Rate this presentation on the conference app.
www.nctm.org/confapp

Download available presentation handouts from the Online Planner!
www.nctm.org/planner

Join the conversation! Tweet us using the hashtag **#NCTMVegas**

Connecting Across the Core using Multiple Representations

Presented by
Carrie Hair, Washoe County School District, Reno, NV
Jenny Salls, Washoe County School District, Reno, NV

Session #149

Agenda

- Introductions

- Multiple representations builds coherence and rigor

- Activity 1: Function Models

- Activity 2: 4-box Projects

- Activity 3: Mini-Posters

- Closing

Why Representations?

Multiple Representations help students

- Model and interpret real world and mathematical situations in a variety of ways

- Become competent in translating between mathematical representations

- Select the representation that best fits a situation

Modeling Functions: Station 1

Station 1: Bouncing Balls – *For this experiment you will drop a ball from 5 different heights (in cm) and record the rebound height.*

Graph your Data (include your scale)

Drop Height	Bounce Height
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Independent Variable (input): _____

Dependent Variable (output): _____

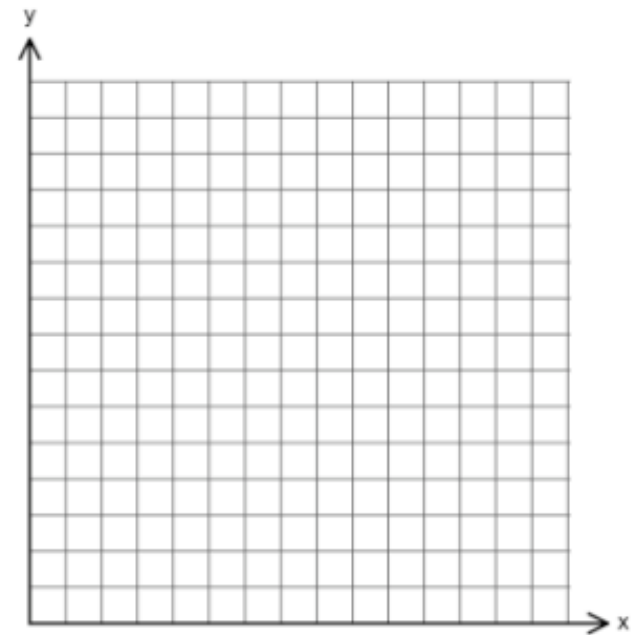What type of function does this data represent? Justify your answer.

Does this data represent a discrete or continuous function? Justify your answer.

Using your graphing calculator, write a regression equation to model this data.

Using the regression equation, predict the bounce height when the ball is dropped from 50 cm.

Compare this to the actual bounce height. Comment on your prediction compared to your actual bounce height
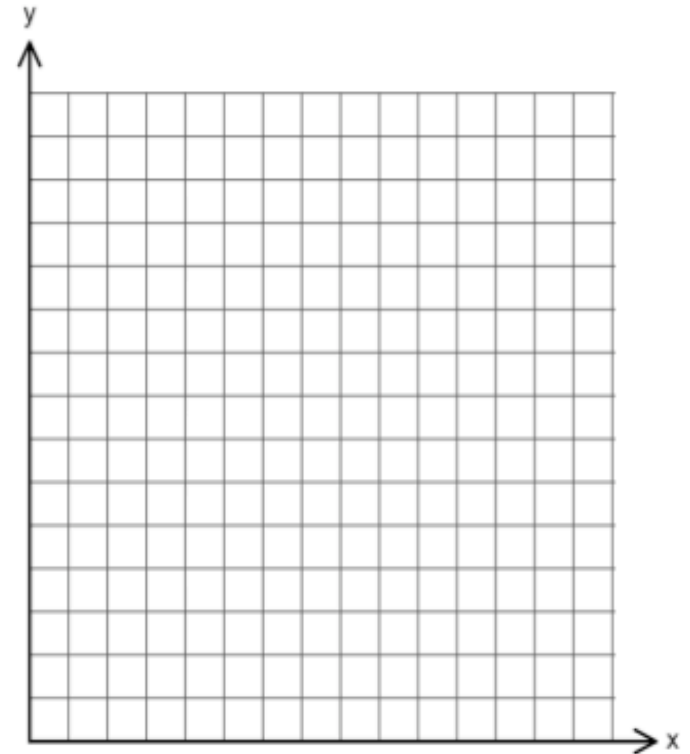
Modeling Functions: Station 2

Station 2: Areas with fixed Perimeters – *For this station you will be exploring different areas for a fixed perimeter. A farmer has 36 meters of fencing for a pig pen. What are the possible areas for the pen he could build?*

Record your data

Width	Length	Area
5	13	65
2	_____	_____
12	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

If the width is 5 and the perimeter has to be 36, then the length is 13, and the area is 5 x 13 = 65

Independent Variable (input): _____

Dependent Variable (output): _____

What type of function does this data represent? Justify your answer.

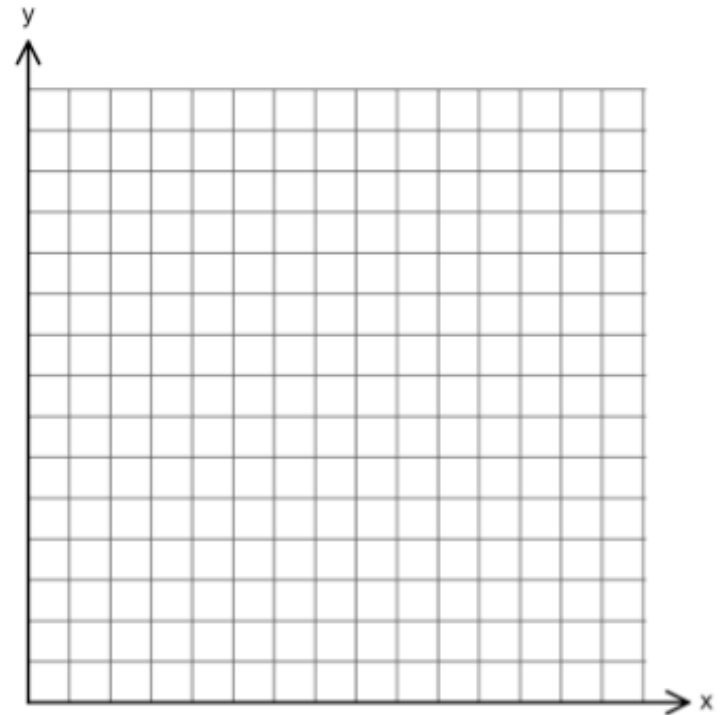*Graph your Data (include your scale)*

Modeling Functions: Station 3

Station 3: "M" and "M"s – *For the "0" term you will count how many total m & m's your group has all together. For the first trial you will place your m & m's back in the bag and dump them out. Count the number of "M"s showing and record the total number for the group under trial 1. Eat the "M"s" and put the remaining m & m's back into the bag. Dump them out , count the total number of "M"s showing in the group, eat the "M"s, put the remaining m & m's back into the bag. Repeat this for 3 more trials.*

Record your data

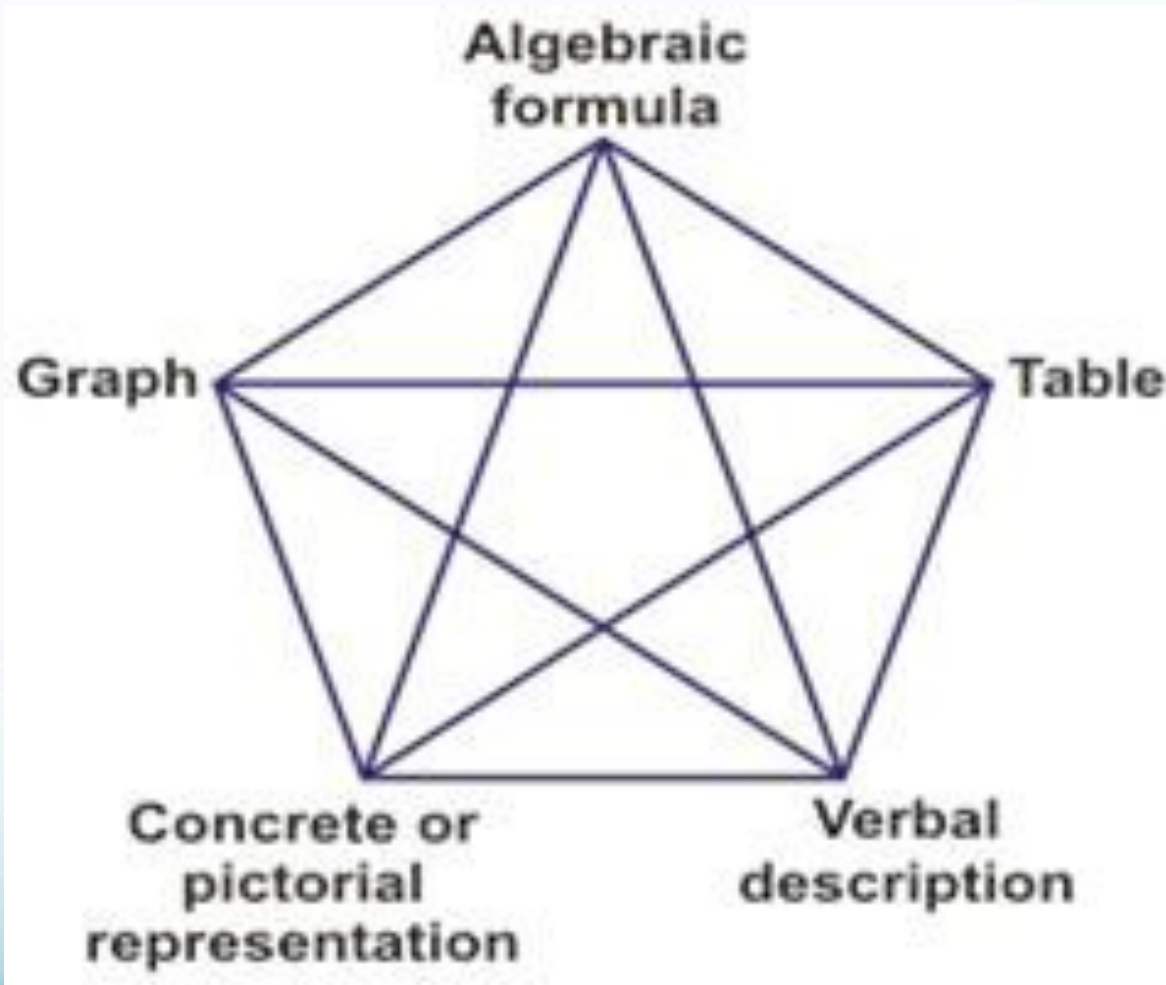| Trial	Number of "m"s	Number of m&m's left
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Graph your Data (include your scale)

Independent Variable (input): _____

Dependent Variable (output): _____

What type of function (pattern) does this data represent? Justify your answer.

Connections through 4-Box Projects

Sample 4-Box Project

My System of Equations   _____

                                       _____

Divide your blank sheet of paper into 4 boxes

Box 1: Graphing Method (5points)   _____
* Neatly write your system of equations
* Graph the first equation
* Write one complete sentence explaining
  how you graphed it, slope-int/ use intercepts, etc.
* Graph the second equation
* Write one complete sentence explaining
  how you graphed it, slope-int/ use intercepts, etc.
* State the solution to the system using the graph

Box 2 : Substitution Method(5 points)   _____
* Neatly show how you would solve you system
  using substitution.
* Write at least 2-3 complete sentences explaining
  your step process in using substitution.
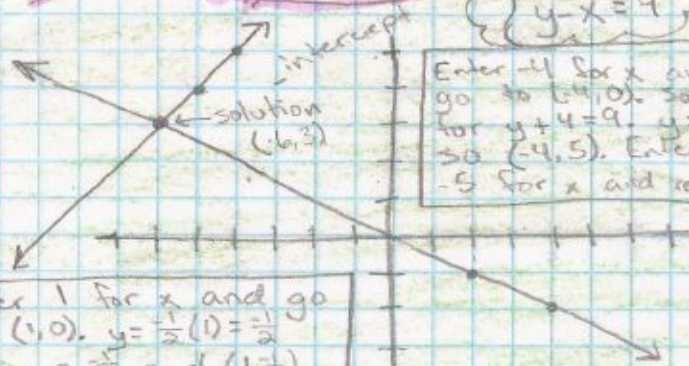
Box 3 : Elimination Method (5 points)   _____
* Neatly show how you would solve you system
  using elimination.
* Write at least 2-3 complete sentences explaining
  your step process in using elimination.

Box 4 : Communication (5 points)   _____
* State which method would be most efficient for the
  System you were given and why. (2 sentences)
* State which method you feel most comfortable with
  And why. (1 -2 sentences)
* State which method you feel least comfortable with
  And why. (1 -2 sentences)

Student Sample

① Graphing Method $\begin{cases} y = -\frac{1}{2}x \\ y - x = 9 \end{cases}$

intercept

solution $(-6,3)$

Enter -4 for x and go to $(-4,0)$. Solve for $y + 4 = 9$. $y = 5$ so $(-4, 5)$. Enter -5 for x and repeat.

Enter 1 for x and go to $(1, 0)$. $y = \frac{1}{2}(1) = \frac{1}{2}$ so $y = -\frac{1}{2}$ and $(1, \frac{1}{2})$. Then enter 2 for x and repeat.

② Substitution Method $\begin{cases} y = -\frac{1}{2}x \\ y - x = 9 \end{cases}$

$y = -\frac{1}{2}x$
$y - x = 9$
$-\frac{1}{2}x - x = 9$
$-\frac{3}{2}x = 9$
$-3x = 18$
$x = -6$

$y - (-6) = 9$
$y + 6 = 9$
$y = 3$

$(-6, 3)$

If you know what y equals $(-\frac{1}{2}x)$, plug it into the other equation. $(-\frac{1}{2}x - x = 9)$

Then solve for x using that equation. Plug your answer for x into the other equation and solve for y.

③ Elimination Method $\begin{cases} y = -\frac{1}{2}x \\ y - x = 9 \end{cases}$

$y = -\frac{1}{2}x$ $\quad$ $\cdot 3 - x = 9$
$y - x = 9$ $\quad$ $-x = 6$
$y + \frac{1}{2}x = 0$ $\quad$ $x = -6$
$2y + x = 0$ $\quad$ $(-6, 3)$
$y - x = 9$
$3y = 9$
$y = 3$

so the "x's or y's match.

Make sure both equations are in standard form. Then multiply one of the equations

If the signs are the same, subtract all numbers in one equation from the other. If they are different, add. Solve for the variable and plug it into an equation to solve for the other.

④ Communication

The substitution method was the most efficient because one of the equations was "y = —", so I could easily substitute it. I feel most comfortable with the graphing method because I never get my answer wrong with it. I don't really like the elimination method because not all fractions have equal "x's or y's" and it can take a longer time to solve with.

4-Box Template

Topic:	Objective:

Representation:	Representation:
Objective:	Objective:
Outline:	**Outline:**
Representation:	Representation:
Objective:	Objective:
Outline:	**Outline:**

Mini-Posters:
Gives Students Choice in their Representations

Mini-Poster Problems: Pick one problem to complete on a blank piece of graph paper

And the Winner Is?

In a school election, Juan received 4 times as many votes as Wayne, Neal received twenty less votes than Juan, and Kerry got half as many votes as Neal. The total votes cast in the election was 1,202. How many votes did Wayne receive?

Race to the Sky!

In Angie's science experiment, plant A is planted when it is 7 cm tall and grows continuously at a rate of 1.5 cm per day. Plant B is planted when it is 2 cm tall and grows continuously at a rate of 4.2 cm per day. Assuming the rates of growth do not change, show after how many days of growth plant B will be twice as tall as plant A.

DJ Problem

Jolene and Jake are in charge of hiring the Disc Jockey (DJ) for the Spring Dance. The DJ from radio station KDOT charges $150 plus $2 per person. The DJ from radio station KBOP charges $250 plus $1 per person. Since most of the students like the DJ from KBOP better, show how many students would need to attend the dance to make KBOP cost the same as KDOT.

_____

Part 1: (10 points) Clearly work out your problem in **2 DIFFERENT WAYS.** You may use equations, tables, diagrams, etc. Your calculations must be accurate and precise. Be neat and organized in your calculations.

_____/10

Part 2: (5 points) Pick one solution to write a detailed explanation about your problem solving process. This should be a minimum of 5 sentences.

_____/5

Part 3: (2 points) Write one sentence justifying the use of one mathematical practice. (Listed on the back) "I used mathematical practice _____ because _____.

_____/2

Part 4: (3 points) Organization. The first 3 parts are clearly identified on the mini-poster and easy to follow.

_____/3

Student Samples

Thank You
for
Participating!

Carrie Hair
Washoe County School District, Reno, NV
chair@washoeschools.net

Jenny Salls
Washoe County School District, Reno, NV
jsalls@washoeschools.net

Rate this presentation on the conference app.
www.nctm.org/confapp

Download available presentation handouts from the Online Planner!
www.nctm.org/planner

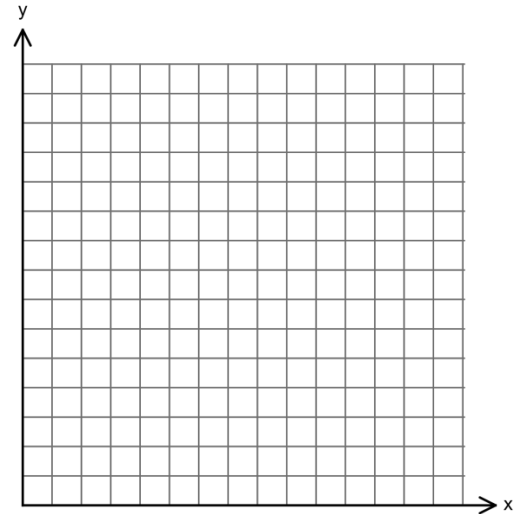Join the conversation! Tweet us using the hashtag **#NCTMVegas**

8th Grade Topic 1 Unit 3
Modeling Functions

Name _____

Date _____ Period: ____

Station 1: Bouncing Balls – *For this experiment you will drop a ball from 5 different heights (in cm) and record the rebound height.*

Drop Height	Bounce Height
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Graph your Data (include your scale)

Independent Variable (input): _____

Dependent Variable (output): _____

What type of function does this data represent? Justify your answer.

Does this data represent a discrete or continuous function? Justify your answer.

Using your graphing calculator, write a regression equation to model this data.

Using the regression equation, predict the bounce height when the ball is dropped from 50 cm.

Compare this to the actual bounce height. Comment on your prediction compared to your actual bounce height

---

Station 2: Areas with fixed Perimeters – *For this station you will be exploring different areas for a fixed perimeter. A farmer has 36 meters of fencing for a pig pen. What are the possible areas for the pen he could build?*

Record your data

Width	Length	Area
5	13	65
2	_____	_____
12	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

If the width is 5 and the perimeter has to be 36, then the length is 13, and the area is 5 x 13 = 65

Graph your Data (include your scale)
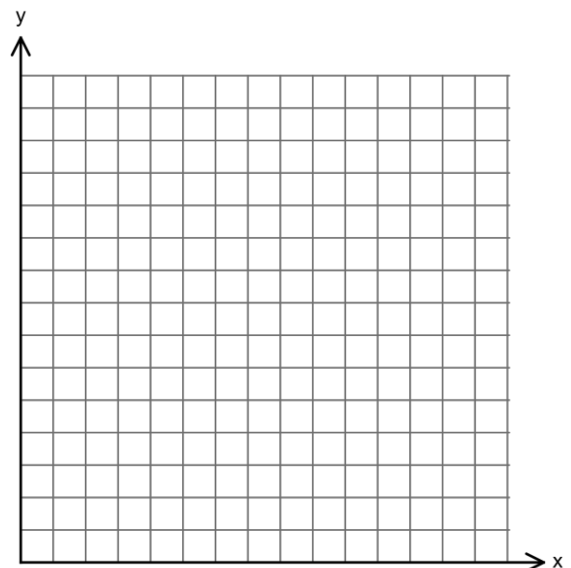
Independent Variable (input): _____

Dependent Variable (output): _____

What type of function does this data represent? Justify your answer.

Does this data represent a discrete or continuous function? Justify your answer.

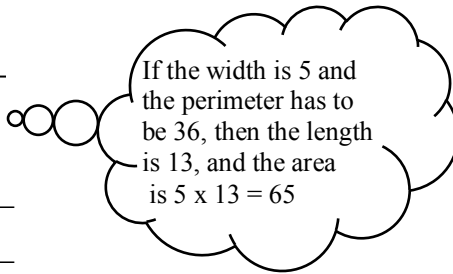Using your graphing calculator, write a regression equation to model this data.

Using the regression equation, predict the area when the width is 7.5 meters.

Compare this to the actual area. Comment on your prediction compared to your actual area.

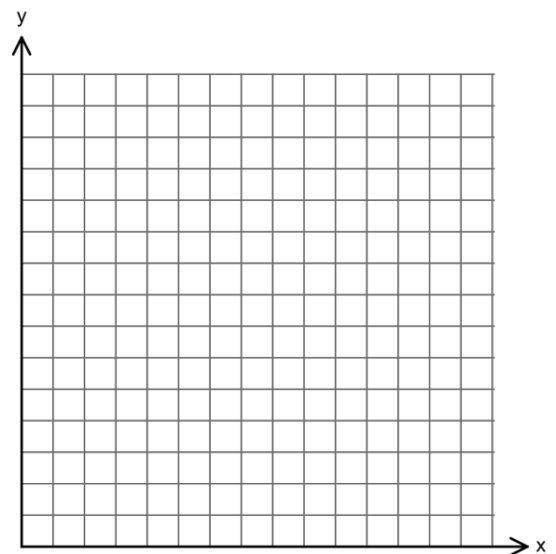***Station 3: "M" and "M"s*** – *For the "0" term you will count how many total m & m's your group has all together. For the first trial you will place your m & m's back in the bag and dump them out. Count the number of "M"s showing and record the total number for the group under trial 1. Eat the "M"s and put the remaining m & m's back into the bag. Dump them out , count the total number of "M"s showing in the group, eat the "M"s, put the remaining m & m's back into the bag. Repeat this for 3 more trials.*

Record your data

Trial	Number of "m"s	Number of m&m's left
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Graph your Data (include your scale)

Independent Variable (input): _____

Dependent Variable (output): _____

What type of function (pattern) does this data represent? Justify your answer.

Does this data represent a discrete or continuous function? Justify your answer.

Using your graphing calculator, write a regression equation to model this data.

Using the regression equation, predict the number of "m"s showing during the 3 trial.

Compare this to the actual number of "m"s showing. Comment on your prediction compared to your actual number of "m"s showing.

Cover Sheet   Name_____Per_____

Unit 3: Portfolio Project

My System of Equations   _____

                               _____

Divide your blank sheet of paper into 4 boxes

Box 1: Graphing Method (5points)   _____
           * Neatly write your system of equations
           * Graph the first equation
           * Write one complete sentence explaining
              how you graphed it, slope-int/ use intercepts, etc.
           * Graph the second equation
        * Write one complete sentence explaining
              how you graphed it, slope-int/ use intercepts, etc.
           * State the solution to the system using the graph

Box 2 : Substitution Method(5 points)   _____
           * Neatly show how you would solve you system
             using substitution.
           * Write at least 2-3 complete sentences explaining
             your step process in using substitution.

Box 3 : Elimination Method (5 points)   _____
           * Neatly show how you would solve you system
             using elimination.
           * Write at least 2-3 complete sentences explaining
             your step process in using elimination.

Box 4 : Communication (5 points)   _____
           * State which method would be most efficient for the
                System you were given and why. (2 sentences)
          *State which method you feel most comfortable with
                And why. (1 -2 sentences)
          *State which method you feel least comfortable with
                And why. (1 -2 sentences)

Overall Appearance/ Neatness (5 points)
          * Neatness   _____
          * Colorful, artwork, creativeness

                                       Your Total   _____/ 25

Topic: **Objective:**

Representation: Objective:	Representation: Objective:
Outline:	Outline:
Representation: Objective:	Representation: Objective:
Outline:	Outline:

Mini-Poster Cover Page
(please attach to your mini-poster)

Mini-Poster Problems: Pick one problem to complete on a blank piece of graph paper

And the Winner Is?
In a school election, Juan received 4 times as many votes as Wayne, Neal received twenty less votes than Juan, and Kerry got half as many votes as Neal. The total votes cast in the election was 1,202. How many votes did Wayne receive?

Race to the Sky!
In Angie's science experiment, plant A is planted when it is 7 cm tall and grows continuously at a rate of 1.5 cm per day. Plant B is planted when it is 2 cm tall and grows continuously at a rate of 4.2 cm per day. Assuming the rates of growth do not change, show after how many days of growth plant B will be twice as tall as plant A.

DJ Problem
Jolene and Jake are in charge of hiring the Disc Jockey (DJ) for the Spring Dance. The DJ from radio station KDOT charges $150 plus $2 per person. The DJ from radio station KBOP charges $250 plus $1 per person. Since most of the students like the DJ from KBOP better, show how many students would need to attend the dance to make KBOP cost the same as KDOT.

Part 1: (10 points) Clearly work out your problem in **2 DIFFERENT WAYS**. You may use equations, tables, diagrams, etc. Your calculations must be accurate and precise. Be neat and organized in your calculations.
_____/10

Part 2: (5 points) Pick one solution to write a detailed explanation about your problem solving process. This should be a minimum of 5 sentences.
_____/5

Part 3: (2 points) Write one sentence justifying the use of one mathematical practice. (Listed on the back) "I used mathematical practice _____because _____.
_____/2

Part 4: (3 points) Organization. The first 3 parts are clearly identified on the mini-poster and easy to follow.
_____/3

Total Score _____/ 20