Coordinate Algebra
Access for Students with Significant Cognitive Disabilities

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Kayse Harshaw

Special Education Services and Supports
Georgia Department of Education
Coordinate Algebra

• What is Algebra?
  • The branch of mathematics that deals with relationships between numbers, utilizing letters and other symbols to represent specific sets of numbers, or to describe a pattern of relationships between numbers.

• Solving for the UNKNOWN
MCC9-12.A.CED.1

– MCC9-12.A.CED.1
– Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. *
What is the Big Idea?

• Students will be provided with examples of real-world problems that can be modeled by writing an equation or inequality. The tasks begin with simple equations. Write linear equations and inequalities in one variable and solve problems in context.

• “Write the number sentence”

=  <  >  ≤  ≥  ≠
Grade Level Examples

• Given that the following trapezoid has area 54 cm², set up an equation to find the length of the unknown base, and solve the equation.

• Suppose a friend tells you she paid a total of $16,368 for a car, and you'd like to know the car's list price (the price before taxes) so that you can compare prices at various dealers. Find the list price of the car if your friend bought the car in:
  – a. Arizona, where the sales tax is 5.6%.
  – b. New York, where the sales tax is 8.35%.
  – c. A state where the sales tax is r.
Grade Level Example

- A rectangle is 12m longer than it is wide. Its perimeter is 68m. Find its length and width.

- **Solution**

  - **Sketch:**
    
    
    
    
    
    
    
    
    
    
    \[
    \begin{array}{c}
    w + 12 \\
    w \\
    w + 12
    \end{array}
    \]

  - **Define a Variable:**
    Width = \(w\)
    
  - **So length = \(w + 12\)**

  - **Equation:**
    
    
    
    
    
    
    
    
    
    \[
    w + w + w + 12 + w + 12 = 68
    \]
    
    
    
    
    
    
    
    
    
    \[
    4w + 24 = 68
    \]
    
    
    
    
    
    
    
    
    
    \[
    4w = 44
    \]
    
    
    
    
    
    
    
    
    
    \[
    w = 11
    \]
    
    
    
    
    
    
    
    
    
    **Width = 11**
    
    **Length = 11 + 12 = 23**
    
    So the width is 11m and the length is 23m.

  - **Check:**
    
    
    
    
    
    
    
    
    
    \[
    11 + (11+12) + (11) + (11+12) = 68
    \] ✔
MCC9-12.A.CED.1
Unpacking the Standard

• Create equations in one variable (to solve a problem)
• Create inequalities in one variable (to solve a problem)
• Use equations to solve problems
• Use Inequalities to solve problems

• Could use each of the above with linear or exponential functions
• IMPORTANT**“Problems” are word problems, not just an isolated equation.
Accessing MCC9-12.A.CED.1 at a pre-requisite level of instruction:

• Given a real world problem—student can create an equation –

• Student could be assisted to create the equation that represents the real world problem (represented with symbols) and then student determines the answer using manipulatives
The class is going to have snack. There are 5 plates on the table. John is to put a cupcake on each plate. He has placed 3 cupcakes on plates. How many more cupcakes does he need?
Access Level Examples

- Equation: $3 + X = 5$

Graphic by BoardMaker, Mayer Johnson
So what is an equation?

- **Equation**: A number sentence that contains an equals symbol.
- Talk it out—
  How many cupcakes do we have?  
  3
  How many cupcakes do we need?  
  5
  What do we need to find out?  
  How many more we need.  
  This is our variable—”x” (or a symbol you that represents the unknown quantity).
Access Level Examples

• Cupcakes we have + cupcakes we need = Enough for the class

• Cupcakes we have: 3 or

• Cupcakes we need: (variable)
The class is going to have snack. There are 5 plates on the table. John is to put a cupcake on each plate. He has placed 3 cupcakes on plates. How many more cupcakes does he need?

Can we use matching and 1:1 correspondence to solve?
The class is going to have snack. There are 5 plates on the table. John is to put a cupcake on each plate. He has placed 3 cupcakes on plates. How many more cupcakes does he need?
MCC9-12.A.CED.2

- **MCC9-12.A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
What is the Big Idea?

- Creating equations in two variables to represent relationships in real world problems
- Graphing relationships between variables
- There are two variables (quantities that can vary)
- If one of the variables changes, the other variable has to change
- \( X + y = \text{constant number} \)
- Remember—This is just creating the equation!
- Equation—The sentence that describes the problem.
- In other words—what is the number sentence (equation) that describes this problem?
Grade Level Example

- David compares the sizes and costs of photo books offered at an online store. The table below shows the cost for each size photo book.
- Write an equation to represent the relationship between the cost, $y$, in dollars, and the number of pages, $x$, for each book size. Be sure to place each equation next to the appropriate book size. Assume that $x$ is at least 20 pages.
- $45 + x(1.50) = y$

<table>
<thead>
<tr>
<th>Book Size</th>
<th>Base Price</th>
<th>Cost for Each Additional Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-in. by 9-in.</td>
<td>$20</td>
<td>$1.00</td>
</tr>
<tr>
<td>8-in. by 11-in.</td>
<td>$35</td>
<td>$1.00</td>
</tr>
<tr>
<td>12-in. by 12-in.</td>
<td>$45</td>
<td>$1.50</td>
</tr>
</tbody>
</table>
MCC9-12.A.CED.2

Unpacking the Standard

• Create equations in two or more variables to represent relationships between quantities
• graph equations (with two variables) on coordinate axes with labels and scales (Teacher could provide labels and/or scales at an access level)

• ***No Solving—just creating and graphing
Understanding the Standard

• You create an equation with two variables to describe the problem.
• \( X + Y = 6 \)
• You cannot solve this equation.
  – If you substitute a value for \( X \), it is no longer an equation with two variables, it becomes an equation with one variable, which is in then becomes \( \text{MCC9-12.A.CED.1} \)

  e.g., If \( x \) has a value of 3, then the equation changes and it is \( 3+y=6 \)
Access Level Examples

• How many boys and girls can ride on an 6 passenger bus?
• Boys + Girls = 6
• $b + g = 6$
Access Level Examples

• Sami has $7 to spend on the community skills trip. How much can he spend at the dollar store and the snack bar?

• Dollar Store + Snack ≤ $7
Access Level Examples

• How many chocolate and vanilla cupcakes can you put in the muffin tin that holds 6?

\[ C + V = 6 \]

Graphic by BoardMaker, Mayer Johnson
$X + Y = 5$ How many variations?
Use for instructional purposes to show how changing the value of one variable causes the value of the other to change.

$X + Y = 5$
Graphing equations with two variables
(Part of CED.2)

• Graphing the possibilities for answers on a coordinate plane gives students a method for determining the possible values of x and y.
- How many boys and girls can ride on an 8 passenger bus?
- If no boys, then 8 girls (0,8).
  If no girls, then 8 boys (8,0).
-- Plot at least 2 points,
  *Then connect with a line segment. (*This is the part of the activity that aligns to the standard)
- Caution (Creating the graph aligns to this standard. Using it to solve for other values actually aligns to a different standard)
MCC9-12.A.REI.3

• Solve equations and inequalities in one variable
• MCC9-12.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
What is the Big Idea?

• Solve equations and inequalities, (number sentence with one variable).
• This standard includes solving equations that have a coefficient as a variable, e.g. cx = 6.
• Extends earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for.
• Given a real life situation and given the equation that represents that situation, the student solves the equation.
Grade Level Example

• If your father spends $78 on gas, approximately how many gallons did he purchase?
  • \$78 = \$3.49 \times g
  • \[ g = \frac{\$78}{\$3.49} \]
    \[ g = 22 \]
    • He purchased approximately 22 gallons of gas.

Solving the equation is the task in this activity that aligns to the standard.
Grade Level Example-Inequalities

Match each inequality in items 1 – 3 with the number line in items A – F that represent the solution to the inequality.
Unpacking the Standard

• Solve linear equations in one variable
• Solve inequalities in one variable
• Solve linear equations in one variable including equations with coefficients represented by letters e.g. $6=cx$
• Solve inequalities in one variable including equations with coefficients represented by letters
Solve linear equations in one variable

• Looking back to the activity in CED.1

• If I have 3 cupcakes, how many more do I need to have enough for 5 people in the class?

• 3 + x = 5
• X = 5 - 3
• X = 2

Solving the equation is the task in this activity that aligns to the standard
Access Level Examples

Identify a viable answer given a one step inequality.

X > 5. What numbers on the number line would be correct?

Student may point to numbers with the problem represented on the number line, use manipulatives, or solve problem on paper.
Access Level Examples

• Identify a viable answer given a one step inequality.
  – X>5. What numbers would be correct?
  – Student may point to numbers with the problem represented on the number line, use manipulatives, or solve problem on paper.

• Identify an viable answer in a real world context for an inequality:
  – Jan brought 8 cupcakes to school. Her class ate at least 4. How many could she have left at the end of the day?
  – 8-4 ≤ x
MCC9-12.F.IF.2

- MCC9-12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
What is the Big Idea?

• To evaluate a function for inputs into their domain means we start with a function statement, substitute a value into the “x” variable (one of the values in the domain) and solve for the answer.

• Put a value into the variable, and solve a function statement.
  – A function is a relationship between two variables in an ordered pair \((x,y)\).
  – In order to be a function, each value of \(x\) is only associated with one value of \(y\).
  – The **domain** of a relation is the set of the first coordinates from the ordered pairs (or the \(x\) in \((x,y)\).
    • What are the numbers that are going to be used as an “x” value?
What is the Big Idea? Continued

• Decode function notation and explain how the output of a function is matched to its “rule”.
• Convert a table, graph, set of ordered pairs, or description into function notation by identifying the rule used to turn inputs into outputs and writing the rule.
Grade Level Example

• (Students interpret a function statement with values already solved in every day language)

• You put a yam in the oven. After 45 minutes, you take it out. Let $f$ be the function that assigns to each minute after you placed the yam in the oven, its temperature in degrees Fahrenheit

  – a. write a sentence explaining what $f(0)=65$ means in everyday language

  a. $f(0)=65$ means that when you placed the yam in the oven, its temperature was 65 degrees Fahrenheit.
Grade Level Example

b. \( f(5) < f(10) \) means that the temperature of the yam 5 minutes after you placed it in the oven was less than its temperature 10 minutes after you placed it in the oven. This would be because the yam's temperature will increase from 65 degrees Fahrenheit during the first few minutes its in the oven.

c. \( f(40) = f(45) \) means that the temperature of the yam 40 minutes after you placed it in the oven was the same as its temperature 45 minutes after you placed it in the oven. This would be because the temperature of the yam eventually plateaus.

d. \( f(45) > f(60) \) means that the temperature of the yam 45 minutes after you placed it in the oven was greater than its temperature 60 minutes after you placed it in the oven. This would be because the yam began to cool down after you removed it from the oven.
Unpacking the Standard

• Use function notation, evaluate functions for inputs in their domains
  – Plug in a value for the variable and “solve”

• Interpret statements that use function notation in terms of a context.
  – Describe what the statement means in a real world context
Access Level Examples

• If I go to the vending machine to buy gum, I put in money, buy the gum, and get change.

\[ f(\$) = \$ - 0.25 \] (Here \$ represents “money”. Could use Boardmaker symbol for change/money as the variable).

• This is an example of making a purchase at the vending machine and how it is displayed in function notation.

• \$ is the money put into the machine.

• \( f \) is making the purchase and pushing the gum button—thus spending 25 cents.

• \( (\$ - 0.25) \) is the function or mini formula for determining the change.

• This is not measuring their ability to use a vending machine, the student must show their work!
Access Level Examples

• If I go to the vending machine to buy gum, I put in money, buy the gum, and get change.

• Evaluate functions for inputs in their domains
  – E.g. plug in a value and solve
  \[ f(x) = x - .25 \]
  – What if I put in $1.00
    • \[ f($1.00) = 1.00 - .25 \]
      \[ f($1.00) = .75 \]
  – What if I put in 50 cents?
    • \[ f(.50) = .50 - .25 \]
      \[ f(.50) = .25 \]
Access Level Examples

• If I go to the vending machine to buy gum, I put in money, buy the gum, and get change.
  \[ f(\$1) = \$1 - \$0.25 \]
  How much change did you get back if you put in $1.00?

• At a lower level of access, the student could use symbols.

  \[ \begin{align*}
  \text{What is the answer?} \\
  \quad &\text{When I put $1 in the vending machine and bought gum, I got back 75 Cents.} \\
  \quad &\text{When I put $1 in the vending machine and bought gum, I got back 3 quarters} \\
  \quad &\text{When I put money in the vending machine and bought gum, I got back this much change.}
  \end{align*} \]

• Prompting could include: What did you put in? ($1) How much did the gum cost? What did you get back? (change, 3 quarters, or .75)
Access Level Examples

• At a lower level of access, the student could use symbols.
  
  • $X$ is the money put into the machine
  • $f$ is making the purchase and pushing the gum button—thus spending 25 cents.
  • $y$ or $(x - .25)$ is collecting the change.
  • This is not measuring their ability to use a vending machine, the student must show their work!
Access Level Examples

• Interpret statements that use function notation in terms of a context.
  – Describe what the statement means

• If I go to the vending machine to buy gum, I put in money, buy the gum, and get change.
  – The function notation is $f($) = $ - .25$

• Can you describe what $f($) = $ .75 means in everyday language?
  – When I put $1 in the vending machine and buy gum, I get 75 cents change back.
Access Level Examples

• Interpret statements that use function notation in terms of a context.
• Describe what the statement means
  – \( f($) = $ - $0.25 \)
    If I buy a pack of gum and put money into the machine, my change will be the amount of money I put in minus $0.25.
  
  – \( f(\text{ball player}) = \text{batting average} \) ("I’ll name a ball player, give their batting average")
    \( f(\text{Babe Ruth}) = 0.342 \)
    “Babe Ruth’s batting average is 0.342.”
  
  – \( f(\text{person}) = \text{height} \)
    \( f(\text{Mark}) = 5'7" \) Mark’s height is 5’7”

• It is a function because for each value of the domain has only one value associated with it.
MCC9-12.F.IF.6

- **MCC9-12.F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

- (This is limited to linear and exponential functions)
What is the Big Idea?

• What is the **rate of change** as the values change in the function?
• In Coordinate Algebra start F.IF.6 by focusing on linear and exponential functions whose domain is a subset of the integers.
  – In other words—find the rate of change between 2 values.
  – The average rate of change of a function \( y = f(x) \) over an interval \([a, b]\) is
    \[
    \frac{\Delta y}{\Delta x} = \frac{f(b) - f(a)}{b - a},
    \]
    or the difference of the values of y divided by the difference of the values of x.
• In addition to finding average rates of change from functions given symbolically, graphically, or in a table.
• Students may collect data from experiments or simulations (such as a falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.
• **In other words, what is the rate of change between the function of two of the values of x?**
Grade Level Example

• Use the following table to find the average rate of change of $g$ over the intervals $[-2, -1]$ and $[0, 2]$:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>2</td>
</tr>
<tr>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>2</td>
<td>-10</td>
</tr>
</tbody>
</table>

• For the interval $[-2, -1]$ \[
\frac{\Delta y}{\Delta x} = \frac{-1-2}{-1-(-2)} = -3
\]

• For the interval $[0, 2]$ \[
\frac{\Delta y}{\Delta x} = \frac{-10-(-4)}{2-0} = \frac{-14}{2} = -7
\]
MCC9-12.F.IF.6

Unpacking the Standard

• Calculate the average rate of change of a function (presented symbolically) over a specified interval.
• Calculate the average rate of change of a function (presented as a table) over a specified interval.
• Interpret the average rate of change of a function (presented symbolically) over a specified interval.
• *Interpret the average rate of change of a function (presented as a table) over a specified interval.
• Estimate the rate of change from a graph.
Access Level Examples

- Calculate the rate of change of a function presented as a table over a specified interval.
- Each pencil Jim buys at the store costs .10. What is the rate of change between buying 2 pencils and 3 pencils? $f(p) = p \times .10$

<table>
<thead>
<tr>
<th>p</th>
<th>$f(p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.10</td>
</tr>
<tr>
<td>2</td>
<td>.20</td>
</tr>
<tr>
<td>3</td>
<td>.30</td>
</tr>
<tr>
<td>4</td>
<td>.40</td>
</tr>
</tbody>
</table>

- 2 pencils are .20
- 3 pencils are .30
- The difference in the rate of change from 2 to 3 is .20 to .30 or .10
- For the interval (2, 3) the rate of change is .10
Estimate the rate of change from a graph.

- The rate of dollars I earn for every hour I work is 2:1
MCC9-12.F.BF.1

• Build a function that models a relationship between two quantities
• MCC9-12.F.BF.1 Write a function that describes a relationship between two quantities.
  – MCC9-12.F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
What is the Big Idea?

• Write a function statement that describes a function process.
• How can I write a math process that is applied in the same way each time you change the value of “x” into a math sentence using function notation?
• The function is the “rule” or the “mini equation”.
• When a relation between two variables (x,y) is determined to be a function, use $f(x)$ notation.
What is the Big Idea?

• Given the context of a relationship between two quantities due to a function on one of the quantities, build the function statement.

• From context, write an explicit expression, define a recursive process, or describe the calculations need to model a function between two quantities.

  – **Explicit Expression.** A formula that allows direct computation of any term for a sequence \(a_1, a_2, a_3, \ldots, a_n, \ldots\) (any value of a can be determined independently)

  – **Recursive Formula.** A formula that requires the computation of all previous terms to find the value of \(a_n\). (e.g. total in savings account at year \(a\) given an interest rate)
Grade Level Example

• In Coordinate Algebra focus on situations that exhibit linear, exponential relationships.
• Students will analyze a given problem to determine the function expressed by identifying patterns in the function’s rate of change. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions.
Grade Level Example

• You buy a $10,000 car with an annual interest rate of 6% compounded annually and make monthly payments of $250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation or table.
Unpacking the Standard

• MCC9-12.F.BF.1 Write a function that describes a relationship between two quantities.
  – Determine an explicit expression from a context.
  – Determine a recursive process from a context.
    • (suggestion—do not use recursive process in this standard at an access level)
  – Determine steps for calculation from a context.
Access Level Examples

• Write a function of an explicit expression from a context.

• Buying pencils from the school store
  – Each pencil (p) costs $.10
  – Function of buying a pencil $f(p)$ is $p \times .10$
  
  • $f(p) = p \times .10$
  
  • For students at an access level, you could use the “$x$” symbol for multiplication. But, do not let it be confused with the variable “x”
Access Level Examples

• Determine an explicit expression from a context.

• Buying items from the Dollar Store
  – Each item (i) costs $1
  – Function of buying an item $f(i)$ is $(i \times 1)$
    • $f(i)$ is $(i \times 1)$
  – At a higher level of access (using a calculator)
    • Buying (i) items at the Dollar Store requires tax at $.07 rate.
    • Each item cost $1.00 plus .07 tax
    • $f(i)$ is $i(1.07)$
      or cost of all items plus tax for the total cost.
Geometry in Algebra

• Congruence and transformations in the plane
MCC9-12.G.CO.2

• Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch).
What is the Big Idea?

• In middle school students have worked with translations, reflections, and rotations and informally with dilations. Point out the basis of rigid motions in geometric concepts, e.g., translations move points a specified distance along a line parallel to a specified line; rotations move objects along a circular arc with a specified center through a specified angle.
Grade Level Example

• Use various technologies such as transparencies, geometry software, interactive whiteboards, and digital visual presenters to represent and compare rigid and size transformations of figures in a coordinate plane. Comparing transformations that preserve distance and angle to those that do not.

• Describe and compare function transformations on a set of points as inputs to produce another set of points as outputs, to include translations and horizontal and vertical stretching.

• Students may use geometry software and/or manipulatives to model and compare transformations.
• Draw transformations of reflections, rotations, translations, and combinations of these using graph paper, transparencies and/or geometry software.
• Distinguish between transformations that are rigid (preserve distance and angle measure-reflections, rotations, translations, or combinations of these) and those that are not (dilations or rigid motions followed by dilations).
MCC9-12.G.CO.2
Unpacking the Standard

• Represent transformations in the plane using, e.g., transparencies and geometry software;
• describe transformations as functions that take points in the plane as inputs and give other points as outputs.
• Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch).
Access Level Examples

• Using premade transparencies on a graph, can the student move a figure on the plane to designated points?

  Move the corner of the square from (2,4) to (5,4).

  Student could use arrow as a guide to assist in placement.
Access Level Examples

• Compare figures on a coordinate plane to determine if they are the same, different, skewed...
MCC9-12.G.CO.3

• MCC9-12.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
Describe and illustrate how a rectangle, parallelogram, and isosceles trapezoid are mapped onto themselves using transformations. How can you move a shape (using the transformations of flip, rotate, turn, to put it back on itself in exactly the same place? The coordinate plane is not mentioned in this standard.
Grade Level Example

• Calculate the number of lines of reflection symmetry and the degree of rotational symmetry of any regular polygon.

• Students may use geometry software and/or manipulatives to model transformations.

• For each of the following shapes, describe the rotations and reflections that carry it onto itself.
Grade Level Example

• For each of the following shapes, describe the rotations and reflections that carry it onto itself e.g. can you do one translation and have it stay the same?

» Rectangle: can flip one time, rotate 180 degrees,

» Hexagon: can flip or rotate

» Polygon—rotate 360 degrees
  • Cannot flip once—would have to flip twice
MCC9-12.G.CO.3

Unpacking the Standard

• Given a rectangle, describe the rotations that carry it onto itself.
• Given a parallelogram, describe the rotations that carry it onto itself.
• Given a trapezoid, describe the rotations that carry it onto itself.
• Given a regular polygon, describe the rotations that carry it onto itself.
• Given a rectangle, describe the reflections that carry it onto itself.
• Given a parallelogram, describe the reflections that carry it onto itself.
• Given a trapezoid, describe the reflections that carry it onto itself.
• Given a regular polygon, describe the reflections that carry it onto itself.
Access Level Examples

• This can include physical placements of manipulatives back into its original outline.
  – The shapes would initially be placed in an outline of itself.
  – The instructor would move the shape and change the orientation.
  – The student would describe or demonstrate the transformations needed to place the shape back in its outline.

Flip  Turn
Domain of Algebra Connections to Statistics and Probability
MCC9-12.S.ID.1

• Summarize, represent, and interpret data on a single count or measurement variable
• MCC9-12.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots)
What is the Big Idea?

• Graph numerical data on a real number line using dot plots, histograms, and box plots.
• Data represented must be based on numbers, not categories, e.g., how many homes have 1 tv, 2tvs, 3tvs, etc.
Grade Level Example

• Graph numerical data on a real number line using dot plots, histograms, and box plots.
• Analyze the strengths and weakness inherent in each type of plot by comparing different plots of the same data.
• Describe and give a simple interpretation of a graphical representation of data
The following data set shows the number of songs downloaded in one week by each student in Mrs. Jones class:

- 10, 20, 12, 14, 12, 27, 88, 2, 7, 30, 16, 16, 32, 25, 15, 4, 0, 15, 6.
- Choose and create a plot to represent the data.

On the midterm math exam, students had the following scores:

- 95, 45, 37, 82, 90, 100, 91, 78, 67, 84, 85, 85, 82, 91, 93, 92, 76, 84, 100, 59, 92, 77, 68, and 88.

- What are the strengths and weaknesses of presenting this data in a certain type of plot for:
  - Students in a class?
  - Parents?
MCC9-12.S.ID.1

Unpacking the Standard

• Represent data with plots on the real number line (dot plots)
• Represent data with plots on the real number line (histograms)
• Represent data with plots on the real number line (box plots)
Access Level Examples

• Represent numerical data in dot plots on a number line:

• How many times have my classmates been to the beach?
MCC9-12.S.ID.2

• **MCC9-12.S.ID.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★
What is the Big Idea?

• Given two sets of data or two graphs, identify the similarities and differences in shape, center, and spread.
• Compare data sets and summarize the similarities and difference between the shape, and measures of center and spreads of the data sets.
• Which type of graph is best for the type of data and comparison?
Grade Level Example

• The frequency distributions of two data sets are shown in the dot plots below.

<table>
<thead>
<tr>
<th></th>
<th>Greater for Data Set 1</th>
<th>Equal for Both Data Sets</th>
<th>Greater for Data Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• For each of the following statistics, determine whether the value of the statistic is greater for Data Set 1, equal for both data sets, or greater for Data Set 2.
MCC9-12.S.ID.2
Unpacking the Standard

• Use statistics appropriate to the shape of the data distribution to compare center (median) of two or more different data sets.

• Use statistics appropriate to the shape of the data distribution to compare center (mean) of two or more different data sets.

• Use statistics appropriate to the shape of the data distribution to compare spread (interquartile range) of two or more different data sets.
Access Level Examples

• How many times have you been to the beach?
• What is the spread (Range) of the data?
  – Lowest point — Students, 0; Teachers 1
  – Highest point — Students 7; Teachers 10
  – Spread (Range): Students 7; Teachers 9
  – Largest range: Teachers

– Could do mean and median

Students trips to the beach

Teachers trips to the beach
MCC9-12.S.ID.6

- MCC9-12.S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
  - c Fit a linear function for a scatter plot that suggests a linear association.
What is the Big Idea?

• Can you put a “best line of fit” on the graph?
• Determine if one variable is related to another and if the second variable can be predicted or estimated if you know the first.
Grade Level Example

• S.ID.6c –
• Is there a line of best fit?
• Categorize data as linear or not. Write the equation of the line of best fit.
Grade Level Example

• Examine plotted data of forearm length and height in a class. Estimate a linear function for the data

• Could the graph be used to estimate the height for any person with a known forearm length? Why or why not?
Grade Level Example

- Example graph of arm span and height with line of best fit.

http://jwilson.coe.uga.edu/EMAT6680/Norman/Emat6700/Graph_LeastSquares.jpg
MCC9-12.S.ID.6
Unpacking the Standard

• Describe how the data on two quantitative variables graphed on a scatter plot are related.
Represent data on two quantitative variables on a scatter plot

• Plot height and weight of class members on a coordinate plane

http://www.mathsisfun.com/data/images/scatter-plot.gif
Describe how the data on two quantitative variables graphed on a scatter plot are related.

- Can you put a line of best fit on the graph?
- Does height go up as weight goes up?
Access Level Examples

Is there a line of best fit for this graph? If you measure someone’s hair, will you know their shoe size?
Access Level Examples

• Vitruvian Man example on resource board.
• Hours you work and money you earn.

• From scatter plot to represent data and/or interpret the relation between the two variables as positive, negative or no correlation.
Resources

- Coordinate Algebra Webinars for General Education Courses
- **Webinar Information**
  - A two-hour course overview webinar may be accessed at [http://www.gpb.org/education/common-core/2012/02/28/mathematics-9th-grade](http://www.gpb.org/education/common-core/2012/02/28/mathematics-9th-grade)
  - The unit-by-unit webinars may be accessed at [https://www.georgiastandards.org/Common-Core/Pages/Math-PL-Sessions.aspx](https://www.georgiastandards.org/Common-Core/Pages/Math-PL-Sessions.aspx)
The websites below are interactive and include a math glossary suitable for high school children. **Note – At the high school level, different sources use different definitions. Please preview any website for alignment to the definitions given in the frameworks.**

- This web site has activities to help students more fully understand and retain new vocabulary.

- [http://intermath.coe.uga.edu/dictnary/homepg.asp](http://intermath.coe.uga.edu/dictnary/homepg.asp)
- Definitions and activities for these and other terms can be found on the Intermath website. Intermath is geared towards middle and high school students.
Kayse Harshaw
Education Program Specialist
Special Education Services and Supports
Georgia Department of Education
Atlanta, Georgia
sharshaw@doe.k12.ga.us