

MathLinks

GRADE 8 TASKS Algebra and Statistics

Equation Exploration (equations)	7
Functional Relationships? (functions)	8
Describing and Drawing Graphs (functions)	9
Staircase Slopes (linear functions - slope)	10
Your Savings Problem (linear functions)	11
Choosing a Gym Membership (linear functions - systems)	12
Grades or Popularity (data)	13
Vitruvian Man (data)	14

EQUATION EXPLORATION

equations

Make up the following types of equations, show all steps in solving them, provide reasons/justifications for each step, and note your solutions clearly.

Equation type	Solution type
1. Integer coefficients, variables on both sides	Exactly one solution
2. Integer coefficients, variables on both sides, parenthesis on both sides	Exactly one solution
3. Rational number coefficients, variables on both sides	Exactly one solution
4. Rational number coefficients, variables on both sides, parenthesis on both sides	Exactly one solution
5. Integer coefficients, variables on both sides	No solutions
6. Integer coefficients, variables on both sides	Infinitely many solutions

Solve these linear equations in one variable. Check your work.

7. $\frac{3}{5}x - \frac{1}{10}x = \frac{1}{2}x + 1$

8. $0 = 0.98y + 0.02y - y$

9. $5w - 2(w + 2) = -(2w + 15)$

10. $\frac{7}{8}w = \frac{1}{2}w + \frac{3}{4}w$

FUNCTIONAL RELATIONSHIP?

functions

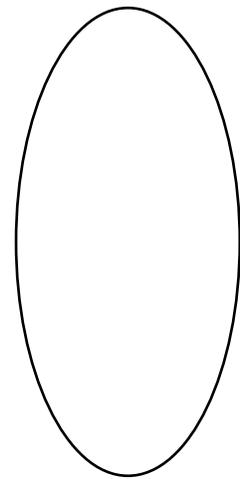
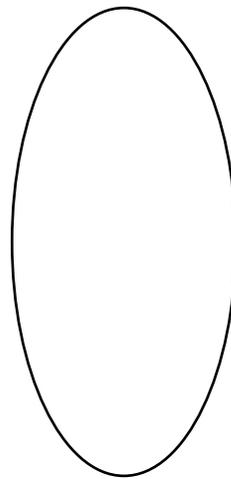
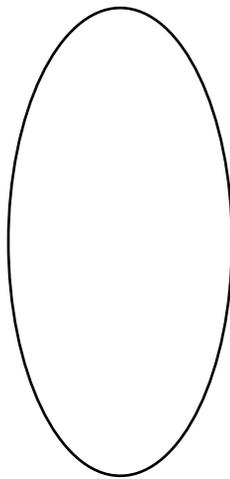
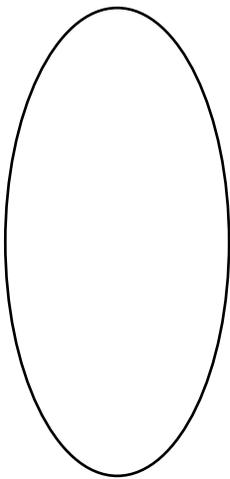
In order to make phone numbers easier to remember, the digits 2-9 on phones correspond to different letters. For example, the digit 2 corresponds with the letters A, B, and C.

1. Find a phone that shows this relationship and examine it.
2. A construction company wanted their phone number to be 1-800-BUILD-IT. What is the phone number for the company using only digits? _____
3. Translate the following words into numbers:

“GOOD” _____, “HOME” _____, Your first name _____

Does every word have a unique number pattern? Explain.

4. Create a mapping diagram that shows how the <u>digits</u> (input) are related to the <u>letters</u> (output).	5. Create a mapping diagram that shows how the <u>letters</u> (input) are related to the <u>digits</u> (output).
digits	letters
letters	digits



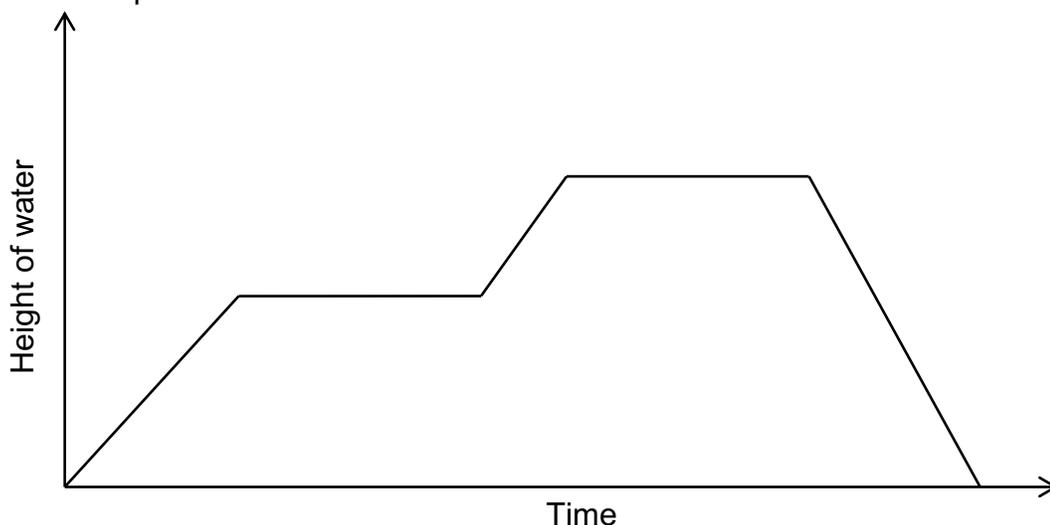
6. Efraim wants to remember the last four digits of his new phone number, 6328. Use your diagrams to help you find two different words for this sequence of digits.
7. Which mapping diagram (problem 4 or problem 5) represents a function? Explain.

DESCRIBING AND DRAWING GRAPHS

functions

1. The Bath Graph

- Write a paragraph or two to explain what story this graph could be telling.
- Then exchange papers with at least one partner and write appropriate critiques of their stories and explanations.



2. The Rollercoaster

Draw a reasonable graph for a typical rollercoaster ride, based on the following information. Label the axes with speed on the vertical axis and time on the horizontal axis. Also label each section by letter (each segment or curved portion of your graph) based upon the descriptions below, A-F. Note that you are **not graphing height**.

- The rollercoaster starts slowly and gradually builds speed.
 - It comes to a hill and climbs up slowly.
 - It races downhill.
 - It does a full loop.
 - It continues at a constant speed.
 - It gradually comes to a stop.
- Write a few sentences to summarize your work and explain how you know you have drawn a good depiction of the rollercoaster ride described. Include in your explanation if this graph could represent a function and why.
 - Then exchange papers with at least one partner and write appropriate critiques of their stories and explanations.

STAIRCASE SLOPES

linear functions - slope

Stairs are made up of treads, which are the horizontal parts you step on, and risers, which are the vertical boards holding up the tread. Laws regulate the height of risers, and require risers to be of uniform height.

1. The slogan formula for finding slope is $\frac{\text{rise}}{\text{run}}$. On a staircase, what measurement corresponds to the “rise,” and what measurement corresponds to the “run”?
2. Find at least three different sets of staircases. For each staircase, take appropriate measurements of the riser and the tread for several stair steps. Describe the measurement tools and units you used.

Complete steps 3 and 4 for each of the staircases you chose.

3. Create a table to record your tread and riser measurements for each step as well as the $\frac{\text{rise}}{\text{run}}$ ratio as a fraction.
4. Compare the ratios for different steps. Are these ratios all the same? If not, find a ratio that appropriately represents the entire staircase. Explain how you figured out this value.
5. Write a short paragraph to (1) describe what this value determined in problem 4 represents in the context of each staircase, and (2) compare these values for your different staircases and use descriptive words similar to those used in class.

Challenge: Research laws that regulate the height of risers in your community. Are the staircases you measured “built to code?”

YOUR SAVINGS PROBLEM

linear functions

Imagine that you are given a \$100 gift and it is deposited into your bank account as a starting amount (initial value) for your savings plan.

Now think of a relatively expensive item that you would like to save for.

Your tasks are to:

1. Research a reasonable price for this item by looking online, in a store, at an advertisement, etc.
2. Research different jobs that are typical for teenagers (babysitting, yard work, or be as creative as you like) and find a reasonable hourly wage.
3. From the information you have gathered, estimate a reasonable monthly wage. Consider that you have obligations (like school), and can only work a certain number of hours per week.

From this information, determine the amount you intend to save each month (your rate of change for your savings plan).

4. Create a table showing the total amount saved each month under your savings plan. Use the data from your table to create a graph.
5. Write an equation to model your savings plan in the form $y = mx + b$.
6. Write a paragraph to summarize your results.
7. Write a paragraph or two to describe your thought process from start to end.

CHOOSING A GYM MEMBERSHIP

linear functions - systems

You are researching gym memberships at “Workout World” for a friend. You don’t know how much your friend plans to use the gym, but you have learned that they have the following plans:

PLAN A: A 1-year membership is \$300 per year.

PLAN B: A 1-month membership is \$50 per month

PLAN C: A single use fee is \$10 per visit.

Use graphs, tables, and equations to compare these options, and advise your friend under which circumstances he should choose each option. Your advice must be very specific based upon your graphs, tables, and equations.

GRADES OR POPULARITY

data

Sasha asked 200 students the following questions:

- Are you male or female?
- What do you care about more: earning good grades or being popular?

Here is Sasha's data in the relative frequency tables.

Table 1

	Male	Female	TOTAL
Popular	54%	46%	100%
Grades	50%	50%	100%

Table 2

	Male	Female
Popular	62%	58%
Grades	38%	42%
TOTAL	100%	100%

1. Each pair of statements contains one statement that is true and one that is not. Circle the untrue statement and then rewrite it so it is true.

a.	<p>62% of males care more about being popular.</p> <p>54% of males care more about being popular.</p>
b.	<p>42% of people who care more about getting good grades are female.</p> <p>50% of people who care more about getting good grades are female.</p>

2. If you know that the gender of the person surveyed is male, can you make a reasonable guess about his concern about popularity or grades? Explain.
3. If you know that the person surveyed cares more about grades than popularity, can you make a reasonable guess about his or her gender? Explain.
4. Do you think Sasha's data might reflect student behaviors at your school? How might you find out?

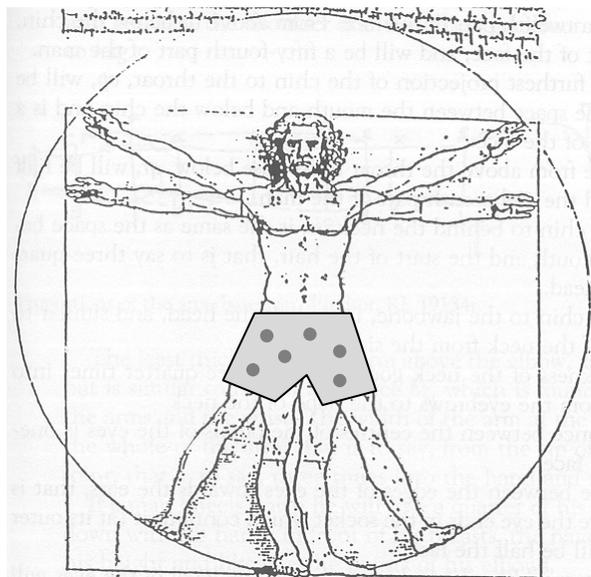
VITRUVIAN MAN

data

Leonardo da Vinci, a famous Italian renaissance inventor and painter, was greatly influenced by Vitruvius, a Roman engineer and architect who lived during the first century B.C. Vitruvius discovered a formula to model what he thought were ideal proportions for a man. Da Vinci used this ideal model when drawing the Vitruvian Man.

The drawing shows a man standing in a square, which intersects a circle. The man has two pairs of outstretched arms and two pairs of outstretched legs. Here are some of the proportions of the Vitruvian man:

- The span of the man's arms is equal to his height.
- The distance from the bottom of the chin to the top of the head is one-eighth of his height,
- The width of his shoulders is one-fourth of his height.
- The distance from the bottom of his knee to the bottom of his foot is one-fourth of his height,
- The space from the mouth to below the chin will be one quarter of the face.
- The space between the midpoint of the nose and the chin will be half the face.



Collect bivariate measurement data to determine how well the Vitruvian man's proportions match a sample of people from the 21st century (for example, you, your family, and your friends.)

- Identify your variables and decide how to measure them.
- Collect data from at least 15 people.
- Create scatter plots
- Estimate a line of best fit, and find its equation.
- Draw conclusions about your study in general, and the fit of your model to Vitruvian proportions.

Adapted from: <http://www.lessoncorner.com//amfroehle/VitruvianManDataCollection>