MiSP Simple Machines / Inclined Plane Assessment L3

Name _____   Date _____

Introduction:

A family was talking about a plan to build a ramp to their home's front door because the children's grandfather, who lives with them, can only move about in a wheelchair. They talked in terms of standard units (pounds and feet) rather than metric units (newtons and meters). The combined weight of the grandfather and his wheelchair is **200 pounds**. The height from the ground to the front door is **four feet**.

The youngest member of the family wanted to help his grandfather enter the house, but he was only able to do **25 pounds** of push.

Family members disagreed about how long to make the ramp. Luckily, the family's eighth-grade child came up with some data based on experimentation she had done in school:

	DISTANCE TO DOOR (FEET)	PUSH NEEDED (POUNDS)
NO RAMP	4	200
RAMP	10	80
RAMP	15	53
RAMP	20	40
RAMP	25	32
RAMP	30	27
RAMP	35	23
RAMP	40	20
RAMP	45	18

The data from the chart was graphed as follows:

WHEELCHAIR RAMP DESIGN
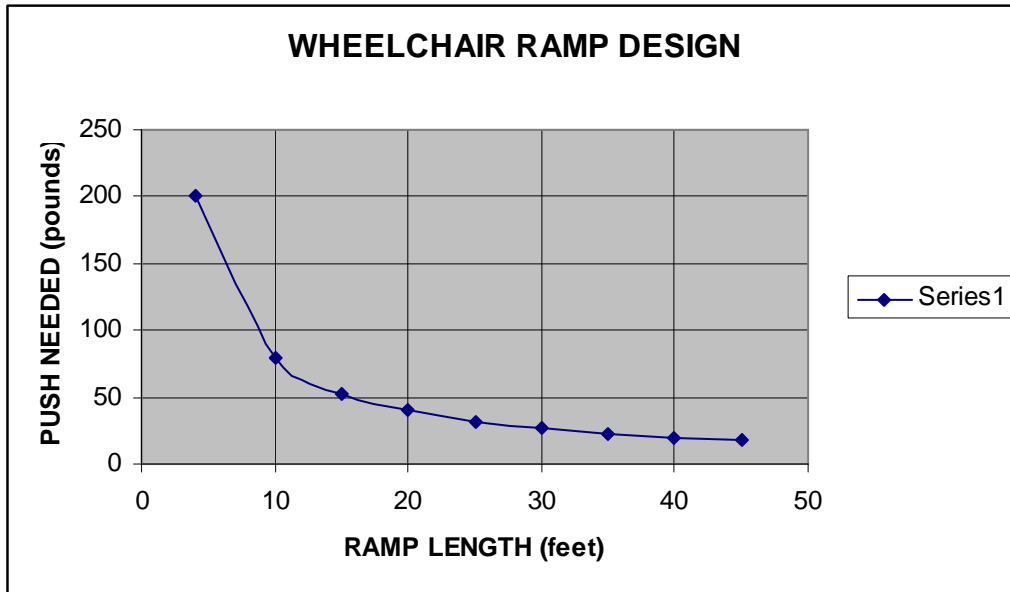
1. Based on the data chart and graph, how long should the ramp be if the youngest child in the family will be able to push his grandfather up the ramp with a force of 25 pounds? Why?

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2. How much push would be required for a ramp 27½ feet long?

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3. A ramp is a type of simple machine called an inclined plane. How does an inclined plane make it easier to do work?

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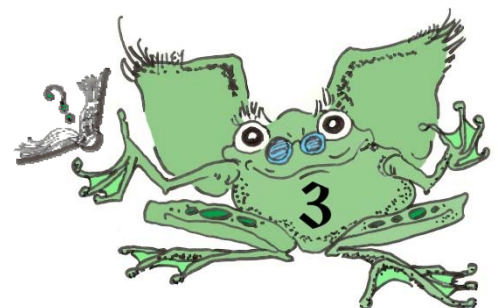
4. The work of moving the child's grandfather up to the front door is helped by the ramp, but there is a cost. What is the trade-off when using a ramp to make a job easier?

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5a. You can connect the data points (10, 80) and (15, 53) with a line. What is the unit rate of change (slope) for that line?

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5b. A unit rate of change can be a negative (-) or positive (+) number. What is the sign of the unit rate of change calculated in 5a? What does that mean in words?

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5c. If you connected the data points (40, 20) and (45, 18) with a straight line, would the unit rate of change be negative or positive? The absolute value of that unit rate of change is less than the unit rate of change you calculated in 5a. What does that tell you about the effect of increasing the length of the ramp on the push needed at this part of the graph?

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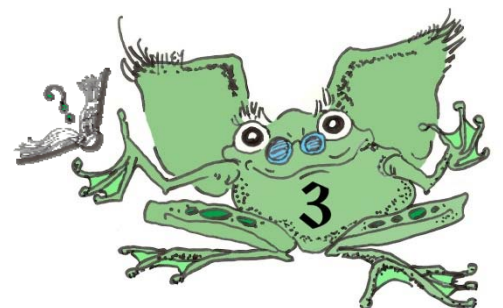
6. Determine the *y*-intercept for the line segment between the (10, 80) and (15, 53) data points.

7. Using the unit rate of change calculated in 5a and the *y*-intercept from 6, what is the formula for the line that includes the (10, 80) and (15, 53) data points?

8. If the family's eighth-grade student had data only for ramp lengths of 10 and 15 feet and determined the formula for the line that includes those points, she would have made a big mistake if she had used that formula to find out how long the family's ramp should be (so a person could be pushed up the ramp with 25 pounds of push). Why?

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