Name_____

Linear Relationship Investigation

Portfolio Piece

Objectives: Find a linear relationship in the real world, collect data, and analyze the results.

Requirements:

- Title
- Introduction in paragraph form with explanation of:
  - Brief summary of experiment
  - Why did you choose to investigate this?
  - Hypothesis of why you think the relationship is linear
  - Definition of Independent Variable and Dependent Variable
  - Variables to be measured
    - Independent Variable
    - Dependent Variable
- Data table with at least 8 pieces of data
- Hand-made graph of data with line of best fit drawn in
- Equation in slope-intercept form showing the relationship between your variables
  - Include a title for your formula (ex: Grymonpré's Law of Football-Handing in Circles)
- Labeled diagram showing:
  - Both variables
  - What the slope represents in the actual situation
  - What the y-intercept represents in the actual situation
- Explanation in paragraph form of:
  - How you determined the slope and y-intercept
  - Value of the slope
  - What the slope represents in the actual situation
  - Value of the y-intercept
  - What the y-intercept represents in the actual situation
  - Sources of error
  - Importance & applications for your equation

Ideas: things that stack, relationships that include rates.

Due Dates

Variables Information	Tuesday, March 1
Data Table & Graph	Friday, March 4
First Draft	Monday, March 7
Second Draft	Friday, March 11

Name_____

Linear Relationship Investigation

Variables Information

Due Tuesday, March 1

Summary of Experiment	
Independent Variable	**Dependent Variable**
Measured in units of	Measured in units of
Hypothesis: Why do you think these variables will demonstrate a linear relationship?	
Draw a sketch below showing both variables.	

Footballs and Circles

Kris Grymonpré

Why I chose to investigate this topic, and my brief description.

Ancient people have sat around campfires wondering, “If I had a soft Colts football, how long would it take to hand it around this circle of people?” Indeed, this question has baffled many mathematicians. Until now. I have studied the complex variables involved in passing a football around in a circle. The independent variable, which I changed, was the size of the circle (s), measured in the number of people. The dependent variable, which changed as a result of changing the independent variable, was the time to hand the football around the circle, measured in seconds. It makes sense that the relationship between these variables is linear because each person added to the circle also adds another hand-off, which adds more time. Because each person takes about the same amount of time when handing off a football, there should be a linear pattern in the data.

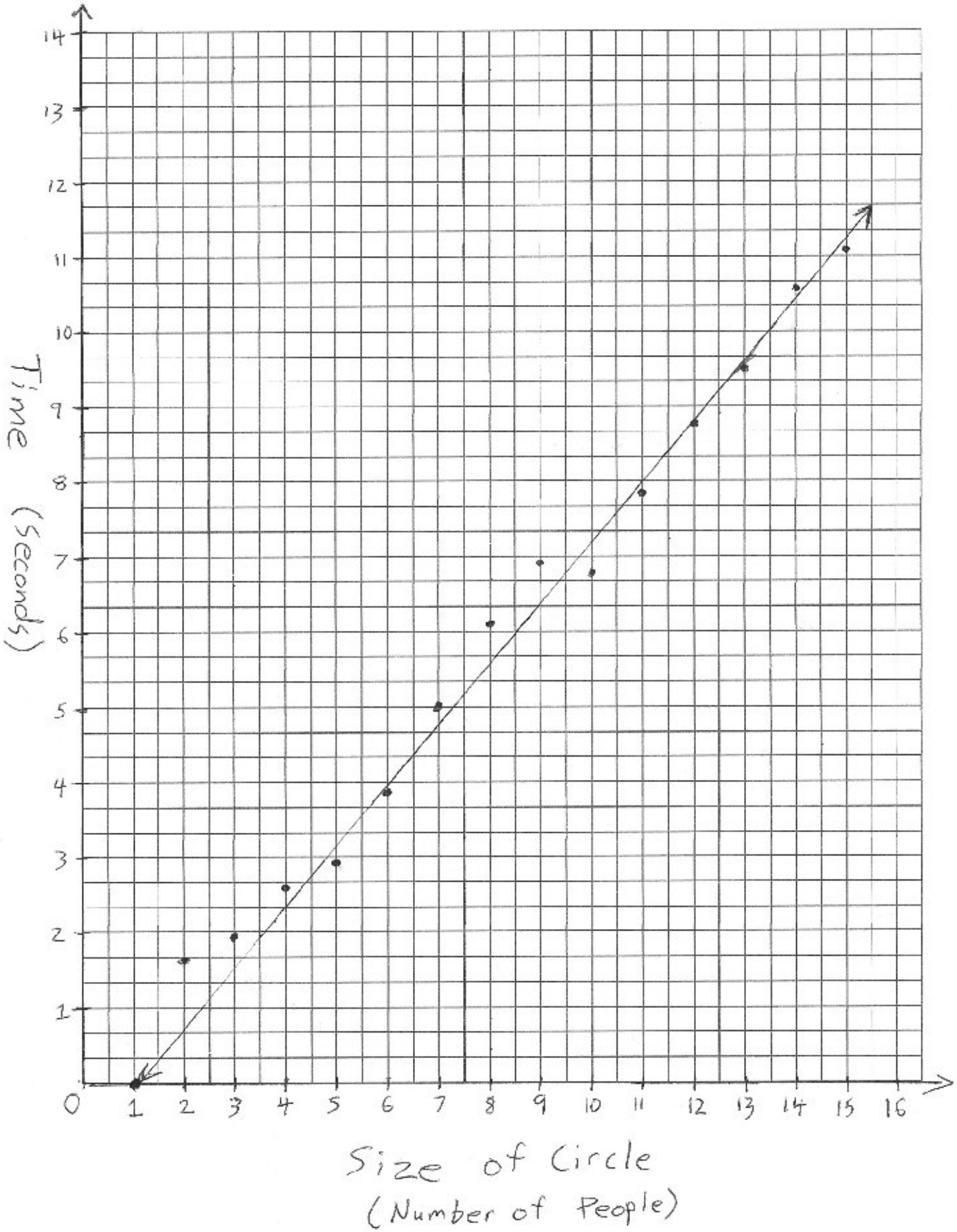
Independent & Dependent Variable Information

Hypothesis of why it should be linear with reasoning

Data Table

s	t
1	0.0
2	1.6
3	1.9
4	2.6
5	2.9
6	3.8
7	5.0
8	6.1
9	6.9
10	6.7
11	7.8
12	8.7
13	9.5
14	10.6
15	11.1

Football Hand-Offs in a Circle



Using the graph, I measured the rise of the entire graph to be about 11.1 seconds and the run to be 14 people. The slope (m) is the same as rise over run, which gives us m = 0.8 seconds per person. Because the slope is 0.8 and there is a data point at the coordinates (1, 0), the y-intercept must be at the coordinates (0, -0.8). This would mean that when the line has a run of 1, the rise is 0.8. Therefore, the y-intercept is -0.8 sec. Using these numbers, I came up with the following equation which best fits the data:

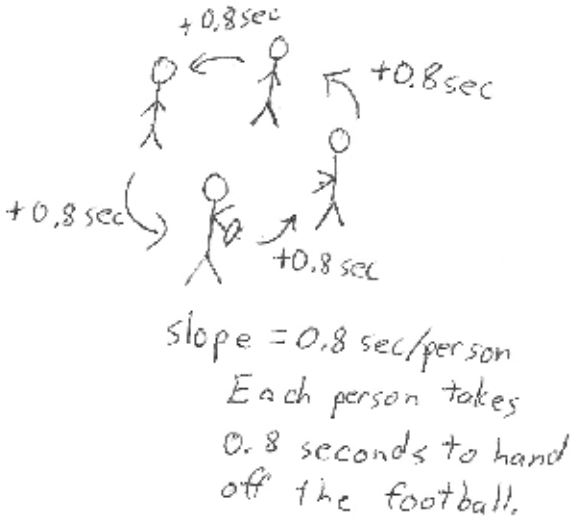
How I got the slope & y-intercept, and what their values are

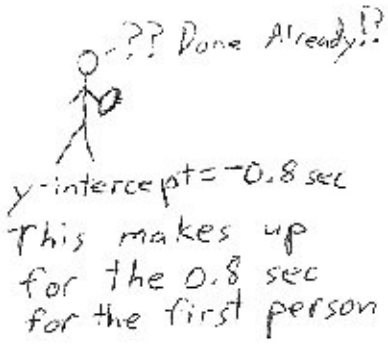
$$t = 0.8s - 0.8$$

Equation in slope-intercept form, with title

This equation is hereby named *Grymonpré's Law of Football-Handing in Circles*. The slope is 0.8 and represents the time it takes each person to hand off the football. On average, people took 0.8 seconds per hand-off. The y-intercept is -0.8, which at first seems odd because there is no such thing as negative time. This value, however, makes up for the fact that with only one person, there are no hand-offs, so -0.8 seconds effectively cancels out the 0.8 seconds for the first person. The slope and y-intercept are represented in the diagram below.

What the slope & y-intercept represent in my situation (or what they should represent and why they are different)





Sources of error

The graph shows the line of best fit, which represents my equation. However, not all of the data are on the line. Possible sources of error may be incorrect timing or mistakes when handing off the football. It is also important to note that different people may have slightly different times for handing the football to the next person.

Applications

Grymonpré's Law of Football-Handing in Circles can be used to estimate the amount of time needed to pass a football around in a circle of any size. If the entire school of 300 students formed an enormous circle, it would take approximately 239.2 seconds, or 3 minutes 59.2 seconds. If Mr. G were to pass blurt alert cards around the 17 desks, it would take about 13.6 seconds to return to Mr. G. Applications of *Grymonpré's Law of Football-Handing in Circles* include any time that objects are being handed from person to person in a circle. Games of hot potato will never be the same.

Name_____

Linear Relationship Investigation Rubric

Category	Beginning	Approaching	Meeting	Exceeding
Completeness	Several days late. Several sections from assignment are missing.	One day late. One or two sections from assignment are missing.	On-time. Includes every section from assignment.	On-time. Includes extra information not required.
Calculations & Graphing Skills	Many calculations are incorrect. Graph is missing several items from checklist.	Some calculations are incorrect. Graph is missing one or two items from checklist.	Calculations are correct. Graph includes everything from checklist.	Calculations are correct. Graph is visually appealing.
Connections	Few or no connections are made between the data, equation, graph, and situation. Analysis of data is incorrect.	Some connections are made between the data, equation, graph, and situation, but there are some missed connections. Analysis of data is unclear or slightly incorrect.	Several appropriate connections are made between the data, equation, graph, and situation. Analysis of data is reasonable.	Extra connections are made, some showing deep thought. Analysis of data shows good critical thinking skills.
Communication	Writing is not in complete sentences or extremely unclear. Few or no mathematical terms are used appropriately.	Writing is slightly unclear or difficult to understand. Some mathematical terms are either missing or used inappropriately.	Writing is clear and concise in complete sentences. Mathematical terms are used appropriately.	Writing is easy to read and flows nicely. Mathematical terms are used appropriately and explained in great detail.

Graph checklist:

- All lines drawn with a straight edge, with arrowheads
- Axes numbered evenly
- Every data point plotted as a point, not connected
- Line of best fit drawn in, with arrowheads
- Axes have labels with units
- Graph has title

Draft Number _____

Overall Grade _____