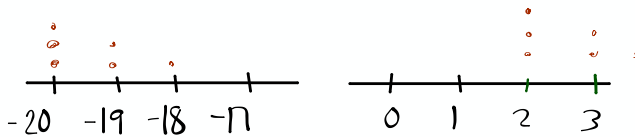


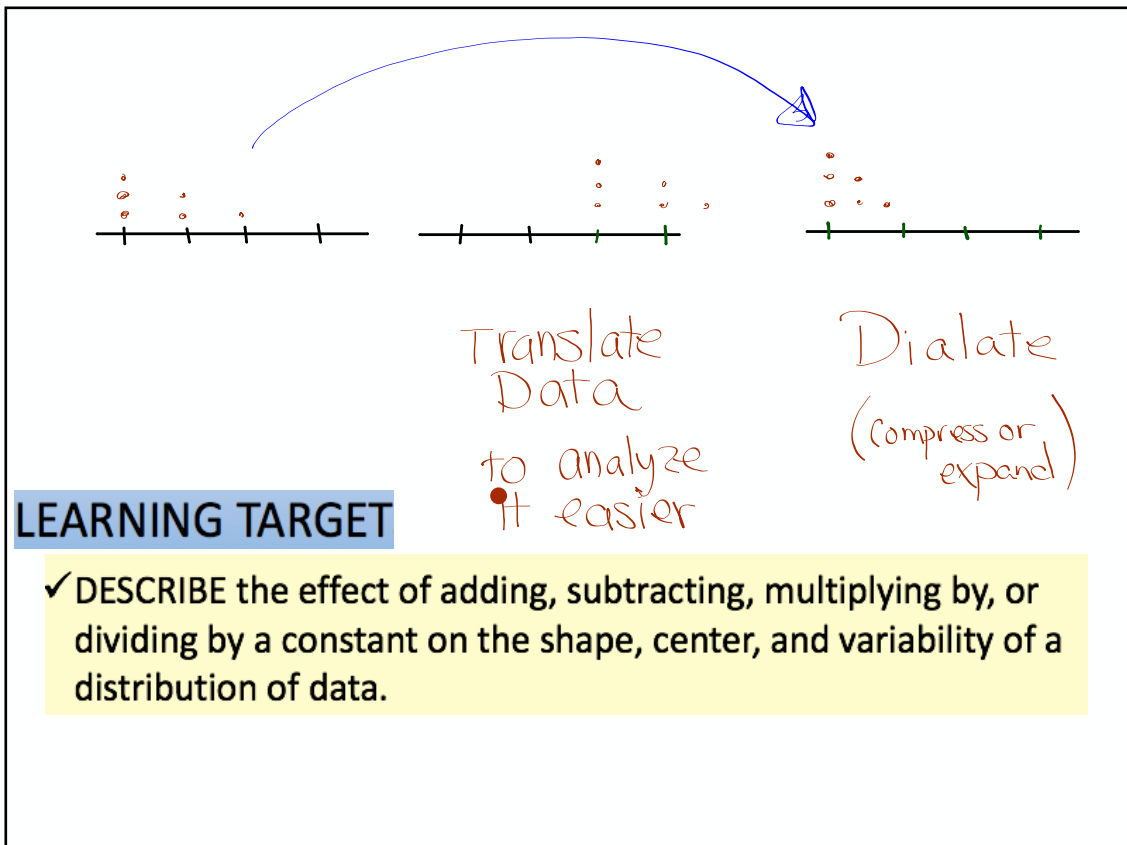
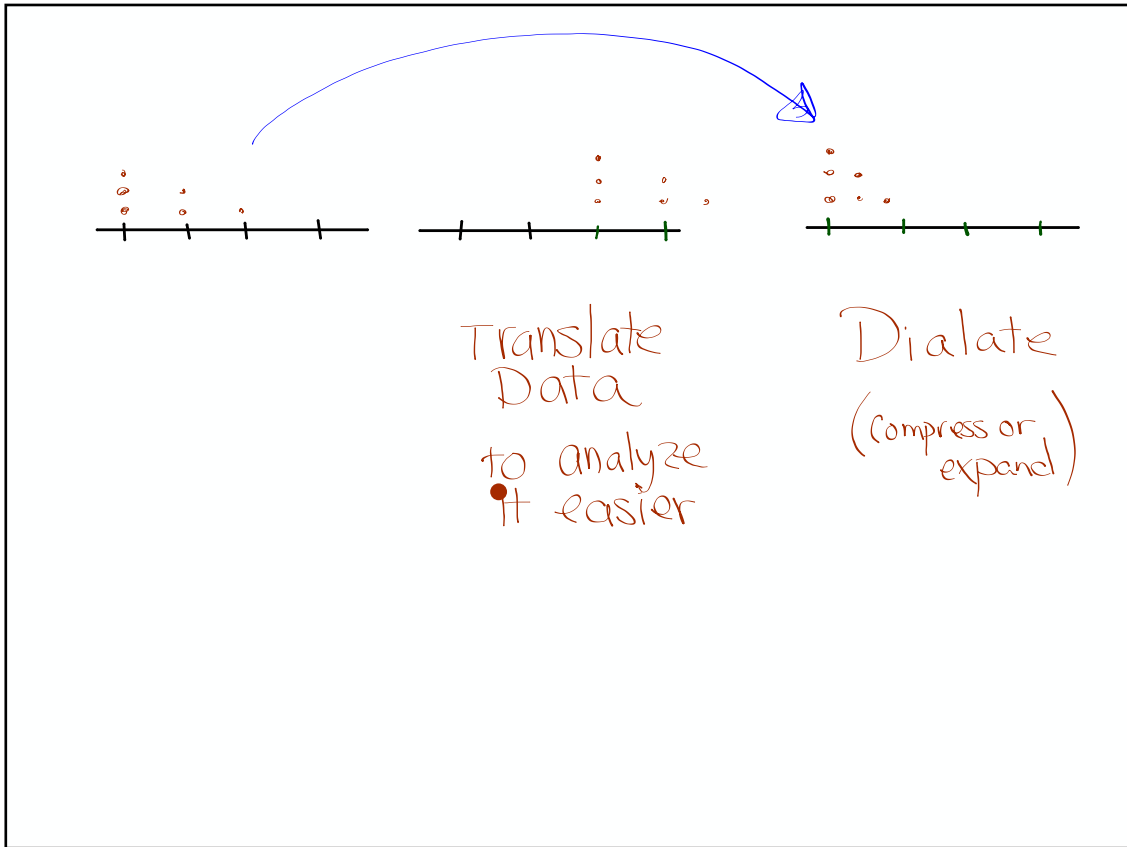
Transforming Data

Section 2.1 day 2

You will receive your test
later in the period.



Translate
Data
to analyze
it easier



Exploration

(handout)



An Exploration in Transforming Data - 2.1 Day 2

You will continue to use the Ch. 1 Test data from the last class

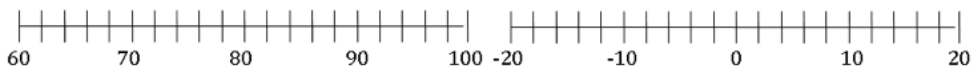
There are two mathematical operations used when calculating a z-score: $z = \frac{VALUE - MEAN}{SD}$

1. First, we take each score, and Subtract the mean (*remember the mean was 80*). Fill in the table and then make a dotplot for each.

SCORE	61	65	65	73	75	77	78	78	79	80	80	80	80	81	81	88	89	93	98	99
SCORE - MEAN	-19																			

Dotplot for SCORE

Dotplot for SCORE - MEAN



What happens to the **shape**, **center**, and **variability** when you subtract the mean from each score?

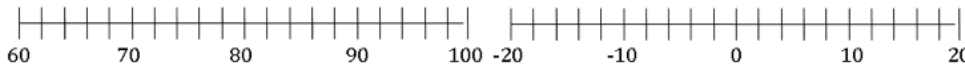
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SCORE - MEAN	-19	-15	-15	-7	-5	-3	-2	-2	-1	0	0	0	0	1	1	8	9	13	18	19

Dotplot for SCORE

Dotplot for SCORE - MEAN



What happens to the **shape**, **center**, and **variability** when you subtract the mean from each score?

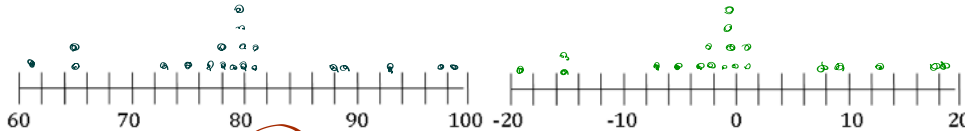
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Dotplot for SCORE

Dotplot for SCORE - MEAN



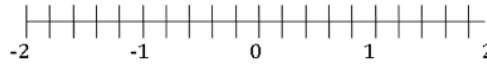
What happens to the **shape**, **center**, and **variability** when you subtract the mean from each score?

shape center variability
 Same moved down same
 New mean = 0
 range $99 - 61 = 38$
 $19 - (-19) = 38$

2. Second, we take the SCORE – MEAN and *divide* by the standard deviation (remember the standard deviation is 10). Fill in the table and then make a dotplot for each.

SCORE - MEAN	-19	-15	-15	-7	-5	-3	-2	-2	-1	0	0	0	0	1	1	8	9	13	18	19	
$\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$	<i>-1.9</i>	<i>-1.5</i>																			

Dotplot for $\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$

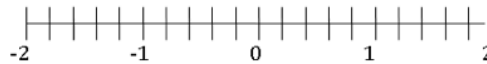


What happens to the **shape**, **center**, and **variability** when you divide by the standard deviation for each value?

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$\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$	<i>-1.9</i>	<i>-1.5</i>	<i>-1.5</i>	<i>-.7</i>	<i>-.5</i>	<i>-.3</i>	<i>-.2</i>	<i>-.2</i>	<i>-.1</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>.1</i>	<i>.1</i>	<i>.8</i>	<i>.9</i>	<i>1.3</i>	<i>1.8</i>	<i>1.9</i>

Dotplot for $\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$

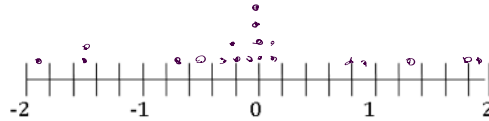


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$\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$	$-\frac{19}{10}$	$-\frac{15}{10}$	$-\frac{15}{10}$	$-\frac{7}{10}$	$-\frac{5}{10}$	$-\frac{3}{10}$	$-\frac{2}{10}$	$-\frac{2}{10}$	$-\frac{1}{10}$	0	0	0	0	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{13}{10}$	$\frac{18}{10}$	$\frac{19}{10}$

Dotplot for $\frac{\text{SCORE} - \text{MEAN}}{\text{SD}}$



What happens to the **shape**, **center**, and **variability** when you divide by the standard deviation for each value?

Same

Same
mean = 0

decreased
New SD = $\frac{10}{10} = 1$

3. What is the mean and standard deviation of the distribution of **z-scores**? Will this be true for any distribution of z-scores?

$$\text{mean} = 0 \quad \text{SD} = 1$$

Standardized distribution (z-scores) always have a mean = 0 and SD = 1

Summary: Transformation of data

What happens to the shape, center, and variability of a distribution when you:

...add or subtract the same value a from each value?

...multiply or divide by the same value b from each value?

Standardizing a distribution will produce:

Summary: Transformation of data

What happens to the shape, center, and variability of a distribution when you:

...add or subtract the same value a from each value?

shape and variability stay the same. Center shifts up (down)
by a

...multiply or divide by the same value b from each value?

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shape stays same. Center and variability get multiplied (divided) by b

Standardizing a distribution will produce:

before we continue
we're going to

Standardize every
number in a data set

Using Excel
actually Google
sheets

1	Carson, Samuel
2	Clark, Kathryn
3	Ellis, Indiana
4	Erickson, Willi
5	Mozan, Elizabet
6	Ngo, Hannah L.
7	No, Grace
8	Sanders, Keshia
9	Schwake, Shane
10	Sherlock, Clayt
11	Snyder, Eva L.
12	Vega, Araceli
13	Vuong, Karen N.
14	Wilson, Bethany
15	

	Raw data	Value - Mean	(value-mean)/std deviation
	5		
	15		
	25		
	35		
	45		
	55		
Mean			
Std Deviation			

Moral of the Story

Standardizing a distribution will produce a mean of 0 and a standard deviation of 1 for any distribution.

Summary: Transformation of data

What happens to the shape, center, and variability of a distribution when you:

...add or subtract the same value a from each value?

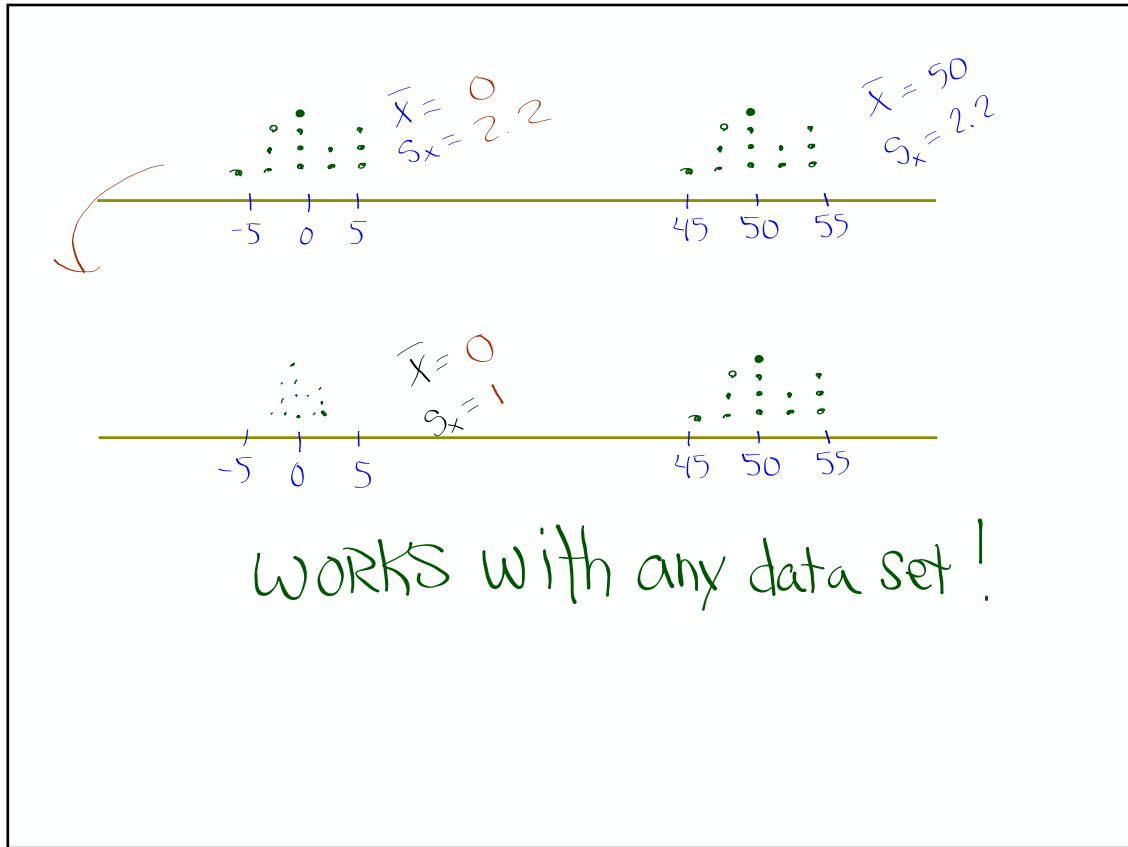
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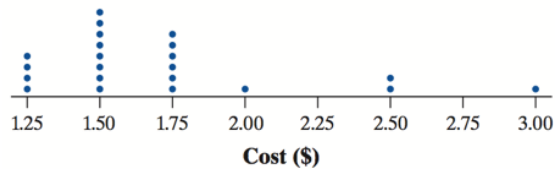
Standardizing a distribution will produce:

mean of 0 and $SD = 1$



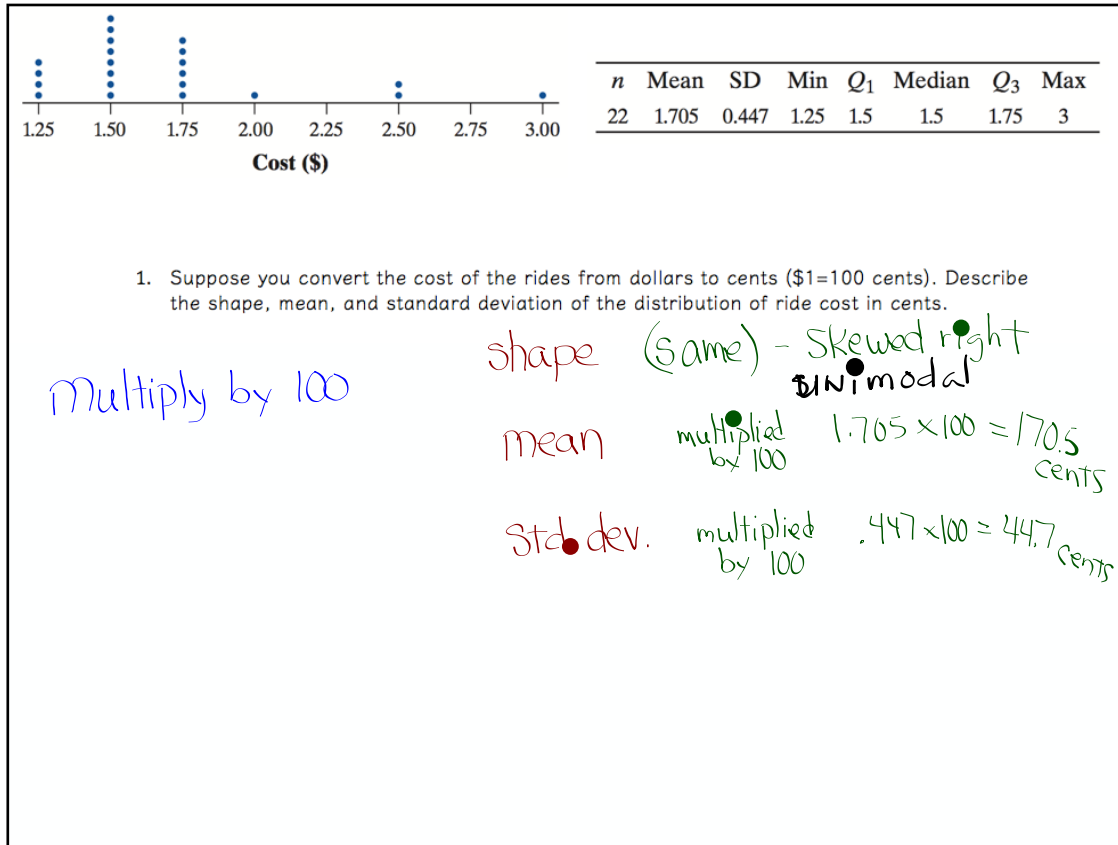
Check Your Understanding:

Knoebels Amusement Park in Elysburg, Pennsylvania, has earned acclaim for being an affordable, family-friendly entertainment venue. Knoebels does not charge for general admission or parking, but it does charge customers for each ride they take. How much do the rides cost at Knoebels? The figure shows a dot-plot of the cost for each of 22 rides in a recent year, along with summary statistics.



n	Mean	SD	Min	Q_1	Median	Q_3	Max
22	1.705	0.447	1.25	1.5	1.5	1.75	3

- Suppose you convert the cost of the rides from dollars to cents ($\$1=100$ cents). Describe the shape, mean, and standard deviation of the distribution of ride cost in cents.



2. Knoebels' managers decide to increase the cost of each ride by 25 cents. How would this the shape, center, and variability of this distribution compare with the distribution of cost in Question 1? Assume a price increase after converting to cents.

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Assume
price increase
after converting
to cents

shape (same)-skewed right

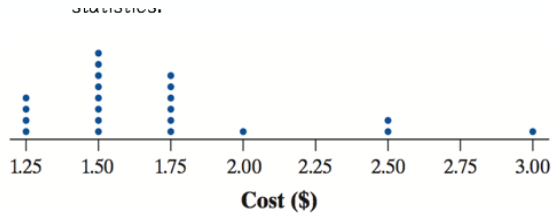
center

shifts up
25 $170.5 + 25 = 195.5$
cents

variability

Same

still
44.7 cents



n	Mean	SD	Min	Q ₁	Median	Q ₃	Max
22	1.705	0.447	1.25	1.5	1.5	1.75	3

3. Now suppose you convert the increased costs from Question 2 to z-scores. What would be the shape, mean, and standard deviation of this distribution? Explain your answers.

shape same (skewed right)

mean

$$\bar{x} = 0$$

μ

σ S

std. deviation

$$s_x = 1$$

σ

Do You Use Uber ?

Taking an Uber ride in New York City has an initial fee of \$2.55 with an additional charge of \$1.75 per mile (we will ignore the small per minute waiting fee). In equation form,

$$\text{cost} = 2.55 + 1.75 (\text{miles}).$$

A local New York City resident records the number of miles for his first 25 rides with Uber. The mean distance of his rides is 5.6 miles with a standard deviation of 1.2 miles.

(a) Find the mean cost of the 25 trips.

(b) Calculate the standard deviation of the cost of the 25 trips. Interpret this value in context.

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(a) Find the mean cost of the 25 trips.

$$\text{Mean} = (1.75)(5.6) + 2.55 = \$12.35$$

(b) Calculate the standard deviation of the cost of the 25 trips. Interpret this value in context.

$$s_x = (1.75)(1.2) = \$2.10$$

Adding or Subtracting
won't change variability
so we don't add.

- the costs of an Uber ride typically vary from \$12.35 by \$2.10

BB

then see your tests

50% Multiple choice → 1 TEST score
50% Free response

but I want you to get meaningful
feedback on your free response questions

50% Multiple choice → 1 TEST score
 50% Free response

but I want you to get meaningful feedback on your free response questions

Multiple Choice	% correct = $\frac{10}{14} = 71\%$	Conversion to SHS % = $83\frac{1}{2}$	Average of M/C and FRQ = _____
FRQ Raw Score	Average out of 4.0 = 2.2	Conversion to SHS % = 78%	

↑
 Keep track as course progresses to see where you stand.

Assignment

2.1 21, 25, 29, 31, 33-38

and study pp. 97-103

1	Baker, Gabriell
2	Booth, Caitlin
3	Cervantes-Frank
4	Cleveland, Cars
5	Coffin, Kaleb C
6	Conaghan, Whitn
7	Haverland, Meg
8	Knapp, Kaelyn S
9	Pelayo, Miriam
10	Saunders, Morga
11	Schnoor, Natali
12	Sluga, Celia J.
13	Smith, Tatum F.
14	Sowers, Harley
15	

Per. 5

