L – Radicals, Lesson 2, Graphing Root Functions (r. 2018)

RADICALS
Graphing Root Functions

Common Core Standard	Next Generation Standard
F-IF.7b Graph square root, ~~cube root~~, and piece-wise-defined functions, including step functions and absolute value functions.	**AI-F.IF.7b** Graph square root, and piecewise-defined functions, including step functions and absolute value functions and **show key features.** **Note: Algebra I key features include the following: intercepts, zeros; intervals where the function is increasing, decreasing, positive, or negative; maxima, minima; and symmetries.**

LEARNING OBJECTIVES

Students will be able to:

1) Graph functions involving square roots.

Overview of Lesson

Teacher Centered Introduction	Student Centered Activities
Overview of Lesson **- activate students' prior knowledge** **- vocabulary** **- learning objective(s)** **- big ideas: direct instruction** **- modeling**	**guided practice ← Teacher: anticipates, monitors, selects, sequences, and connects student work** **- developing essential skills** **- Regents exam questions** **- formative assessment assignment (exit slip, explain the math, or journal entry)**

VOCABULARY

square root cube root nth root

BIG IDEAS

NOTE: All of the functions in this lesson require special consideration for the domain of the independent variable (the x-axis).

ROOT FUNCTIONS

Root functions are associated with equations involving square roots, cube roots, or nth roots. The easiest way to graph a root function is to use the three views of a function that are associated with a graphing calculator.

STEP 1. Input the root function in the y-editor of the calculator.

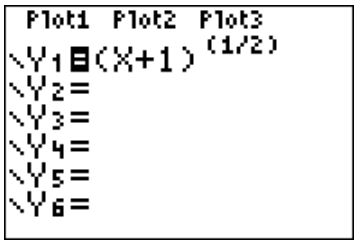
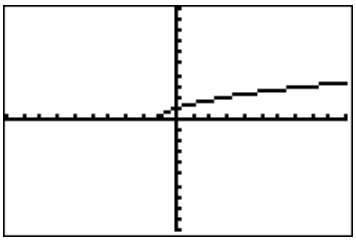
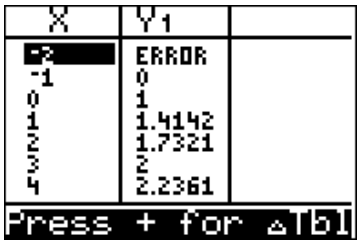
(Note: The use of rational exponents is recommended, i.e.

$\sqrt{x} = x^{\frac{1}{2}}$ $\sqrt[3]{x} = x^{\frac{1}{3}}$ $\sqrt[4]{x} = x^{\frac{1}{4}}$

STEP 2. Look at the graph of the function.

STEP 3. Use the table of values to transfer coordinate pairs to graph paper.

Example: Graph the root function $f(x) = \sqrt{x+1}$

STEP 1 Input the function rule in the y-editor of your graphing calculator	STEP 2. Look at the graph view of the function.	STEP 3. Select coordinate pairs from the table view to create your graph.
		

DEVELOPING ESSENTIAL SKILLS

Use technology to graph the following the following functions:

$$y = \sqrt{x}$$

$$y = -\sqrt{x}$$

$$y = \sqrt{x+3}^{(1/2)}$$

$$y = x^{(1/2)} + 3$$

$$y = \sqrt[3]{x}$$

ANSWERS

NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = X^{(1/2)}$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

$\backslash Y_8 =$

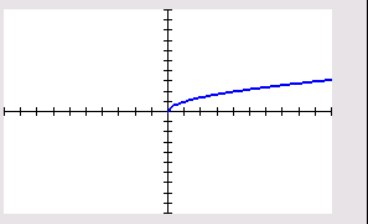
NORMAL FLOAT AUTO REAL RADIAN MP

PRESS + FOR △Tbl

X	Y1
-2	ERROR
-1	ERROR
0	0
1	1
2	1.4142
3	1.7321
4	2
5	2.2361
6	2.4495
7	2.6458
8	2.8284

X= -2

NORMAL FLOAT AUTO REAL RADIAN MP



NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = -X^{(1/2)}$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

$\backslash Y_8 =$

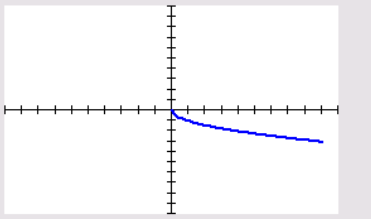
NORMAL FLOAT AUTO REAL RADIAN MP

PRESS + FOR △Tbl

X	Y1
-2	ERROR
-1	ERROR
0	0
1	-1
2	-1.414
3	-1.732
4	-2
5	-2.236
6	-2.449
7	-2.646
8	-2.828

X= -2

NORMAL FLOAT AUTO REAL RADIAN MP



NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = (X+3)^{(1/2)}$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

$\backslash Y_8 =$

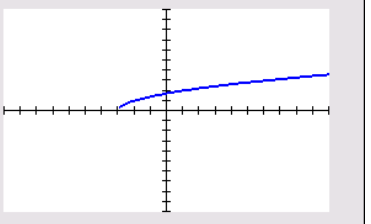
NORMAL FLOAT AUTO REAL RADIAN MP

PRESS + FOR △Tbl

X	Y1
-5	ERROR
-4	ERROR
-3	0
-2	1
-1	1.4142
0	1.7321
1	2
2	2.2361
3	2.4495
4	2.6458
5	2.8284

X= -5

NORMAL FLOAT AUTO REAL RADIAN MP



NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = X^{(1/2)} + 3$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

$\backslash Y_8 =$

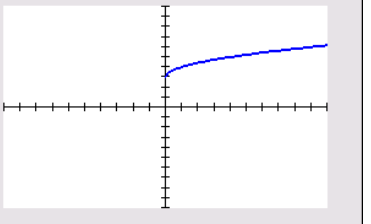
NORMAL FLOAT AUTO REAL RADIAN MP

PRESS + FOR △Tbl

X	Y1
-5	ERROR
-4	ERROR
-3	ERROR
-2	ERROR
-1	ERROR
0	3
1	4
2	4.4142
3	4.7321
4	5
5	5.2361

X= -5

NORMAL FLOAT AUTO REAL RADIAN MP



NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = X^{(1/3)}$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

$\backslash Y_8 =$

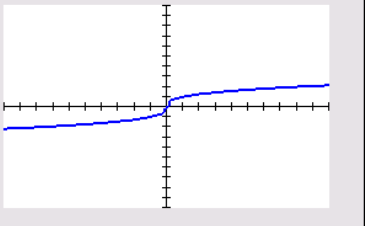
NORMAL FLOAT AUTO REAL RADIAN MP

PRESS + FOR △Tbl

X	Y1
-5	-1.71
-4	-1.587
-3	-1.442
-2	-1.26
-1	-1
0	0
1	1
2	1.2599
3	1.4422
4	1.5874
5	1.71

X=0

NORMAL FLOAT AUTO REAL RADIAN MP

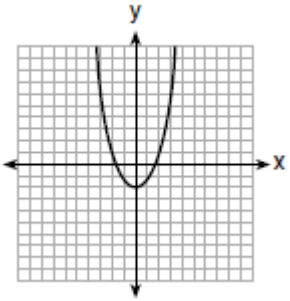


REGENTS EXAM QUESTIONS (through June 2018)

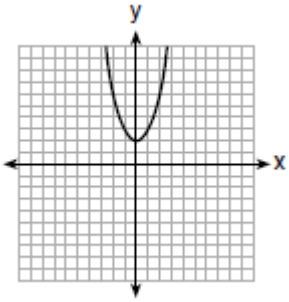
F.IF.C.7: Graphing Root Functions

394) Which graph represents $y = \sqrt{x-2}$?

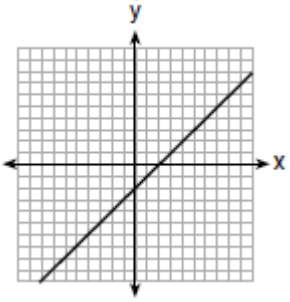
1)



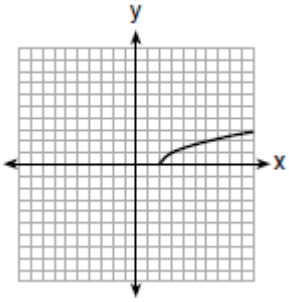
3)



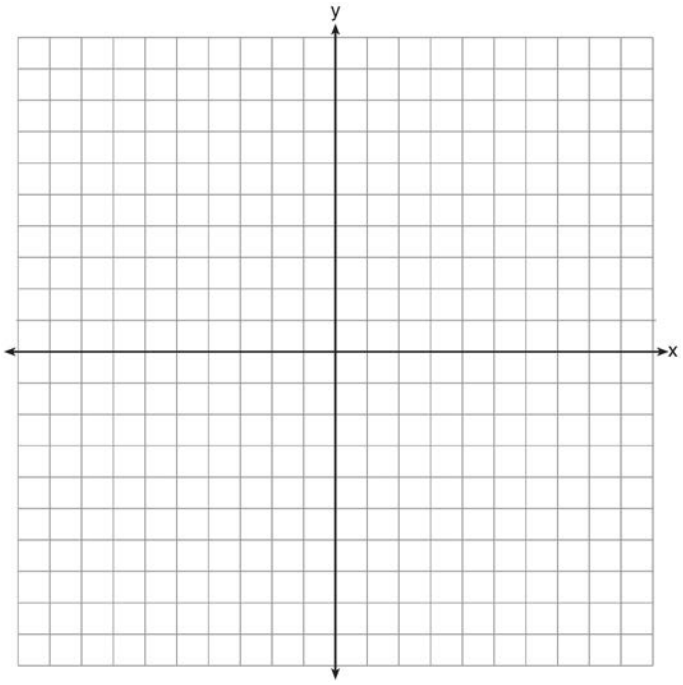
2)



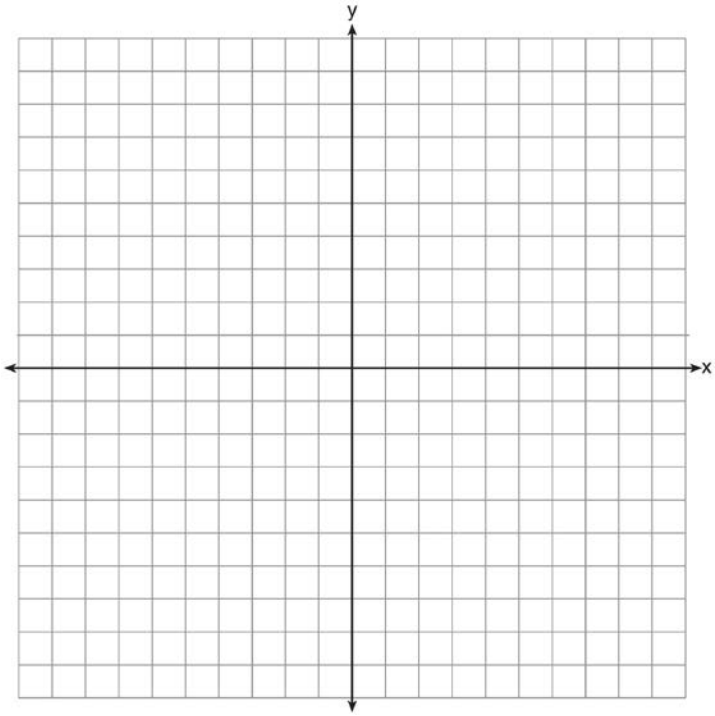
4)



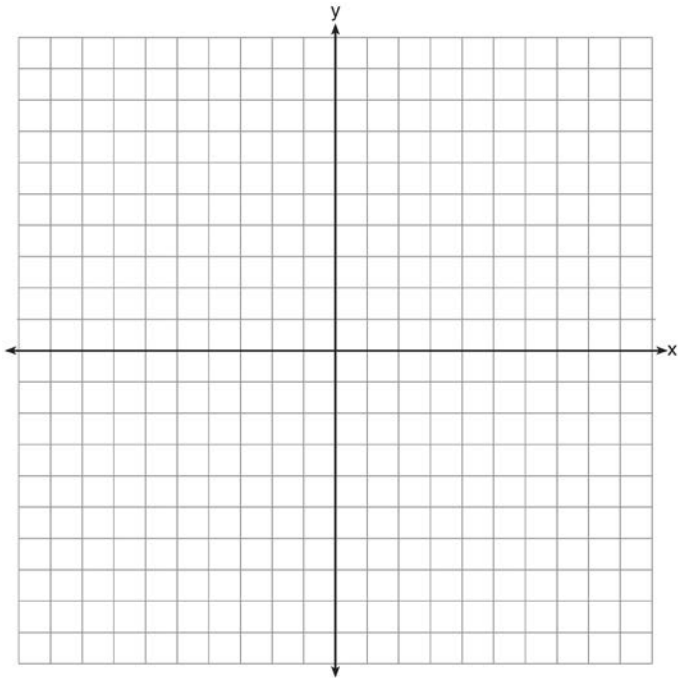
395) On the set of axes below, graph the function represented by $y = \sqrt[3]{x-2}$ for the domain $-6 \leq x \leq 10$.



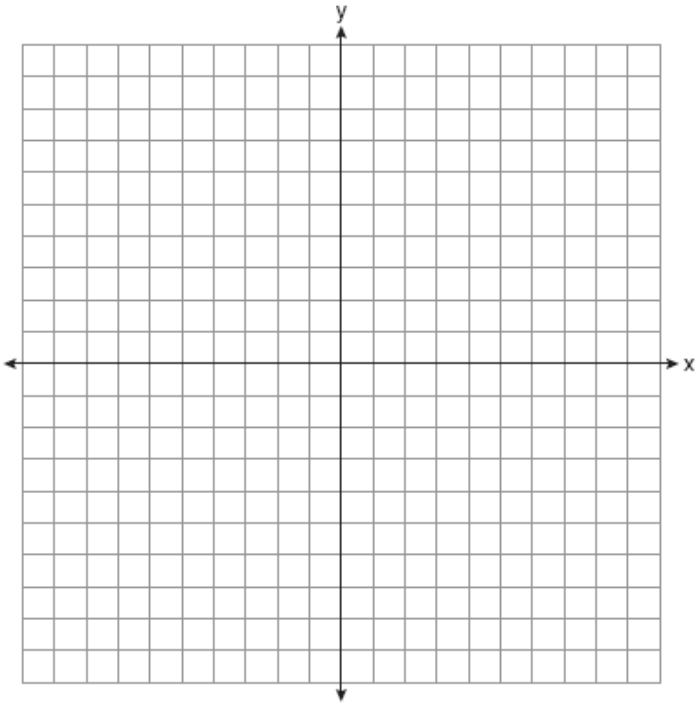
396) Draw the graph of $y = \sqrt{x} - 1$ on the set of axes below.



397) Graph the function $y = -\sqrt{x+3}$ on the set of axes below.



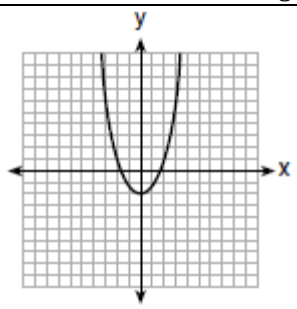
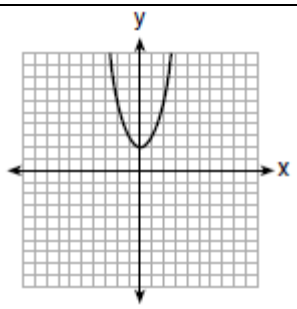
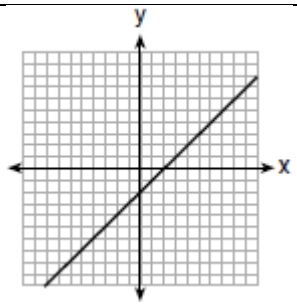
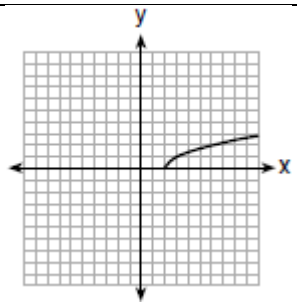
398) Graph $f(x) = \sqrt{x+2}$ over the domain $-2 \le x \le 7$.



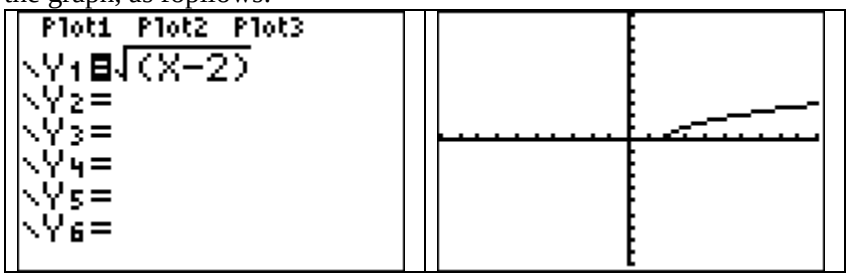
SOLUTIONS

394) ANS: 4

$y = \sqrt{x-2}$ is a root function, so its graph must look like a root function.

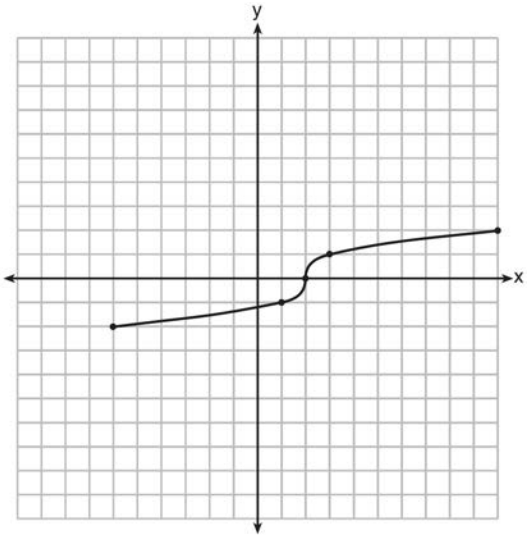
a)  This is a quadratic function.	c)  This is a quadratic function.
b)  This is a linear function.	d)  By the process of elimination, this is the only root function.

You can also solve this problem by inputting the equation $y = \sqrt{x-2}$ into a graphing calcualtor and looking at the graph, as fopllows:



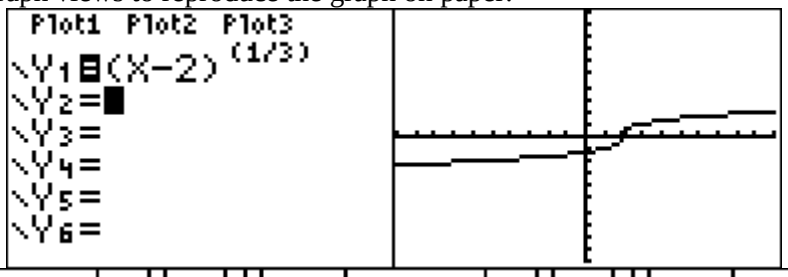
PTS: 2 NAT: F.IF.C.7 TOP: Graphing Root Functions
KEY: bimodalgraph

395) ANS:



Strategy: Input the function in a graphing calculator, then use the graph and table views to construct the graph on paper. Limit the domain of the graph to $-6 \le x \le 10$.

STEP 1: Use exponential notation to input the function into the graphing calculator, where $\sqrt[3]{x-2} = (x-2)^{(1/3)}$. Then use the table and graph views to reproduce the graph on paper.



X	Y1
■	-2
-5	-1.913
-4	-1.817
-3	-1.71
-2	-1.587
-1	-1.442
0	-1.26

X= -6

X	Y1
1	-1
2	0
3	1
4	1.2599
5	1.4422
6	1.5874
7	1.71

X=7

X	Y1
8	1.8171
9	1.9129
10	2
11	2.0801
12	2.1544
13	2.224
14	2.2894

X=14

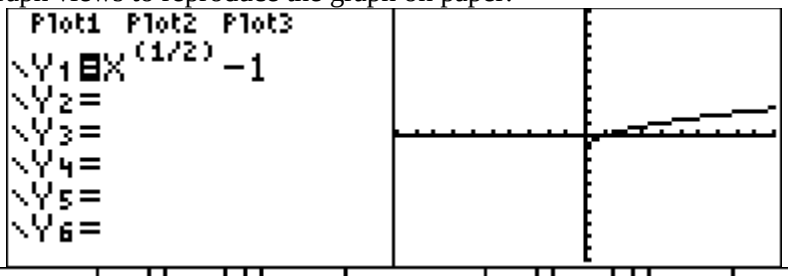
STEP 2: Limit the domain of the function to $-6 \le x \le 10$. Used closed dots to show the ends of the function at coordinates (-6, -2) and for (10, 2).

PTS: 2 NAT: F.IF.C.7 TOP: Graphing Root Functions

396) ANS:

Strategy: Input the function in a graphing calculator, then use the graph and table views to construct the graph on paper.

STEP 1: Use exponential notation to input the function into the graphing calculator, where $\sqrt{x} - 1 = x^{(1/2)} - 1$. Then use the table and graph views to reproduce the graph on paper.



X	Y1
-6	ERROR
-5	ERROR
-4	ERROR
-3	ERROR
-2	ERROR
-1	ERROR
0	-1

X=0

X	Y1
1	0
2	.41421
3	.73205
4	1
5	1.2361
6	1.4495
7	1.6458

X=7

X	Y1
8	1.8284
9	2
10	2.1623
11	2.3166
12	2.4641
13	2.6056
14	2.7417

X=14

Note: Do nopt plot coordinates with errors. Focus on plotting coordinates with integer values and estimate the graph between the points with integer values when drawing the graph.

STEP 2: Limit the domain of the function to $-6 \le x \le 10$. Used closed dots to show the ends of the function at coordinates (-6, -2) and for (10, 2).

PTS: 2 NAT: F.IF.C.7 TOP: Graphing Root Functions

397) ANS:

Strategy: Input the equation in a graphing calculator. Plot the coordinates with integer values. Complete the graph.

NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

$\backslash Y_1 = -\sqrt{(X+3)}$

$\backslash Y_2 =$

$\backslash Y_3 =$

$\backslash Y_4 =$

$\backslash Y_5 =$

$\backslash Y_6 =$

$\backslash Y_7 =$

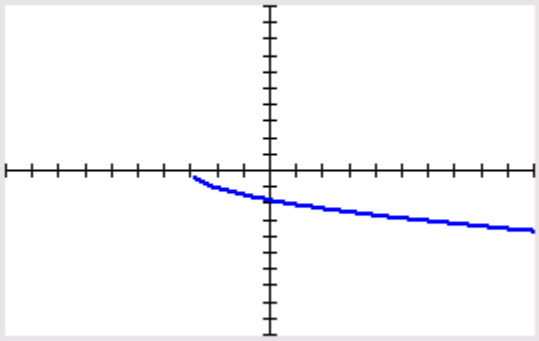
$\backslash Y_8 =$

NORMAL FLOAT AUTO REAL RADIAN MP
PRESS + FOR △Tbl

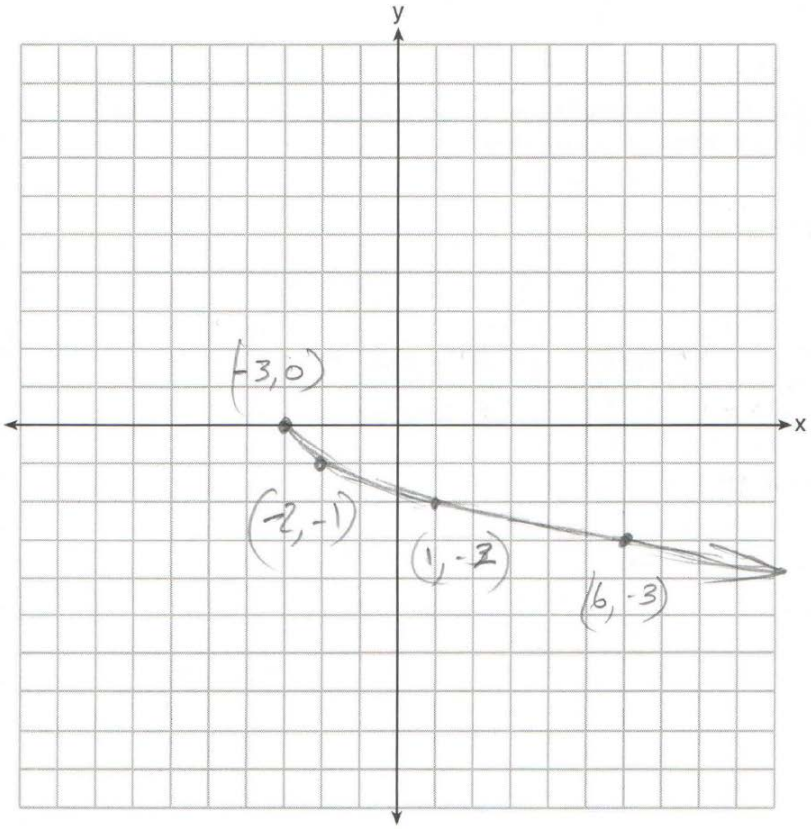
X	Y1
-4	ERROR
-3	0
-2	-1
-1	-1.414
0	-1.732
1	-2
2	-2.236
3	-2.449
4	-2.646
5	-2.828
6	-3

X= -4

NORMAL FLOAT AUTO REAL RADIAN MP

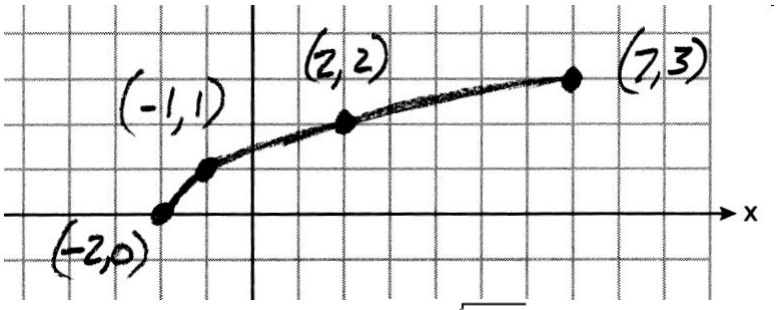


25 Graph the function $y = -\sqrt{x+3}$ on the set of axes below.

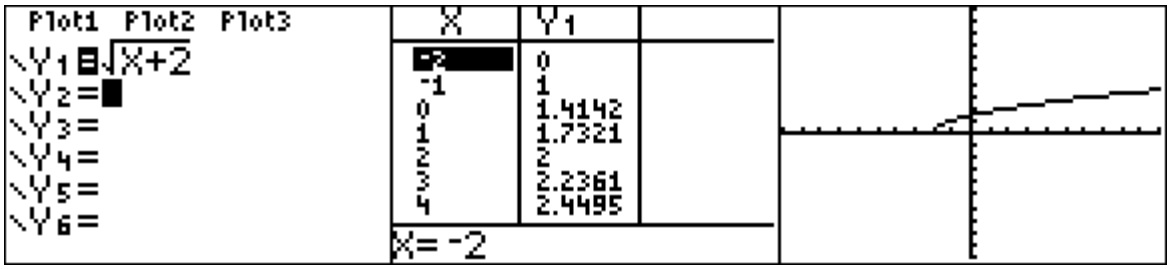


PTS: 2 NAT: F.IF.C.7

398) ANS:



Strategy: Input the function $f(x) = \sqrt{x+2}$ in a graphing calculator and use the table of values and graph views to plot the graph for integer values.



PTS: 2 NAT: F.IF.C.7 TOP: Graphing Root Functions