Name: _____   Date: _____

CUBE ROOTS
COMMON CORE ALGEBRA I

Just like square roots undo the squaring process, **cube roots**, undo the **process of cubing a number**. The cube root's technical definition along with its symbolism is given below.

CUBE ROOTS

If $x^3 = a$ then $\sqrt[3]{a}$ is a solution to this equation. Or... $\sqrt[3]{a}$ is any number that when cubed gives a.

Exercise #1: It is good to know some basic cube roots of smaller numbers. Find each of the following and justify by using a multiplication statement.

(a) $\sqrt[3]{8}$

(b) $\sqrt[3]{1}$

(c) $\sqrt[3]{27}$

(d) $\sqrt[3]{0}$

(e) $\sqrt[3]{-1}$

(f) $\sqrt[3]{-8}$

One of the most striking differences between **square roots** and **cube roots** is that you can find the **cube root of negative real numbers**. For square roots, that will have to wait until you learn about non-real numbers in Algebra II.

Exercise #2: Using your calculator, use a guess and check scheme to find the following cube roots. Justify using a multiplication statement.

(a) $\sqrt[3]{343}$

(b) $\sqrt[3]{-2744}$

(c) $\sqrt[3]{12,167}$

Most calculators have a cube root option, although it may be harder to find than the square root button.

Exercise #3: Find each of the following cube roots to the nearest *tenth* by using your calculator's cube root option/button.

(a) $\sqrt[3]{100}$

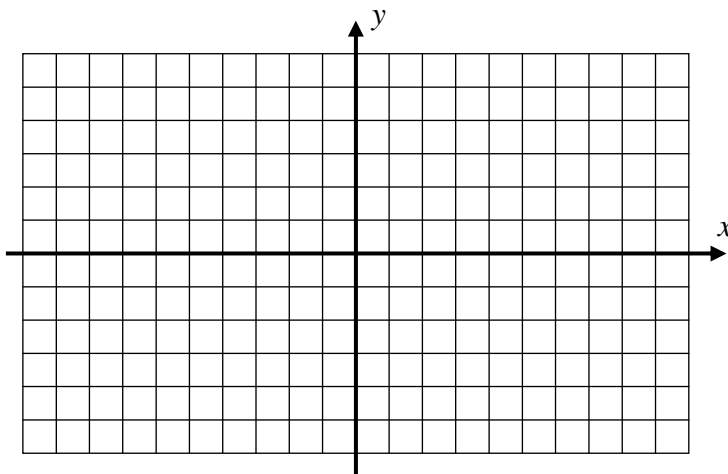(b) $\sqrt[3]{-364}$

(c) $\sqrt[3]{982}$

The cube root also gives rise to the **cube root function**. Like the square root function, its basic graph is relatively easy to construct.

Exercise #4: Consider the basic cubic function $y = \sqrt[3]{x}$.

(a) Fill out the table of values below without the use of your calculator.

x	-8	-1	0	1	8
y					

(b) Plot its graph on the grid provided below.

(c) Using your calculator, produce a graph to verify what you found in part (b).
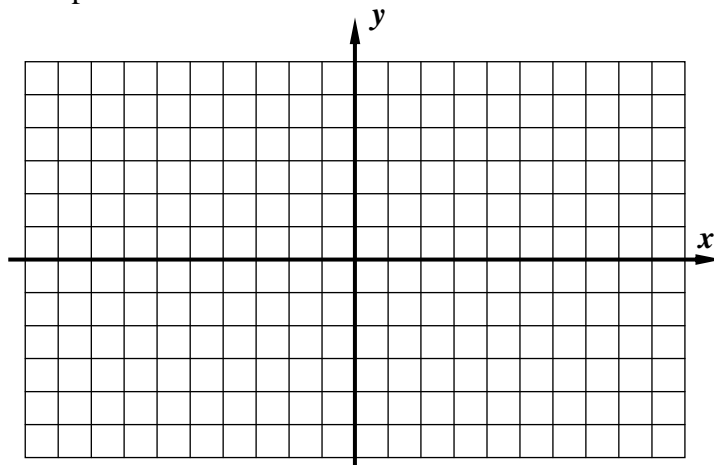
Just like with all other functions, cube root graphs can be **transformed** in a variety of ways. Let's see if our **shifting pattern** continues to hold with cube roots.

Exercise #5: Consider the function $f(x) = \sqrt[3]{x+2} - 4$.

(a) Use your calculator to create a table of values that can be plotted. Show your table below.

x					
y					

(b) Create a graph of this function on the axes provided.

(c) Describe how the graph you drew in Exercise #4 was shifted to produce this graph?

Name: _____   Date: _____

FLUENCY

1. Find each of the following cube roots without the use of your calculator. Justify your answer based on a multiplication statement.

   (a) $\sqrt[3]{8}$　　　　　　(b) $\sqrt[3]{-1}$　　　　　　(c) $\sqrt[3]{125}$　　　　　　(d) $\sqrt[3]{0}$

   (e) $\sqrt[3]{-8}$　　　　　　(f) $\sqrt[3]{27}$　　　　　　(g) $\sqrt[3]{\dfrac{1}{64}}$　　　　　　(h) $\sqrt[3]{-\dfrac{1}{1000}}$

2. Use your calculator to find the following cube roots by trial and error. Justify your answers using a multiplication statement.

   (a) $\sqrt[3]{512}$　　　　　　(b) $\sqrt[3]{-2197}$　　　　　　(c) $\sqrt[3]{9261}$　　　　　　(d) $\sqrt[3]{-15,625}$

3. The cube root function is the inverse of the cubing (x^3) function. Just as we can solve certain quadratic equations by using square roots, we can solve certain cubic equations by using cube roots. Solve each of the following in the form required. Use your calculator on (b) to find the cube root.

   (a) $2x^3 - 1 = 53$ (Solve exactly)　　　　　　(b) $\dfrac{x^3}{8} - 3 = 7$ (Solve to nearest tenth)

4. If $g(x) = 5\sqrt[3]{x+7} - 4$, then which of the following is the value of $g(57)$?
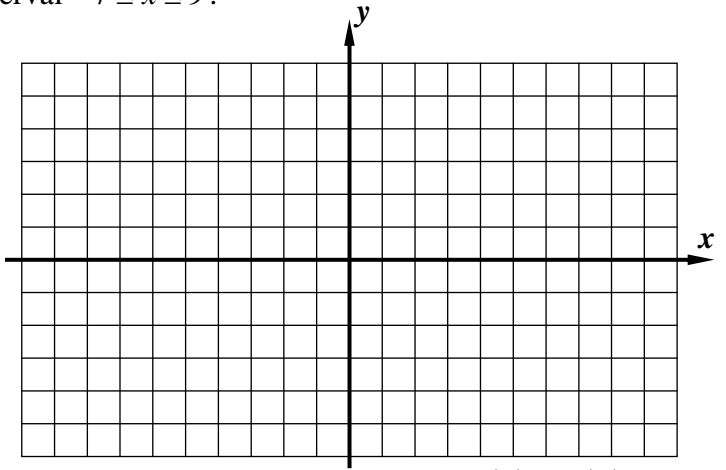
   (1) 19　　　　　　(3) 16

   (2) 11　　　　　　(4) 25

5. Consider the function $f(x) = \sqrt[3]{x-1} + 2$ over the interval $-7 \le x \le 9$.

(a) Graph $f(x)$ over this domain interval only.

(b) State the range of the function over this interval.

(c) Recall that the average rate of change over the interval $a \le x \le b$ is calculated by $\dfrac{f(b) - f(a)}{b - a}$. Find the average rate of change of $f(x)$ over the intervals below:
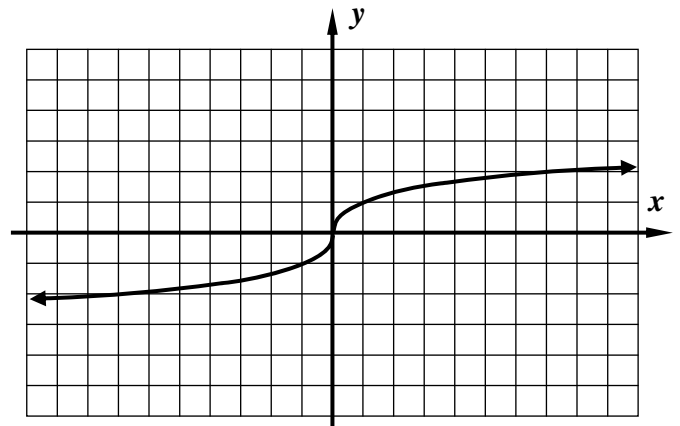
(i) $2 \le x \le 9$ \qquad\qquad (ii) $0 \le x \le 1$ \qquad\qquad (iii) $-7 \le x \le 9$

6. The graph of $y = \sqrt[3]{x}$ is shown below. On the same set of axes, graph $f(x) = -2\sqrt[3]{x}$. Fill out the table below to help with your graph. What happened to the graph of $y = \sqrt[3]{x}$ when multiplied by -2?

x	-8	-1	0	1	8
$f(x) = -2\sqrt[3]{x}$					

REASONING

6. Explain why it is not possible to find the square root of a negative number but it is possible to find the cube root of a negative number. Give examples to support your explanation.