H_o :
H_a :

	Took Candy	Didn't Take Candy
Male	7	9
Female	18	4

2. Mr. Jones decided to do a study to see if discipline was dependent on a student's grade level. His analysis included 60 students that were randomly selected. The data he collected was organized into the contingency table below. His study was conducted at the 10% significance level.

H_o :
H_a :

	Received Referal	Didn't Receive Referal
9th - 10th	21	13
11th - 12th	6	20

3. A medical clinic wants to test their new medicine, but they need to run test trials to see if the medicine makes patients vomit. They studied 100 people by giving some the actual medicine, then others a placebo. The results were gathered in the contingency table below. What would be an appropriate significance level?

H_o :
H_a :

	Vomit	No Vomit
Medicine	7	53
Placebo	4	36

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Right Side...

What is the difference between the r and r^2 value?

Left Side...

By looking at your ICA examples can you figure out where the degree of freedom come from?

Attachments

Vocab backs 1.docx

Vocab words.docx

MS 1 - Standard Graph Q1 half page.xlsx

MS 1 week 3 study guide.docx

Percentile ND Week 2 L1 HW.docx

Percentile ND Week 2 L2 HW.docx

Foot and Forearm LinReg File.xlsx

Shoe Size Height LinReg File.xlsx

Linear regression W2 L3 HW.docx