Name: _____

AP Statistics Handout: Lesson 2.1
Topics: percentiles, cumulative relative frequency, standardized scores (z-scores)

Lesson 2.1 Guided Notes

Two Test Takers: Mr. Young-Saver (picture is an actual photo of him in high school) took the SAT and scored a 1050. Guy Fieri took the ACT and scored a 23. The SAT has a total of 1600 possible points. The ACT has a total of 36 possible points.

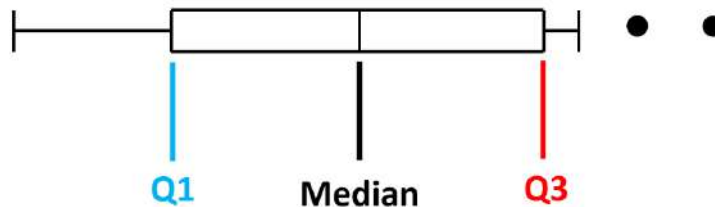Who do you think had the better score? Explain your reasoning.

SAT: 1050

ACT: 23

Percentiles

Percentile: the percent of data _____ a certain data value.

Below are the yearly salaries of employees at a company (in thousands of $). At what percentile is the person who makes a salary of $43,000? Show your work.

29, 32, 34, 34, 34, 34, 35, 35, 39, 43, 67, 185

For a large dataset:

Q1   Median   Q3

1) What percentile is Q1?   2) What percentile is the median?   3) What percentile is Q3?

Back to our two test takers: These tables display the percentiles of different scores on the SAT and ACT (based on 2019-2020 exam year). Using this information, determine whose score (Mr. Young-Saver's or Guy Fieri's) is more impressive. Explain your reasoning.

SAT Score	Percentile
1600	100%
1550	99.3%
1500	98%
1450	95%
1400	93%
1350	89%
1300	84%
1250	78%
1200	71%
1150	62%
1100	53%
1050	45%
1000	35%
950	26%
900	19%
850	13%
800	8%
750	5%
700	3%
650	2%
600	1%

ACT Score	Percentile
36	100%
35	99.9%
34	99.0%
33	98%
32	97%
31	95%
30	93%
29	91%
28	88%
27	85%
26	82%
25	78%
24	74%
23	69%
22	64%
21	58%
20	52%
19	46%
18	40%
17	33%
16	27%
15	20%
14	14%
13	9%
12	4%
11	1%
10	1%

Cumulative Relative Frequency
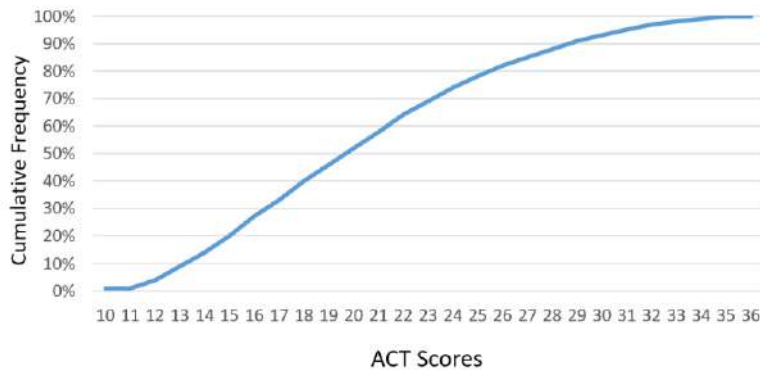
Above is a cumulative relative frequency chart of the ACT data. Answer the following questions, using the chart:

1) Is 18 a good ACT score? Explain.

2) You are applying for an elite college and want to score in the top quartile of test takers. What score do you need?
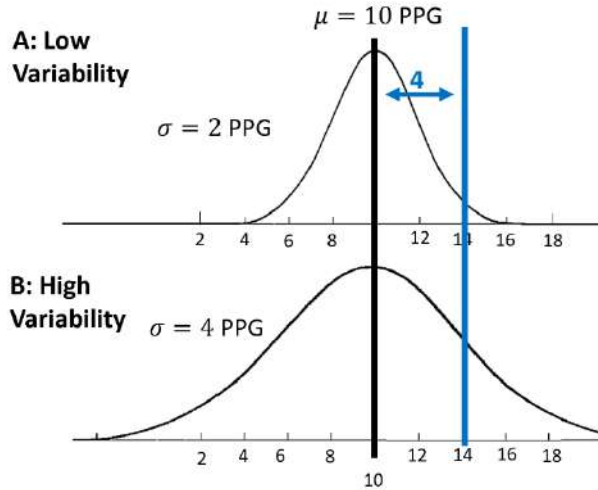
Standardized Scores (Z-Scores)

<u>Z-Scores (also called standardized scores):</u> measures how many _____ a data point is _____ the mean.

$$z = \frac{data\ point - mean}{standard\ deviation} \quad | \quad z = \frac{x_i - \mu}{\sigma}$$

Material adapted from the Skew The Script curriculum (skewthescript.org)

Skew The Script

Why Standard Deviation Matters:

A: Low Variability

$\mu = 10$ PPG

$\sigma = 2$ PPG

4

2 4 6 8 12 14 16 18

B: High Variability $\sigma = 4$ PPG

2 4 6 8 12 14 16 18

10

Here is another real photo of Mr. Young-Saver, playing basketball in high school. Doesn't he look like an elite athlete? Imagine that Mr. Y-S scores **14 points per game (PPG).**

In league A, players average 10 points per game, with a standard deviation of 2 points per game. Players in league B have the same average PPG, but with a higher standard deviation between them (4 PPG). In which league (A or B) is Mr. Young-Saver's performance more impressive? Why?

Standardization: A point's location in the distribution depends on **both** distance from the _____ and the distribution's _____.

Standardized: Who Was the Best?

Wilt - 60's

Jordan - 90's

LeBron - 2010's

Paul Vathis, AP Images

Q: Who was the **G.O.A.T?**

Explain your answer based on the z-scores you calculate:

	Wilt	Jordan	LeBron
	30.1 ppg	30.1 ppg	27.1 ppg
Mean (μ) ppg in their era:	10.8 ppg	8.7 ppg	8.4 ppg
Stdv (σ) ppg in their era:	7.0 ppg	5.9 ppg	5.5 ppg
Z-Score: (show work)			

Skew The Script

Standardized: Players who were not the best…

Adam Morrison

Calculate and interpret *Adam Morrison's z-score for PPG…*
While with the Lakers, he averaged **2.2** PPG.
(League: μ = 8.4 ppg, σ = 5.5 ppg)

data value > mean → _____

data value < mean → _____

$$z = \frac{data\ point - mean}{standard\ deviation}$$

Positive Z-Score: The number of standard deviations _____ the mean.

Negative Z-Score: The number of standard deviations _____ the mean.

Lesson 2.1 Discussion

Wilt - 60's   Jordan - 90's   LeBron - 2010's

Paul Vathis, AP Images

Note: All data is from 2020 season and earlier

	Wilt	Jordan	LeBron
Shots per game:	22.5	**22.9**	19.6
% shots made:	54.0%	**49.7%**	50.4%

Discussion: Given these additional statistics, do you believe Jordan is still the G.O.A.T at scoring? Why or why not? What other stats may be helpful in determining who was the best?

Skew The Script

Lesson 2.1 Practice

Teachers: We recommend providing additional practice exercises from your AP Stats textbook or from prior AP Stats exams. The following textbook sections and AP exam questions are aligned to the content covered in this lesson.

- *The Practice of Statistics (AP Edition),* 4th-6th editions: section 2.1
- *Stats: Modeling the World (AP Edition),* 4th & 5th editions: ch 3 & 5, 3rd edition: ch 4 & 6
- *Statistics: Learning from Data (AP Edition),* 2nd edition: section 3.5
- *Advanced High School Statistics*, section 2.2
- AP Exam Free Response Questions (FRQs): 2011 Q1 (parts b & c), 2019 Q6 (parts d & e)

Note: We recommend including relatively more practice on percentiles and z-scores. Cumulative frequency charts are not heavily tested.

Skew The
Script