Chapter 5 Closure What have I learned?

Reflection and Synthesis

The activities below offer you a chance to reflect about what you have learned during this chapter. As you work, look for concepts that you feel very comfortable with, ideas that you would like to learn more about, and topics you need more help with. Look for connections between ideas as well as connections with material you learned previously.

1. TEAM BRAINSTORM

What have you studied in this chapter? What ideas were important in what you learned? With your team, brainstorm a list. Be as detailed as you can. To help get you started, a list of Learning Log entries and Math Notes boxes are below.

What topics, ideas, and words that you learned *before* this course are connected to the new ideas in this chapter? Again, be as detailed as you can.

How long can you make your list? Challenge yourselves. Be prepared to share your team's ideas with the class.

Learning Log Entries

- Lesson 5.1.1 – Finding and Checking Inverse Equations

- Lesson 5.2.3 – The Family of Logarithmic Functions

- Lesson 5.2.4 – Working with Logs

- Lesson 5.2.5 – Composition of Functions

Math Notes

- Lesson 5.1.2 – Notation for Inverses

- Lesson 5.1.3 – Composition of Functions

- Lesson 5.2.2 – Logarithms and Their Notation

2. MAKING CONNECTIONS

Below is a list of the vocabulary used in this chapter. Make sure that you are familiar with all of these words and know what they mean. Refer to the glossary or index for any words that you do not yet understand.

asymptote	composite function	domain
exponential function	$f^{-1}(x)$	inverse function
inverse function	line of symmetry	logarithm
range	Undoing	$y = x$

Make a concept map showing all of the connections you can find among the key words and ideas listed above. To show a connection between two words, draw a line between them and explain the connection. A word can be connected to any other word as long as you can justify the connection. For each key word or idea, provide an example or sketch that shows the idea.

While you are making your map, your team may think of related words or ideas that are not listed here. Be sure to include these ideas on your concept map.

3. PORTFOLIO: EVIDENCE OF MATHEMATICAL PROFICIENCY

This section gives you an opportunity to show growth in your understanding of key mathematical ideas over time as you complete this course.

Include your investigation from problem 5-81 INVESTIGATING THE FAMILY OF LOGARITHMIC FUNCTIONS in your portfolio. Copy it over neatly and enhance your explanations if necessary.

Then investigate the following problem. (If you completed Appendix B in this course, you may have seen this problem already at the end of that appendix. Now you should have new graphs to add to your list of examples. You should expect to be able to add even more when you revisit this problem again at the end of Chapter 8.)

How many different kinds of graphs can you create that have:

- a. No x-intercepts?
- b. One x-intercept?
- c. Two x-intercepts?
- d. Three or more x-intercepts?

For each type of graph, show a sketch, label the key points, and give its equation. Make sure that each graph you give as an example represents a different family and describe the family in words or with a general equation. Show how to calculate the x-intercepts of each of your sample graphs.

Your teacher may assign you the Chapter 5 Closure Resource Page: Inverses GO to include in your portfolio.

4. WHAT HAVE I LEARNED

Most of the problems in this section represent typical problems found in this chapter. They serve as a gauge for you. You can use them to determine which types of problems you can do well and which types of problems require further study and practice. Even if your teacher does not assign this section, it is a good idea to try these problems and find out for yourself what you know and what you still need to work on.

Solve each problem as completely as you can. The table at the end of the closure section has answers to these problems. It also tells you where you can find additional help and practice with problems like these.

CL 5-126. Quinten and his sister Kelsey always make a habit of undoing each other's work. If Kelsey folds the laundry, Quinten unfolds it. If Quinten rakes the leaves in the yard, Kelsey "unrakes" them! While working on her math homework, Kelsey wrote the following equations. Help Quinten undo these equations by finding their inverse equations.

- a. $y = 3x - 2$

- b. $y = \frac{x+1}{4}$

- c. $y = x^3 + 1$

- d. $y = 1 + \sqrt{x+5}$

CL 5-127. Given the function $f(x) = 2 + \sqrt{x-1}$:

- a. Graph $f(x)$ and state the domain and range.

- b. Determine the equation for $f^{-1}(x)$, that is, the inverse of $f(x)$.

- c. Graph $f^{-1}(x)$ using the appropriate new domain and range.

- d. Compute $f^{-1}(f(5))$ and $f(f^{-1}(5))$ to show that your answer is correct.

CL 5-128. Use the definition of logarithms to compute each of the following *without using a calculator*.

- a. $\log_8(64) = x$

b. $\log_9(x) = \frac{1}{2}$
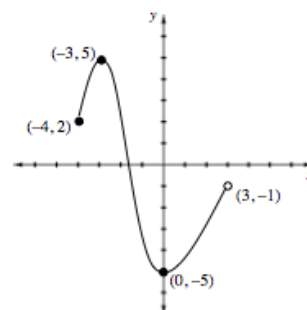
c. $\log_3(3^4) = x$

d. $10^{\log_{10}(4)} = x$

e. What do the answers to (c) and (d) demonstrate about logs and exponents with the same base?

CL 5-129. Use the graph at right to help answer the questions below.

a. State the domain and range of the graph. Is this graph a function?

b. Draw the inverse of the graph. Is the inverse a function? Explain your answer.

c. State the domain and range of the inverse.

CL 5-130. A gallon of milk costs $3.89. Inflation has steadily increased 4% per year.

a. What did a gallon of milk cost ten years ago?

b. How much longer will it be until it costs $10?

CL 5-131. Perform the indicated operation on each of the following rational expressions. Be sure to state any values of the excluded variable and that your final answer is simplified. If a graphing tool is available, check the graph of the original problem to see if it coincides with the graph of your answer.

a. $\frac{5x}{x+3} + \frac{3+x}{x^2+9}$
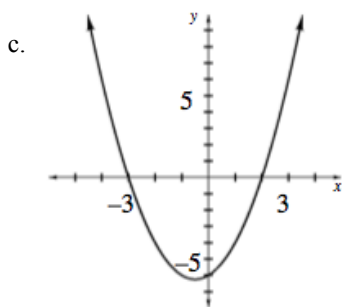
b. $\frac{x}{x-1} - 1$

c. $\frac{x^2+5x+6}{x^2-4x} \cdot \frac{4x}{x+2}$

d. $\frac{x^2-2x}{x^2-4x+4} \div \frac{4x^2}{x-2}$

CL 5-132. Graph the system of $y \geq x^2$ and $y \geq (x-4)^2 + 2$ and shade the inequalities' overlapping region. How is the graph of $y \geq (x-4)^2 + 2$ positioned in relation to the graph of $y \geq x^2$?

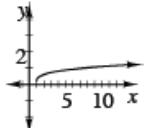**CL 5-133.** Write possible equations for the graphs shown below.

a.
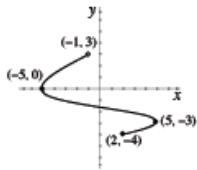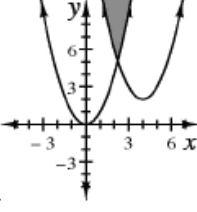
b.

c.

d.
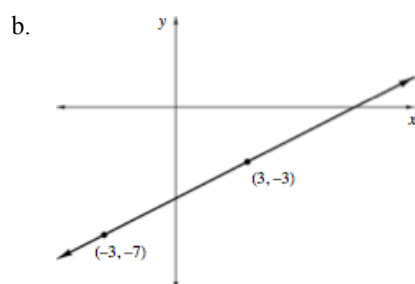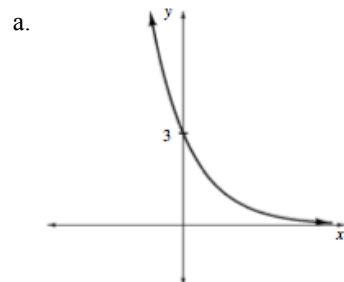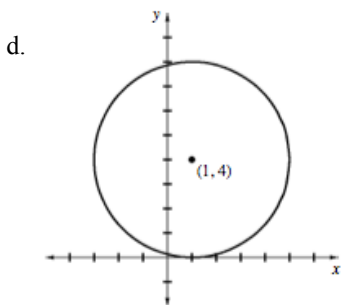
CL 5-134. Factor the expressions below.

a. $3x^2 + 11x + 10$

b. $6x^3 - 31x^2 + 5x$

c. $6ab^2 + 15ab - 21a$

d. $y^2 + 5y - 24$

CL 5-135. Check your answers using the table at the end of this section. Which problems do you feel confident about? Which problems were hard? Have you worked on problems like these in previous math classes? Use the table to make a list of topics you need to learn more about and a list of topics you just need to practice more.

Answers and Support for Closure Activity #4
What Have I Learned?

Note: MN = Math Note, LL = Learning Log

Problem	Solutions	Need Help?	More Practice
CL 5-126.	a. $y = \frac{x+2}{3}$ b. $y = 4x - 1$ c. $y = \sqrt[3]{x-1}$ d. $y = (x-1)^2 - 5$	Lessons 5.1.1 and 5.1.3	Problems 5-2, 5-3, 5-5, 5-40, and 5-41
CL 5-127.	a. domain $x \geq 1$; range $y \geq 2$ b. $f^{-1}(x) = (x - 2)^2 + 1$ c. domain $x \geq 2$; range $y \geq 1$	Lessons 5.1.2 and 5.1.3 MN: 5.1.2 and 5.1.3	Problems 5-21, 5-22, 5-24, 5-26, 5-41, 5-42, 5-43, 5-45, 5-44, 5-33, 5-62, and 5-112

	d. $f^{-1}(f(5)) = f(f^{-1}(5)) = 5$		
CL 5-128	a. 2 b. 3 c. 4 d. 4	Lesson 5.2.2 MN: 5.2.2	Problems 5-70, 5-72, 5-74, and 5-97
CL 5-129.	a. domain: $-4 \leq x < 3$ range: $-5 \leq y \leq 5$ b. See graph below. No, there are 2 outputs when $-5 < x < -1$ and $2 < x \leq 5$. c. domain: $-5 \leq x \leq 5$, range: $-4 \leq y < 3$	Lesson 5.1.2	Problems 5-16, 5-21, 5-24, 5-44, 5-33, and 5-46
CL 5-130.	a. $2.63 b. $\approx$ 24 years (by guess and check)	Lessons A.3.2 and B.2.3	Problems A-116, B-36, and B-46
CL 5-131.	a. $\frac{5x^2 - 14x + 3}{(x-3)(x+3)}$, $x \neq \pm3$ b. $\frac{1}{x-1}$, $x \neq 1$ c $\frac{4(x+3)}{x-4}$, $x \neq -2$, 0 or 4 d. $\frac{1}{4x}$, $x \neq 0, 2$	Lessons 3.2.3, 3.2.4, and 3.25 MN: 3.2.5 LL: 3.2.3 and 3.2.4	Problems 5-31, 5-54, 5-124, and 5-92
CL 5-132.	See graph below. It is shifted to the right 4 units and up 2 units. 	Lesson 4.2.1 MN: 4.2.3 LL: 4.2.1	Problems 4-93, 4-100, CL4-109, 5-13, and 5-67
CL 5-133.	Possibilities include: a. $y = 3(\frac{1}{2})^x$ or $y = 3(2)^{-x}$ b. $y = \frac{2}{3}x - 5$ c. $y = (x-2)(x+3)$ or $y = x^2 + x - 6$	Lessons B.1.5, 2.1.3, 2.2.1, and 2.2.2 MN: 1.1.2, 2.1.3, 2.2.2, 2.2.3	Problems B-60, B-89, 2-95, and 2-107

	d. $(x-1)^2 + (y-4)^2 = 16$		
CL 5-134.	a. $(3x+5)(x+2)$ b. $x(6x-1)(x-5)$ c. $3a(2b+7)(b-1)$ d. $(y-3)(y+8)$	MN: 1.1.4 Checkpoint 5B	Problems 1-13, 2-98, 2-169, and CL2-178