Math Virtual Learning

Algebra IIB

The Data Unit - What is Normal?

May 5, 2020

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Lesson: May 5, 2020

Objective/Learning Target: Students will compute and interpret the percentile of a given data point

Let's Get Started:

If you got 15/18 on a math quiz, what percent did you get on the quiz?

Did you do well on the quiz? How did you do compared with the rest of the class?

You got a 387/585 on a science quiz. What percentage did you get on the quiz?

Did you do well on the quiz? How did you do compared with the rest of the class?

Let's Get Started Answers:

Math Quiz: To find the percent, divide the fraction and multiply by 100: 15/18x100= 83%. You got a B which is pretty good……
But what if everyone else in the class got a 95%? Then you didn't do so well.

Science Quiz: To find the percent: 387/585x100 = 66%. You got a D which isn't so good…..
But what if everyone else in the class got a 35%? Then you performed brilliantly!

Percentages vs. Percentiles

A **percentage** is just a number out of 100. It describes how you did on a test.

A **percentile** describes what percent of the data falls below a specific number. It compares how you did with everyone else.

This link will walk you through some examples and give some additional necessary vocabulary: **Percentiles**

To Compute a Percentile

1. Put the data set in order from smallest to largest.
2. Put a mark between the data point you are computing the percentile on and the number directly below it.
3. Count how many numbers are below the data point and count how many total numbers are in the data set.
4. Divide the number of points below the data point by the total number.

Example 1

Here are 25 test scores: 72, 54, 56, 61, 62, 66, 68, 43, 69, 69, 70, 71, 77, 78 79, 85, 87, 88, 89, 93, 95, 96, 98, 99,and 99

What is the percentile of person who scored 71?

1. Order the numbers:

43, 54, 56, 61, 62, 66, 68, 69, 69, 70, 71, 72, 77, 78, 79, 85, 87, 88, 89, 93, 95, 96, 98, 99, 99

2. Put a line between 70 and 71

3. Count how many numbers are below 71: 10

4. Divide: 10/25 = .40 so it is the 40th percentile

To Find a Value based on a Percentile

1. Put the data set in order from smallest to largest.
2. Change the percentile into a decimal and multiply by the number of data points in the data set. Round down
3. Count the values in the given data set from left to right until reach the number from step 2.
4. Take the value from step 3 and average it with the number directly above it in the data set.

Example 2

Learn how to calculate percentile for the given example: There are 25 test scores such as: 72,54, 56, 61, 62, 66, 68, 43, 69, 69, 70, 71,77, 78, 79, 85, 87, 88, 89, 93, 95, 96, 98, 99, 99. Find the 60th percentile?

Solution:

Step 1:
Arrange the data in the ascending order.
Ascending Order = 43, 54, 56, 61, 62, 66, 68, 69, 69, 70, 71, 72, 77, 78, 79, 85, 87, 88, 89, 93, 95, 96, 98, 99, 99.
Step 2:
Find Rank,
Rank = Percentile / 100
= 60 / 100
k = 0.60
Step 3:
Find 60th percentile,
60th percentile = 0.60 x 25
= 15
Step 4:
Count the values in the given data set from left to right until you reach the number 15.
From the given data set, 15th number is 79. Now take the 15th number and the 16th number and find the average: 79 + 85 / 2 = 164 / 2 = 82
Hence, 60th percentile of given data set = 82.

PRACTICE

26	36	41	50	56	66	71	78	84	89
27	36	42	50	56	66	73	78	84	91
31	36	42	50	57	67	74	78	86	93
31	37	43	51	58	68	74	79	86	93
32	37	44	51	58	68	74	79	86	93
32	38	44	52	60	69	75	79	86	94
33	38	46	54	61	70	76	80	87	94
33	39	48	55	62	70	76	81	87	95
33	39	49	55	63	70	76	83	88	95
35	40	50	56	63	70	77	83	89	95

There are 100 numbers in the data set and they are already in order:

1. _____ Find the 3rd quartile.
2. _____ Find the 88% percentile.
3. _____ What is the percentile for 58?
4. _____ Find the 20% percentile.
5. _____ Find the 2nd quartile.
6. _____ Find the 49% percentile.
7. _____ What is the percentile for 33?
8. _____ Find the 10% percentile.
9. _____ Find the 87% percentile.
10. _____ Find the 1st decile.

PRACTICE ANSWERS

1. (79+79)/2=79 — Find the 3rd quartile.

2. (87+88)/2=87.5 — Find the 88% percentile.

3. 43rd percentile — What is the percentile for 58?

4. (40+41)/2=40.5 — Find the 20% percentile.

5. (63+66)/2=64.5 — Find the 2nd quartile.

6. (63+63)/2=63 — Find the 49% percentile.

7. 6/100 = 0.06 so 6th percentile — What is the percentile for 33?

8. (35+36)/2=35.5 — Find the 10% percentile.

9. (87+87)/2=87 — Find the 87% percentile.

10. (35+36)/2=35.5 — Find the 1st decile.

Percentiles in Real Life

1. **Shoes**. How many pairs of shoes do students have? Do girls have more shoes than boys? Here are data from a random sample of 20 female and 20 male students at a large high school:

Female	50	26	26	31	57	19	24	22	23	38
	13	50	13	34	23	30	49	13	15	51

Male	14	7	6	5	12	38	8	7	10	10
	10	11	4	5	22	7	5	10	35	7

a) Find an interpret the percentile in the female distribution for the girl with 22 pairs of shoes

b) Find an interpret the percentile in the male distribution for the boy with 22 pairs of shoes

c) Who is more unusual: the girl with 22 pairs of shoes or the boy with 22 pairs of shoes? Explain.

Shoe Answers:

1: 5/22 = 23rd percentile. 23% of girls in this sample had less than 22 pairs of shoes.

2. 17/22 = 77th percentile. 77% of boys in this sample had less than 22 pairs of shoes

3. It would be more unusual for a boy to have 22 pairs of shoes because only 23% of boys had that many whil 77% of the girls did.

Challenge

There are more precise ways to find percentiles, especially if there are duplicate numbers in the data set. Here is a more complex formula:

$$R_{100} = 100 \times \frac{N_< + \frac{1}{2}N}{N_t}$$

R_{100} = Percentile Rank

$N_<$ = number of data points less than the selected value

N = number of times your specific data point shows up in the data set

N_t = total number of data points

Try using the challenge formula on this worksheet.

Challenge Percentile Worksheet
Examples and answers to Challenge Percentile Worksheet