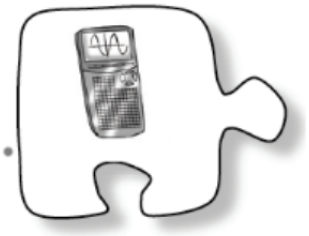
1-34. LEARNING LOG

Throughout this course, you are asked to reflect on your understanding of mathematical concepts in a Learning Log. Your Learning Log should contain explanations and examples to help you remember what you have learned throughout the course, and also contains questions you are trying to understand and answer. It is important to write each entry of the Learning Log in your own words so that later you can use your Learning Log as a resource to refresh your memory. Your teacher will tell you where to write your Learning Log entries and how to structure them. Remember to label each entry with a title and a date so you can refer to it or add to it later.

In your Learning Log, explain how families of functions, parameters, and the descriptions of graphs are related. What do graphs within a family of functions have in common? What is different within a family? Title this entry "Families of Functions" and include today's date.

1.1.4 What is the new function?



Combining Linear Functions

Today you will make some predictions about the graphs that result when two linear functions are combined by adding, subtracting, multiplying, or dividing them. As you explore combinations of linear functions, you may recognize some functions you have previously investigated. What attributes do the new functions have?

1-49.

COMBINING LINEAR FUNCTIONS INVESTIGATION

Your team will be assigned a pair of linear functions from the list below.

1. $f_1(x) = x - 2$, $g_1(x) = 2x + 3$
   1-49 f_1 Student eTool (Desmos)
2. $f_2(x) = x + 3$, $g_2(x) = x - 3$
   1-49 f_2 Student eTool (Desmos)
3. $f_3(x) = x - 3$, $g_3(x) = 2x + 1$
   1-49 f_3 Student eTool (Desmos)
4. $f_4(x) = x - 1$, $g_4(x) = 2x + 5$
   1-49 f_4 Student eTool (Desmos)
5. $f_5(x) = x - 3$, $g_5(x) = 2x - 4$
   1-49 f_5 Student eTool (Desmos)
6. $f_6(x) = x + 4$, $g_6(x) = x + 6$
   1-49 f_6 Student eTool (Desmos)
7. $f_7(x) = x + 1$, $g_7(x) = 2x + 5$
   1-49 f_7 Student eTool (Desmos)
8. $f_8(x) = x + 3$, $g_8(x) = 2x + 3$
   1-49 f_8 Student eTool (Desmos)
9. $f_9(x) = -x + 2$, $g_9(x) = 2x + 1$
   1-49 f_9 Student eTool (Desmos)

Your Task: With your team, investigate the relationship between the original two functions and the different results you get from adding, subtracting, multiplying, and dividing the two functions. Compare the graphs of the original two functions to the graph for each combined function operation. Use the following steps to guide your investigation.

1. Make your own prediction of the shape of each new graph and sketch it on your paper.
2. Discuss your prediction with your teammates.
3. Use a graphing tool to check the results.
4. Summarize your findings.

Be sure to carefully record all of your work and write a complete description of each new graph.

Discussion Points

What do we think the new graph will look like?

What happens when we combine the functions using a different operation? Why?

Why are the graphs for some of the new functions so different from the original functions?

What are the domain and range of each new function?

Discussion Points

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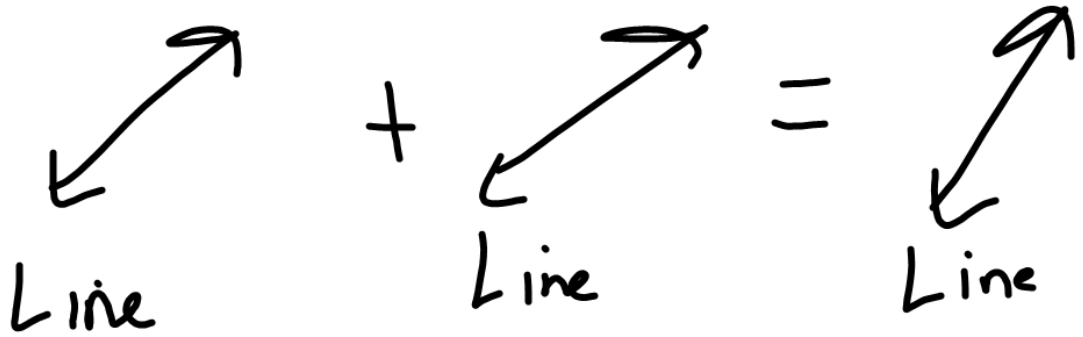
What are the domain and range of each new function?


Line
Line
Line


Line
x^2
Parabola


???
$\frac{1}{x-h}$

1-53. Refer to the Math Notes box in this lesson. The original functions in problem 1-49 are linear functions, but they can also be classified as polynomial functions of degree 1. Answer the questions below for the sum, difference, product, and quotient of your functions from problem 1-49.

a. Is the new function a polynomial function? If it is, what is its degree? If it is not, explain why not.

b. Can your results from part (a) be generalized to apply to any two linear functions? That is, will the sum, difference, product, and/or quotient of any two linear functions always be the same type of function?

1-54. CLOSED SETS

Integers are said to be a **closed set** under multiplication: if you multiply two integers, the result is an integer. Integers are not a closed set under division: if you divide two integers, the result is not always an integer. For example, $2 \div 5$ is not an integer.

a. Are one-variable polynomials a closed set under addition (or subtraction)? In other words, if you add (or subtract) two polynomials that both have the same variable, will the result always be a polynomial? If you think the set is closed, explain why. If, not, give counterexamples.

b. Are one-variable polynomials closed under multiplication? In other words, if you multiply two polynomials that both have the same variable, will the result always be a polynomial? If you think the set is closed, explain why. If, not, give counterexamples.

c. Consider whether polynomials are closed under division. What is your conclusion? Can your results from problems 1-49 and 1-53 help? Explain.

1-55.

With your team describe the graphs of $p(x)$ and $q(x)$ and then visualize and sketch your predictions for the graphs of their sum, difference, product, and quotient *before* checking with a graphing tool.

$$p(x) = x^3 - 3x - 1 \qquad q(x) = x - 1$$

a. $p(x) + q(x)$

b. $p(x) - q(x)$

c. $p(x) \cdot q(x)$

d. $\frac{p(x)}{q(x)}$

e. Now, sketch a complete graph for each combined function and fully describe it. Be prepared to share your observations with the class.