CMC –South 2015
Session 278
Hard Rock - Roxy Two
Evaluation Code: 161571

Building Conceptual Understanding With Scenario-Based Tasks

Presenters:

Nate Goza
Liem Tran

Math for America, Los Angeles
Orthopaedic Medical Magnet High School
Los Angeles Unified School District

Sample Lessons

1) Task 1.8: Connecting the Dots (or Not!)
2) Task 1.10: Double Mata-thon
3) Task 1.11: Dwayne Wade Signals Hello from a Distance
4) Unit 1 Exam Part 3

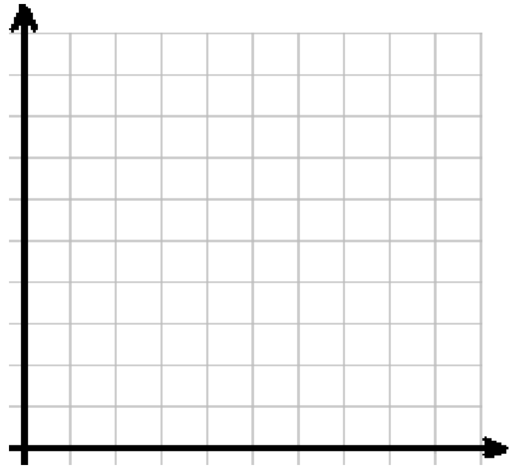
*The complete Unit 1 is online at *www.coast2coast.me/nate*

1.8: Connecting the Dots (or Not!)

Each table below represents a real life relation. Plot the points from the table into the graph next to it. Then decide whether or not you should connect the points depending on the scenario. **Explain your decision.** If you should connect the points, connect them in any way that makes sense to you (and matches the scenario).

1) The table shows the number of home runs a baseball player had in his first four seasons in the Major Leagues.

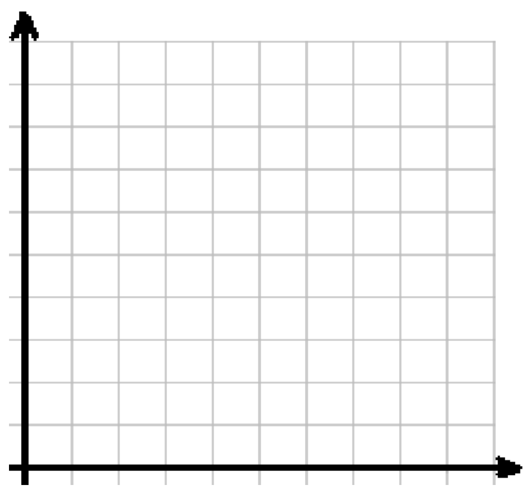
Seasons played	Home Runs Hit
1	27
2	30
3	38
4	44
5	29



Domain: Range:

2) The table shows the miles you have traveled in a car on a trip out of town for 5 hours after you left your home.

Hours since you left home	Miles away from home
1	60
2	125
3	200
4	210
5	210

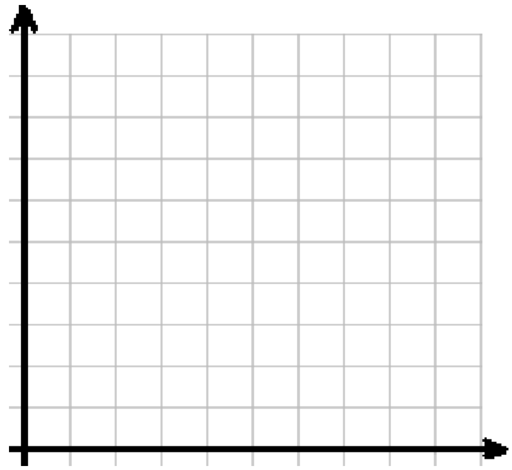


Domain: Range:

This task was created and designed by Nate Goza with input from Liem Tran for

3) The table shows the number Facebook posts my younger cousin made over the first 8 months of this year.

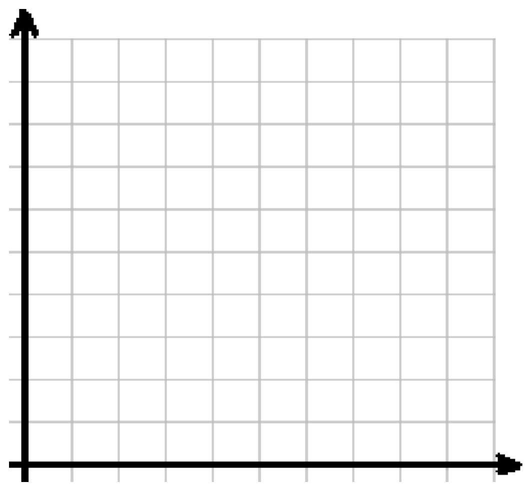
Month	Facebook Posts
1	22
2	40
3	33
4	0
5	18
6	50
7	44
8	30



Domain: Range:

4) The table shows the height of a hot air balloon that takes a couple on a romantic ride over the Grand Canyon.

Minutes since takeoff	Height (feet)
10	100
20	300
30	450
40	450
50	200
60	0



Domain: Range:

If a function contains intervals where all points are connected in such a way that there are no jumps, breaks, or gaps in its graph is said to be **continuous** on those intervals. A function that is continuous over its entire domain is called a **continuous function**.

5) Which of the functions in numbers 1 – 4 are continuous functions?

1.10: Double Mata-thon

Mr. Mata is running a double marathon. The table below shows the number of miles Mr. Mata has run after t hours is shown in the table below.

t (hours since the race began)	Total Number of Miles Completed
1	8
2.5	19
3	23
4	30
4.5	33
5	33
6	41
8	51
9	52.4
10	52.4

1) After 3 hours how far has Mr. Mata run?

2) After 6 hours, how many miles has Mr. Mata run?

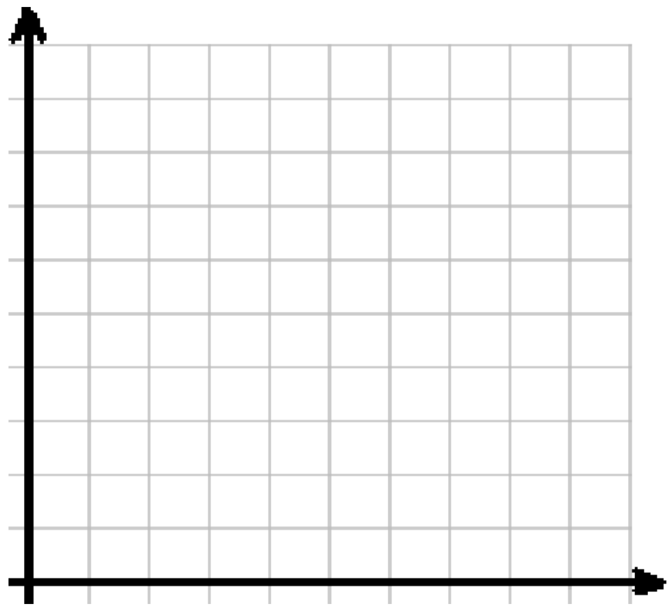
3) How long does it take for Mr. Mata to run the first 30 miles?

4) What was Mr. Mata's average speed between the 6^{th} and 8^{th} hour?

5) Mr. Mata got injured along the way. How many hours into the race did this occur? What evidence from the table led you to your answer?

6) On the plane below, graph the data from the table. Think about whether or not it makes sense to connect the points.

t (hours since the runner began)	Miles Completed
1	8
2.5	19
3	23
4	30
4.5	33
5	33
6	41
8	51
9	52.4
10	52.4



7) Use your graph to estimate how far Mr. Mata has run after 2 hours.

8) Fill in the blanks:

After 8 hours Mr. Mata has run ________ miles.

After 5.5 hours Mr. Mata has run approximately ________ miles.

9) Come up with 2 more statements like the ones in Question 7 using your graph to approximate the distance at times of your choice.

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range.

If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

f is the most common way to "name a function." Probably because the word function starts with an f. However you can name a function in a variety of ways (usually we use a single letter). For example, we can call the function describing Mr. Mata's distance with an M. Since we have been using the input variable t the output of our function can be written as $M(t)$. This allows us to write about the function in a quick, easy way.

We can now say $M(8) = 51$. This means "After 8 hours, Mr. Mata has run 51 miles."

10) Write an equation to match the statement: "After four and a half hours Mr. Mata has run 33 miles."

11) Write a statement to match the equation $M(9) = 52.4$.

12) $M(6) =$ ______ What does this equation tell us?

13) Use your graph to estimate $M(7)$. What does your answer represent?

14) What is *M(0)*? How do you know this?

15) Create two more equations like the one in #11 based on the data from Mr. Mata's Marathon.

16) How many miles are there in a double marathon? How do you know?

17) Say $M(t) = 23$. Then $t =$ __________. What does your answer tell us?

18) How long did it take Mr. Mata to finish the double Marathon? How do you know?

This task was created and designed by Nate Goza with input from Liem Tran for

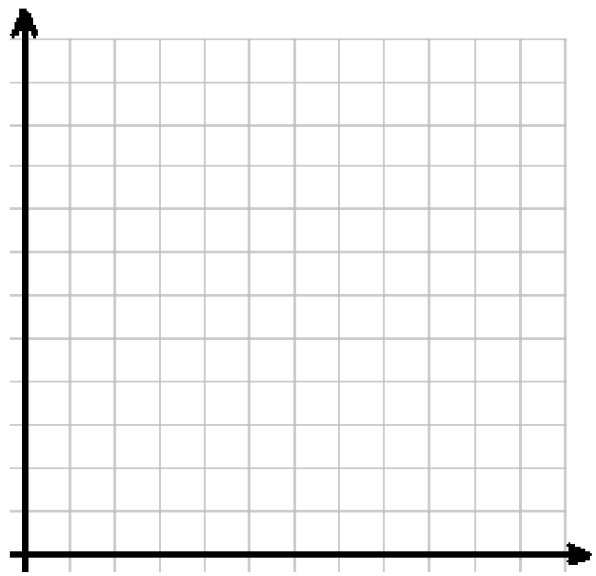
1.11: Dwayne Wade Signals Hello from a Distance

The following table is shows data of an unknown relation:

h	T
0	100
1	104
3	104
5	102
8	97
10	92
12	85

1) Represent the relation with a mapping.

2) Represent the relation with a graph.



3) Is this a function? Why or why not?

4) What is the domain?

5) What is the range?

We can now say that *T* is a function of *h*. Then we can say that $T = f(h)$. We can say the input is *h* and the output is $f(h)$.

6) Is *f* discrete or continuous? How do you know?

7) What is the maximum value of *f*? How do you know?

8) Fill in the blanks:

$f(1) =$ ________ $f(10) =$ _______ $f($_____$) = 102$

The **average rate of change** of a function over an interval is the amount of change in the output divided by the length of the interval (the change in input).

The average rate of change of the function *f* on the interval [a,b] is:

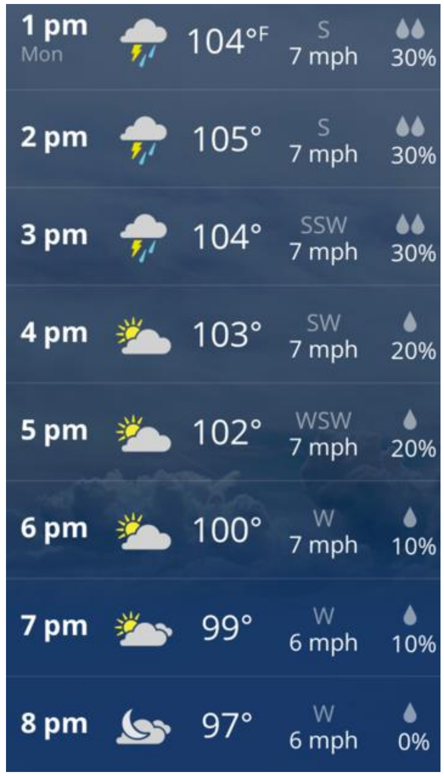
$$\frac{f(b) - f(a)}{b - a}$$

where $f(b)$ and $f(a)$ are (as always) the outputs of *b* and *a*.

9) Calculate the average rate of change of *f* on the interval [0,3].

10) Calculate the average rate of change of *f* on the interval [8,12].

The reason that this assignment was called “Dwayne Wade Signals Hello from a Distance” is because the data in the table represents the temperature in Miami starting at 12:00 PM (noon) and ending at 12:00 AM (midnight) during a Heat Wave. (*Get it? Miami Heat Wave?*). Here is a picture of the actual weather from that day.



Think about and discuss with your group: How is the data from the table on the first page consistent with the temperatures shown in the weather report above?

11) Knowing that *f* represents the temperature in Miami throughout a given day changes our answers from #2 – #6 significantly and gives us insight to what our answers mean. With a colored pen or pencil go back and re-answer 2-6. Don’t erase your old answers!

12) Does the new information about *f* change our answer to #7? Why or why not?

This task was created and designed by Nate Goza with input from Liem Tran for Liem'nNate

13) Now that we know *f* is about the temperature in Miami, explain what your answer to #8 means in terms of the situation.

14) Explain why your answer to #9 is negative based on the situation.

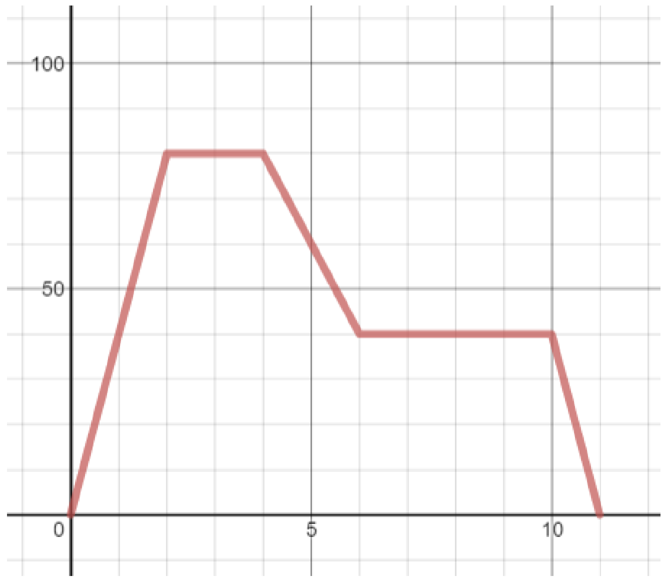
15) What is the average rate of change of *f* on the interval [0,12]? Why is this answer deceiving/confusing?

16) Explain why any relation where the input is time and the output is an outdoor temperature is going to be *a function*.

17) Explain why any function where the input is time and the output is an outdoor temperature is going to be *continuous*.

Unit 1 Exam Part 3: Answer the questions based on the scenario.

Last weekend Mr. Goza drove to San Clemente to meet his cousins for lunch. He fought some moderate traffic on the way. Traffic was heavier on the way home so he stopped in Seal Beach to watch the UCLA Football game with Mr. Tran. After a great Bruin victory Mr. Goza was back on the road. There was still a decent amount of traffic on the way home so it took an hour to get back to LA. The graph $D = G(t)$ below shows Mr. Goza's distance from home (in miles) t hours after he left his house (at 12:00 PM).



1) Correctly label the axis of the graph above. (1)

2) What is the domain of G? (1)

3) What is the range of G? (1)

4) What is $G(10)$? What does your answer represent? (2)

5) On which intervals is the graph decreasing? What does this tell us about Mr. Goza? (3)

This task was created and designed by Nate Goza with input from Liem Tran for

6) What is the average rate of change of *G* on the interval [0,2]? What does your answer represent? (2)

7) How long did Mr. Goza spend watching the game with Mr. Tran? What evidence from the graph led you to this conclusion? (2)

8) What is the maximum value of *G*? What does it tell us about Mr. Goza's trip? (2)

9) What are the solutions to the equation $G(t) = 60$? What do the answers represent? (3)

10) What are the roots of *G*? What do they tell us about Mr. Goza? (3)

11) Explain why the equation $G(t) = 40$ has an infinite number of solutions. (2)

This task was created and designed by Nate Goza with input from Liem Tran for Liem'nNate