

Mathematics Assessment Update Algebra 1 Lessons Learned

Florida Council of Teachers of Mathematics

October 20-21, 2016

Terri L. Sebring



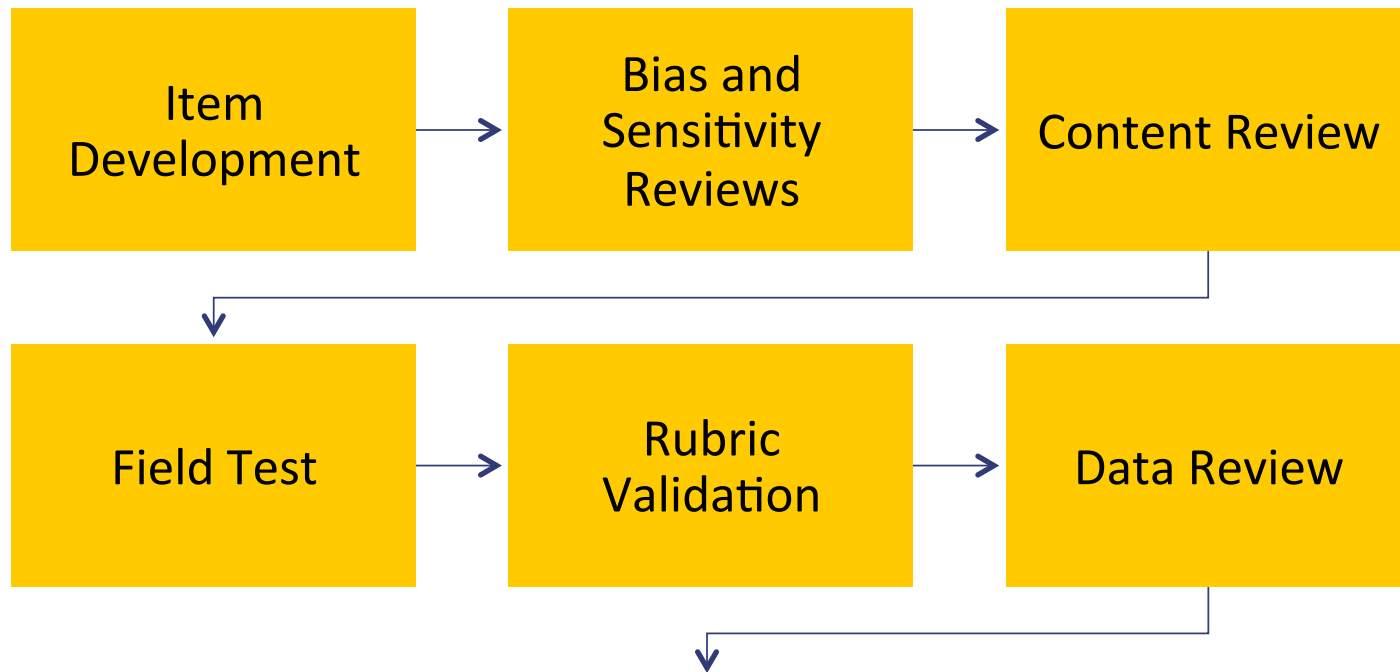
Test Development Center

Role of The Test Development Center
Item Development

The Test Development Center (TDC)

- TDC is funded through a grant by the Florida Department of Education (FDOE). The grant is managed by Tallahassee Community College.
- TDC's purpose is to assist FDOE in the implementation of various aspects of the statewide assessment program.
- TDC works with contractors and Florida educators to develop test items for English Language Arts, Mathematics, Science, and Social Studies assessments.
- TDC also works with contractors and FDOE to produce and distribute interpretive products related to statewide assessments.

FSA Mathematics Item Development Process



Florida
Standards Assessments



General Information

FSA Portal

Practice Tests

Reference Sheet

Calculators

Item Type Tutorials

Equation Tutorial

www.FLDOE.org



Students & Families



Test Administration



Technology Resources



About the FSAs

Welcome to the FSA Portal

This portal is your source for information about Florida Standards Assessments.

Florida's K-12 assessment system measures students' achievement of Florida's education standards, which were developed and implemented to ensure that all students graduate from high school ready for success in college, career, and life. Assessment supports instruction and student learning, and test results help Florida's educational leadership and stakeholders determine whether the goals of the education system are being met.

For information about FCAT 2.0 or NGSSS EOC Assessments, please visit <http://www.fl DOE.org/accountability/assessments/k-12-student-assessment>.

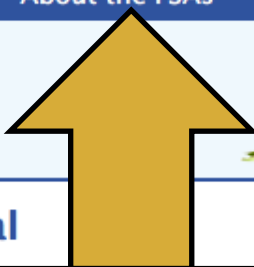
For more information about Florida standards, course descriptions, and standard resources, please visit www.cpalms.org.

FDOE on Twitter

Tweets by @EducationFL

FL Dept of Education @EducationFL

www.FLDOE.org



FSA Test Item Specifications



Administer the FSA



Secure Browser



FSA Resources



Tests



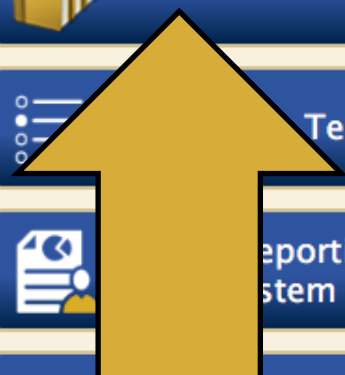
Reporting System



Equation Editor Tutorial, FSA Calculator, Reference sheets



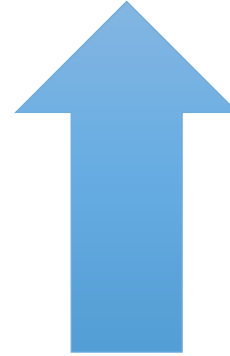
Visit FDOE



Interpretive Information

The following documents provide current interpretive information about the assessments. **Previous versions** of the Test and Item Specifications can be viewed on the “Archives” tab in the [Resources Section in the portal](#).

- [Grade 3 Mathematics Test Item Specifications](#)
- [Grade 4 Mathematics Test Item Specifications](#)
- [Grade 5 Mathematics Test Item Specifications](#)
- [Grade 6 Mathematics Test Item Specifications](#)
- [Grade 7 Mathematics Test Item Specifications](#)
- [Grade 8 Mathematics Test Item Specifications](#)
- [Algebra 1 EOC Test Item Specifications](#)
- [Geometry EOC Test Item Specifications](#)
- [Algebra 2 EOC Test Item Specifications](#)
- [Grade 3 ELA Test Item Specifications](#)
- [Grade 4 ELA Test Item Specifications](#)
- [Grade 5 ELA Test Item Specifications](#)
- [Grade 6 ELA Test Item Specifications](#)
- [Grade 7 ELA Test Item Specifications](#)
- [Grade 8 ELA Test Item Specifications](#)
- [Grades 9–10 ELA Test Item Specifications](#)
- [ELA Test Design Summary – Updated 05–26–16](#)
- [Mathematics Test Design Summary – Updated 1–6–16](#)



Practice Tests

- If you want students to experience different item types consider using different grade/course practice tests.

CBT Practice Tests

- CBT students are required to participate in a practice-test/ePAT session prior to testing.
- Students with CBT accommodations must use the appropriate accommodated practice test.
- Students retaking an assessment who previously completed this requirement for the test they will take (EOC or Retake) are not required to participate in another practice test.

PBT Practice Tests

- Students who will take an **FSA ELA Reading or Mathematics paper-based test ARE REQUIRED** to participate in a PBT Test Item Practice Session to familiarize themselves with the various item types they may encounter on the assessments.
 - Grade 3 FSA ELA Reading
 - Grades 4–10 Reading PBT Accommodations
 - Grades 3–8 Mathematics PBT Accommodations
- Students taking PBT **ELA Writing** are not required to take a practice test, but are strongly encouraged to do so to become familiar with the amount of space they will have for their responses.

Reference Sheets

- Hard copies may be provided (for CBT and PBT)
- Please ensure schools distribute the **correct** sheet
 - Correct Algebra 1 (FSA or NGSSS)
 - Ensure all grade levels are correct
- Copies must be clean (no writing), contain all information (nothing cut off), and be readable (not faded or smudged)

Practice Using the Online Calculator

The online scientific calculator for grades 7 and 8, and the EOCs can be found at:

<http://fsassessments.org/resources/>

Handheld Calculators

- No updates have been made to the information in the calculator policies document on the FSA Portal
- Districts are responsible for noting any functionality changes to approved models
- FDOE will not review/approve additional models for the list; however, districts may provide calculators if Mathematics specialists in the district determine that they meet the published specifications
- Handheld calculators are **OPTIONAL** for CBT and **REQUIRED** for PBT

Handheld Calculators

- School staff and Test Administrators **MUST** be trained on the appropriate use of calculators:
 - Grades 7 and 8 – **SESSIONS 2 and 3 ONLY**
 - FSA EOCs – **SESSION 2 ONLY**
 - NGSSS EOCs (Algebra 1 Retake, Biology 1) – 4-function handheld
- Tests for students who have access to a calculator during non-calculator sessions OR who have access to a calculator with prohibited functionalities must be invalidated.

Equation Tutorial

<http://fsassessments.org/resources/>



Back



Refresh

1. $3x + 8$

2. $3\left(4 + \frac{x}{2}\right)$

3. $6 = 2\frac{1}{2} + 3\frac{1}{2}$

4. $y = \frac{3x^2 - \sqrt{5}}{4}$

5. $y = \sin\left(\pi x + \frac{\pi}{2}\right) + 3$

Press here to see how you did



1.

2.

3.

4.

5.

| | | | | | | | | | | | |
|---|---|---|---------------------------|-------------------|-------------------|--------|--------|------------------|---------------------------|-------|-----|
| ← | → | ↶ | ↷ | ✖ | | | | | | | |
| 1 | 2 | 3 | x | y | | | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^\square | \square_\square | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π | i |
| | | | sin | cos | tan | arcsin | arccos | arctan | | | |



Algebra 1 Retakes

NGSSS Algebra 1 Retake

FSA Algebra 1 Retake

Algebra 1 (NGSSS) Retake

NGSSS EOC Test Materials (CBT)

| Assessment | All Students |
|-------------------|--|
| Algebra 1 (NGSSS) | Testing platform – TestNav 8 Practice test - ePAT Four-Function Calculator (online or handheld) Reference Sheet |

<http://www.fldoe.org/accountability/assessments/k-12-student-assessment/end-of-course-eoc-assessments>

<http://www.fsassessments.org/resources/>

Spring FSA Algebra 1 RETAKE

- The department has added a retake-only administration of the FSA Algebra 1 EOC assessment in the spring.
- Students who need to retake FSA Algebra 1 OR graduating seniors who need to pass the assessment will participate in this administration (March 27–April 7).
- Results will be reported on an accelerated timeline.
- First-time test takers participate in the FSA Algebra 1, Geometry, and Algebra 2 administration (April 17–May 12).
- Students may not participate in both spring FSA Algebra 1 EOC administrations.

<http://www.fsassessments.org/resources/>

Spring FSA Algebra 1 RETAKE

- Schools must take care to administer the CORRECT Algebra 1 RETAKE assessment to students (NGSSS or FSA)
- NGSSS Retakers should all be adult students in 2016–17
- Students who need to retake the FSA Algebra 1 EOC assessment in the Fall, Winter, or Summer, participate in the regular FSA Algebra 1 EOC administration (there is no “retake” test in TIDE or TDS for these administrations).

<http://www.fsassessments.org/resources/>

FSA Algebra 1

| | Fall EOC (9/12–23) | Winter EOC (11/28– 12/16) | Spring Algebra 1 Retake (3/27 – 4/7) | Spring EOC (4/17–5/12) | Summer EOC (7/10–21) |
|---------------------------|-----------------------|---------------------------------|---|---------------------------|-------------------------|
| First-Time Test Takers | X | X | | X | X |
| Retakers | X | X | X | | X |

<http://www.fsassessments.org/resources/>



FSA Concordant Scores

FSA Concordant and Comparative Scores

- Currently, students who need to satisfy their graduation requirement for the Grade 10 FSA ELA or the FSA Algebra 1 EOC Assessment are eligible to use the following concordant and comparative scores:
 - Grade 10 FSA ELA students may use the FCAT 2.0 Reading passing score on either the ACT or SAT
 - FSA Algebra 1 EOC students may use the NGSSS Algebra 1 EOC passing score on PERT
- Per s. 1008.22(8), F.S., these concordant and comparative will remain in effect until such time as new scores are adopted.

<http://www.fsassessments.org/resources/>

FSA Concordant/Comparative Scores (cont.)

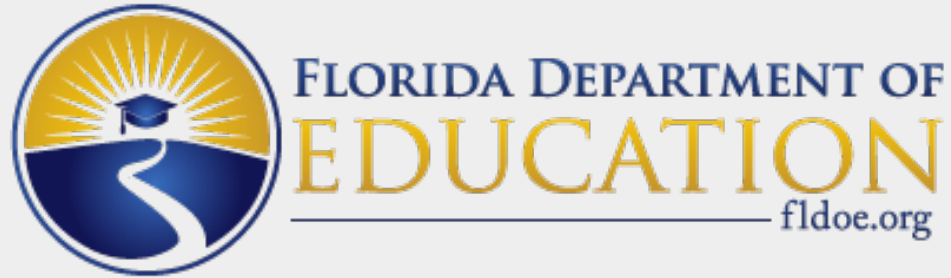
- This fall, FDOE will begin conducting a new alignment study to determine new concordant ACT and SAT scores for FSA Grade 10 ELA and a new comparative PERT score for the FSA Algebra 1 EOC.
- The study will also consider whether it would be appropriate to use the PSAT and/or NMSQT to satisfy the Grade 10 ELA graduation requirement.
- Once new concordant and comparative scores have been adopted, they will apply to all students who have the respective FSA assessments as part of their graduation requirements.

<http://www.fsassessments.org/resources/>

FSA Concordant/Comparative Scores (cont.)


- The tentative timeline for the alignment study is as follows:
 - Alignment study work begins in Winter 2016/early 2017
 - Concordant and comparative score recommendations made to the State Board of Education for approval in Spring/Summer 2017
 - New concordant and comparative scores would become effective beginning with fall 2017 FSA tests.

<http://www.fsassessments.org/resources/>



Functionality of Technology-Enhanced Items

Online tools for students

| Test Tool | Category | Location | Description |
|--|-----------|--------------|--|
| Notes  | Subject | Global Menu | Open an on-screen notepad and take notes. This tool is available for FSA ELA Reading and Writing. |
| Strikethrough | Universal | Context Menu | Cross out answer options for multiple-choice/selected-response and multi-select items. |
| Student Comments | Subject | Context menu | Students can open an on-screen notepad for any item they would like to take notes on. This tool is available on FSA Mathematics and EOC assessments. |
| System Settings | Universal | Global Menu | Adjust audio (volume) during the test. |
| Tutorial | Universal | Context Menu | View a short video about each item type and how to respond. |
| Zoom In | Universal | Global Menu | Enlarge the font and images in the test. Four levels of zoom are available. |
| Zoom Out | Universal | Global Menu | Undo the zooming and shrink the font and images in the test back to original levels. Four levels of zoom are available. |

- **Equation**
- **Selectable Hot Text**
- **Drag and Drop Hot Text**
- **Open Response**
- **Matching Items**
- **Table**
- **Editing Task Choice**
- **Editing Task**
- **GRID (Graphic Response Item Display)**

Equation Items

- Equivalent fractions and decimals will be accepted except in items that are assessing a standard where a certain form is the expectation of the standard.
- A zero in the ones place for answers that fall between -1 and 1 (excluding 0 itself) is not required.
- Students can type in an answer using a mixed number or a fraction greater than one.

Equation Items

Equivalent algebraic expressions may be accepted except in items that are assessing a standard where a certain form is the expectation of the standard. Students should read the directive carefully.

Equivalent Forms

If an item requires the student to write an equation the student will not be restricted to give that equation in a certain form unless a form is required by the standard such as items that require the student to complete the square.

If the correct answer to an item is $y = 3x - 8$ then here are some of the possible student responses.

$$y = 3x - 8$$

$$y - 3x = -8$$

$$-3x + y = -8$$

$$y - 1 = 3(x - 3)$$

← → ↶ ↷ ✕

| | | | | | | | | | |
|---|---|---|---------------------------|-------------------|-----|---|------------------|---------------------------|-------|
| 1 | 2 | 3 | x | y | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^\square | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π |

Equation Items

Chantel drew a picture of her dog on a piece of paper that is 12 centimeters long. She used a copy machine to enlarge her drawing. She used the 115% setting to make each new copy. She then used each new copy to generate the next copy, using the same copier setting.

Enter a recursive formula that will give the length of each new copy.

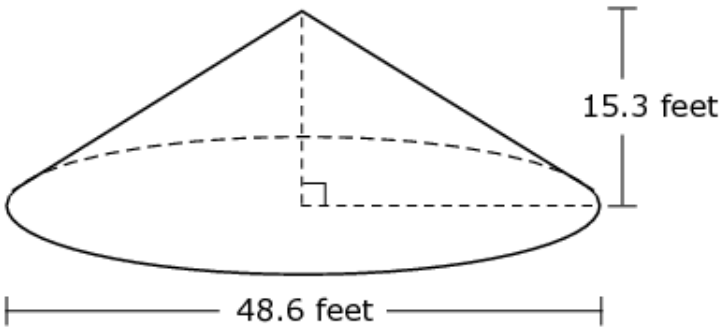
$a_1 =$

$a_n =$

Two parts does not mean the item is worth two points

| | | | | | | | | | | | |
|-----------|---|---|---------------------------|-------------------|-------------------|-----|---|------------------|---------------------------|-------|--|
| ← → ↶ ↷ ✕ | | | | | | | | | | | |
| 1 | 2 | 3 | n | a | | | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^\square | \square_\square | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π | |

As phosphate is mined, it moves along a conveyor belt, falling off of the end of the belt into the shape of a right circular cone, as shown.



A shorter conveyor belt also has phosphate falling off of the end into the shape of a right circular cone. The height of the second pile of phosphate is 3.6 feet shorter than the height of the first. The volume of both piles is the same.

To the nearest tenth of a foot, what is the diameter of the second pile of phosphate?

Students should round to the nearest tenth as their last step.

Students should not round midstep.

In items where students have to use π to find a value, if the item is not specific about what value of π to use, the student can use the exact value, 3.14 or $22/7$. All of these will be scored as correct.

Equation Items

4



A salesperson earns \$125 a day, plus a commission of 5% of the price of each item she sells. The salesperson sold one item yesterday that was \$750.

Create an equation that can be used to determine the amount of money the salesperson earned yesterday.

$y =$ Equation response field



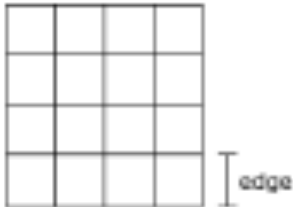
Navigation buttons

| | | | | | | | | | | |
|---|---|---|---------------------------|-------------------|-------------------|-----|---|------------------|---------------------------|-------|
| 1 | 2 | 3 | x | y | | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^\square | \square_\square | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π |

Special symbols
(fraction, exponent, square root, etc.)

Hot Text - Selectable

Mike creates a design for a square kitchen floor. Each tile measures 1 foot square. An example of the design is shown.



Mike found that the expression $4n + 2n^2 - 2n$ would give the total number of edges for a design of any size, where n is the length, in feet, of one side of the design.

Select an expression and an explanation to match the meaning of the value the expression represents.

| Expression | Explanation |
|-------------|--|
| n | Area of the design |
| $2n$ | Perimeter of the design |
| $2n^2 - 2n$ | Number of edges in one row of the design |
| $4n + 2n^2$ | Number of edges inside the design |

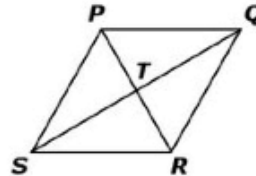
When a student selects an expression it highlights.

Hot Text Items – Drag-and-Drop

A proof with some missing statements and reasons is shown.

Given: $PQRS$ is a
parallelogram.
 $\overline{PQ} \cong \overline{QR}$

Prove: $PQRS$ is a rhombus.



| Statement | Reason |
|--|---|
| 1. | 1. Given |
| 2. | 2. Given |
| 3. $\overline{PQ} \cong \overline{SR}$ and $\overline{PS} \cong \overline{QR}$ | 3. Opposite sides of a parallelogram are congruent. |
| 4. | 4. |
| 5. $\overline{PQ} \cong \overline{QR} \cong \overline{RS} \cong \overline{SP}$ | 5. |
| 6. $PQRS$ is a rhombus. | 6. |

Drag the correct statement from the statements column and the correct reason from the reasons column to the table to complete line 3 of the proof.

| Statements | Reasons |
|---|---|
| | Diagonals of a parallelogram bisect each other. |
| $\overline{PT} \cong \overline{TR}$ and $\overline{ST} \cong \overline{TQ}$ | Opposite angles of a parallelogram are congruent. |
| $\triangle PTQ \cong \triangle QTR$ | |
| $\angle SPQ \cong \angle QRS$ | Side-Side-Side |

Open-Response Items

Kyle defines a circle as “the set of all the points equidistant from a given point.”

Explain why Kyle’s definition is not precise enough.

Type your answer in the space provided.

Students should not use mathematical symbols in an open response. For example, $f(x)$ is not understood by the scoring engine.

Matching Items

Match each complex expression with its value.

| | 3 | $-4i$ | $5 + 5i$ |
|---|--------------------------|--------------------------|----------------------------|
| $3i(i + 2i^3)$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| $2i + i^2(5i^2 - 3i)$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| $i^2(3i^2 + 1) + 1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



Table Items

The table below shows the values for the function $y = f(x)$.

| x | y |
|-----|-----|
| -4 | 7 |
| -1 | -2 |
| 0 | 3 |
| 3 | -4 |
| 6 | 5 |

Complete the table for the function $y = f\left(\frac{1}{5}x\right)$.

| x | y |
|-----|-----|
| | |
| | |
| | |
| | |
| | |
| | |

Editing Task Choice Items

Johnny wants to find the equation of a circle with center $(3, -4)$ and a radius of 7. He uses the argument shown.

There are three highlights in the argument to show missing words or phrases. For each highlight, click on the word or phrase that correctly fills in the blank.

Johnny's Argument

Let (x, y) be any point on the circle. Then, the horizontal distance from (x, y) to the center is ? . The vertical distance from (x, y) to the center is ? . The total distance from (x, y) to the center is the radius of the circle, 7. The ? can now be used to create an equation that shows the relationship between the horizontal, vertical, and total distance of (x, y) to the center of the circle.

Editing Task Choice items

A librarian in a large city collects data about his summer reading program. He collects data for two years, 2011 and 2012, on how many books are read each week. His ordered data sets are shown.

| 2011 | 2012 |
|--------|--------|
| 44,126 | 35,001 |
| 44,901 | 41,534 |
| 55,080 | 68,550 |
| 58,546 | 75,534 |
| 79,984 | 76,617 |
| 99,860 | 84,834 |

The librarian writes a summary about his data, as shown.

Click on each blank and select the appropriate word or phrase to complete the librarian's summary.

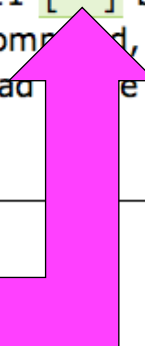
If you compare the means, it appears that in 2011 [] books were read on average than in 2012. When the medians for the two years are compared, the data show that in 2011 [] books were read than in 2012. As far as the spread of the data, both data sets have the same [].

Replace "[]" with:

approximately 71 fewer

OK

Cancel



Editing Task Choice items

There are two highlights in the paragraph to show which word or phrase may be incorrect. For each highlight, click the word or phrase that is correct.

Ethan was solving $2.71x^3 + 8.64 = 3.12$. Ethan's first step resulted in $2.71x^3 = -5.52$ because he applied the **addition property of equality**. Ethan should then **use the multiplicative property of equality**.



Replace "addition property of equality" with:

- ✓ addition property of equality
- substitution property
- multiplicative property of equality

GRID Item with Action Buttons

Margaret uses a figure to prove the polynomial identity of $a^2 - b^2$.

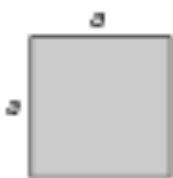


Figure 1



Figure 2

Drag expressions to the figure to complete the visual proof.

a

b

(ab)

$(a - b)$

$(a + b)$

Delete


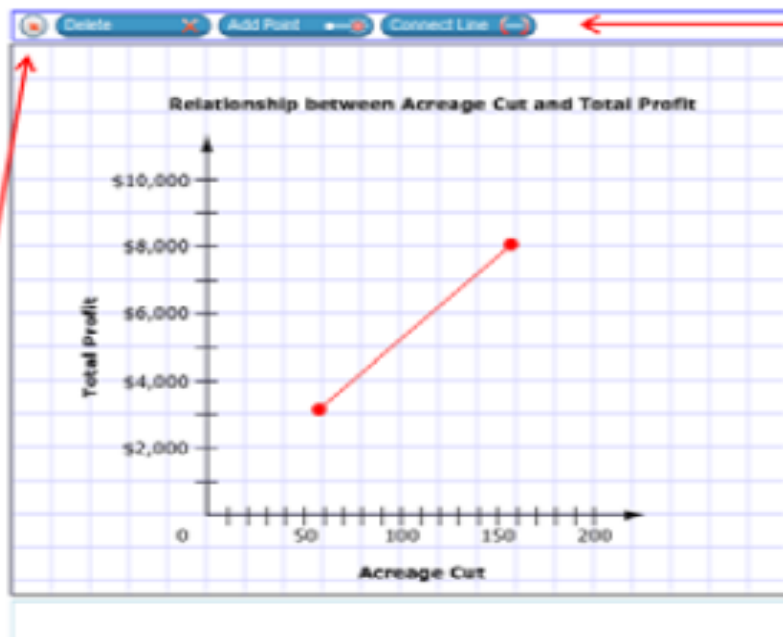


Figure 3

GRID Item with Action Buttons

12

Using the information from the table, show the correct economic relationship between the acreage cut and total profit from 0 to 200 acres.



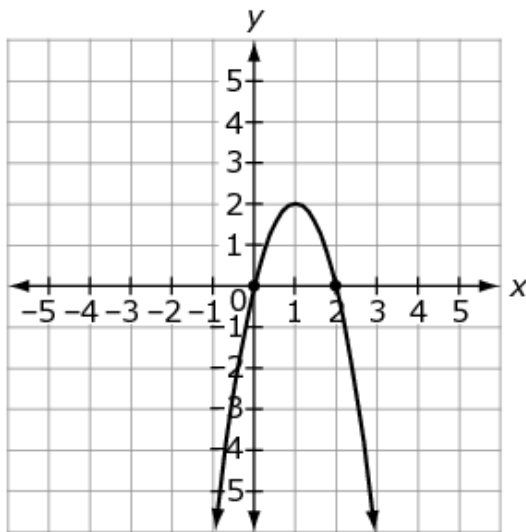
action buttons

points and line added to graph

Click the arrow button if you do not want to add an extra point or line by accident.

GRID Item

A quadratic function $f(x)$ is shown.



Select symbols and values to restrict the domain of $f(x)$ so that $f^{-1}(x)$, the inverse of $f(x)$, is a function and the domain of $f^{-1}(x)$ includes $x = 2$.

| | | | | | | |
|---|---|---|---|---|---|---|
| | ○ | □ | | ○ | □ | |
| (| + | 0 1 2 3 4 5 6 7 8 9 ∞ | , | + | 0 1 2 3 4 5 6 7 8 9 ∞ |) |
| [| - | | - |] | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

GRID Item

A company manufactures heating cable. The cable sells for \$4.50 per foot. The cost, in dollars, of producing the heating cable is $3\sqrt{x}$, where x is the length of the heating cable, in feet. The company makes a profit of \$1053 on each spool of heating cable.

Drag expressions to the boxes and symbols to the circles to create an equation that can be used to find how many feet of heating cable are on each spool.

234
Delete

1053

4.5x

234x

1053x

$3\sqrt{x}$

$3x\sqrt{x}$

$13.5\sqrt{x}$

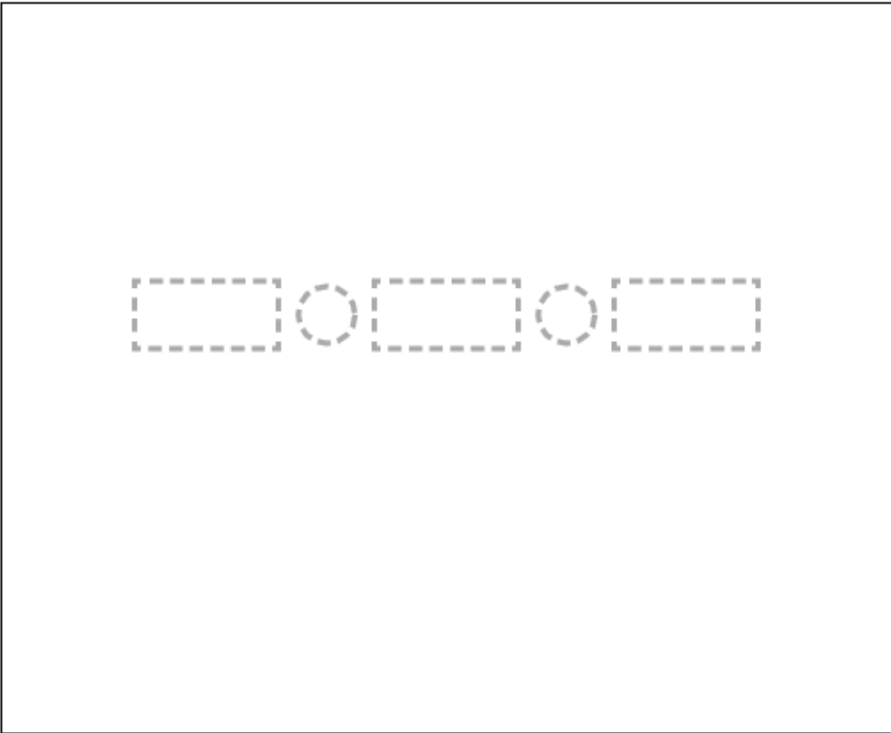
+

-

•

÷

=



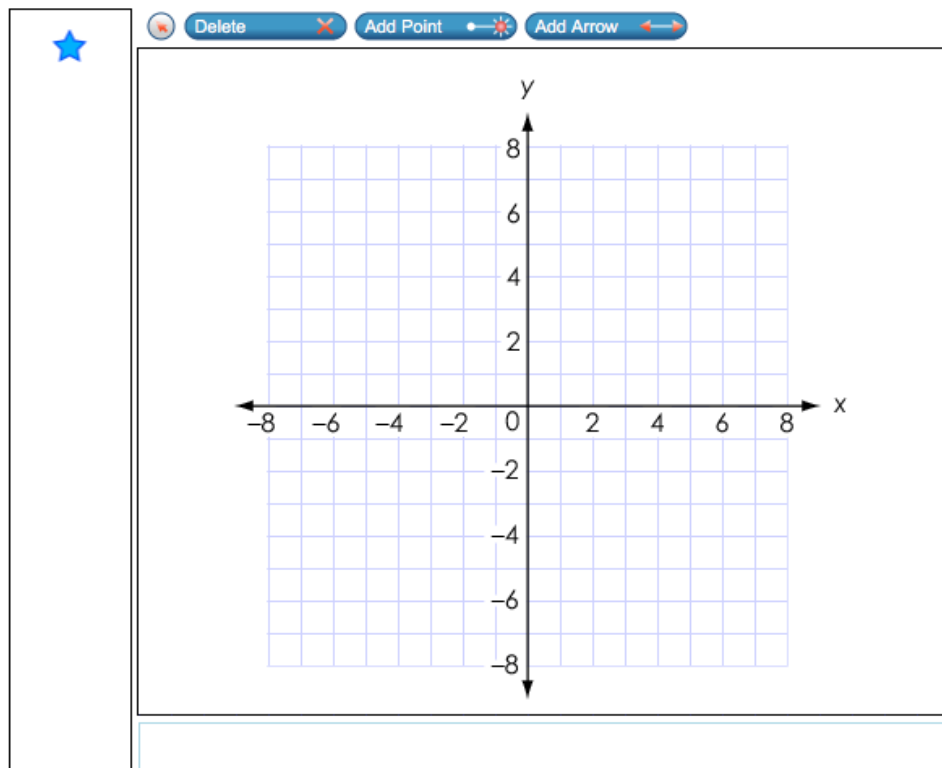
GRID Item

A system of inequalities is shown.

$$y \geq 5$$

$$y \leq \frac{2}{3}x + 3$$

- A. Use the Add Arrow tool to graph the boundary lines of the system.
- B. Place a star on the coordinate plane to show one solution to the system.



Do students understand what constitutes a solution to a system of inequalities?



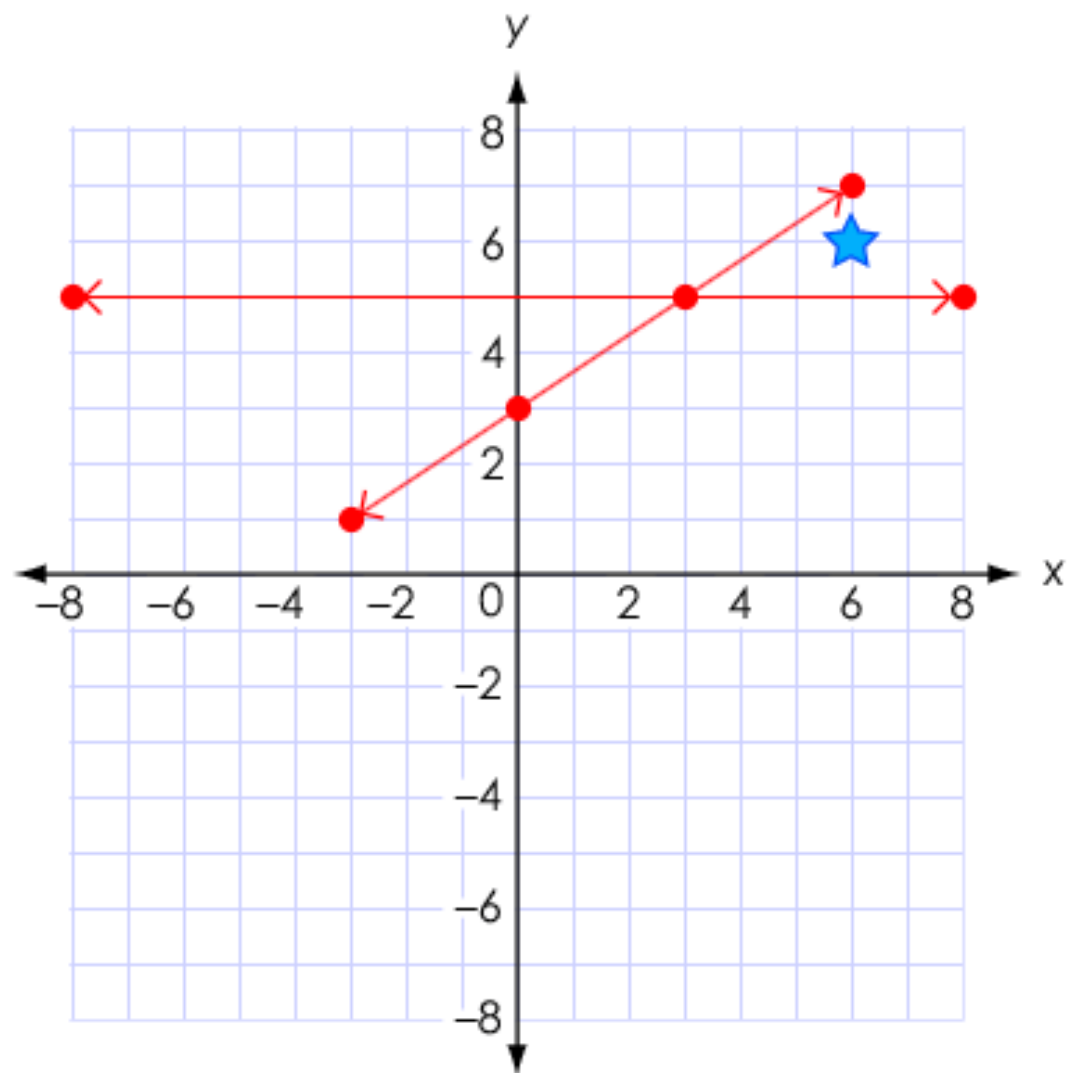
Delete



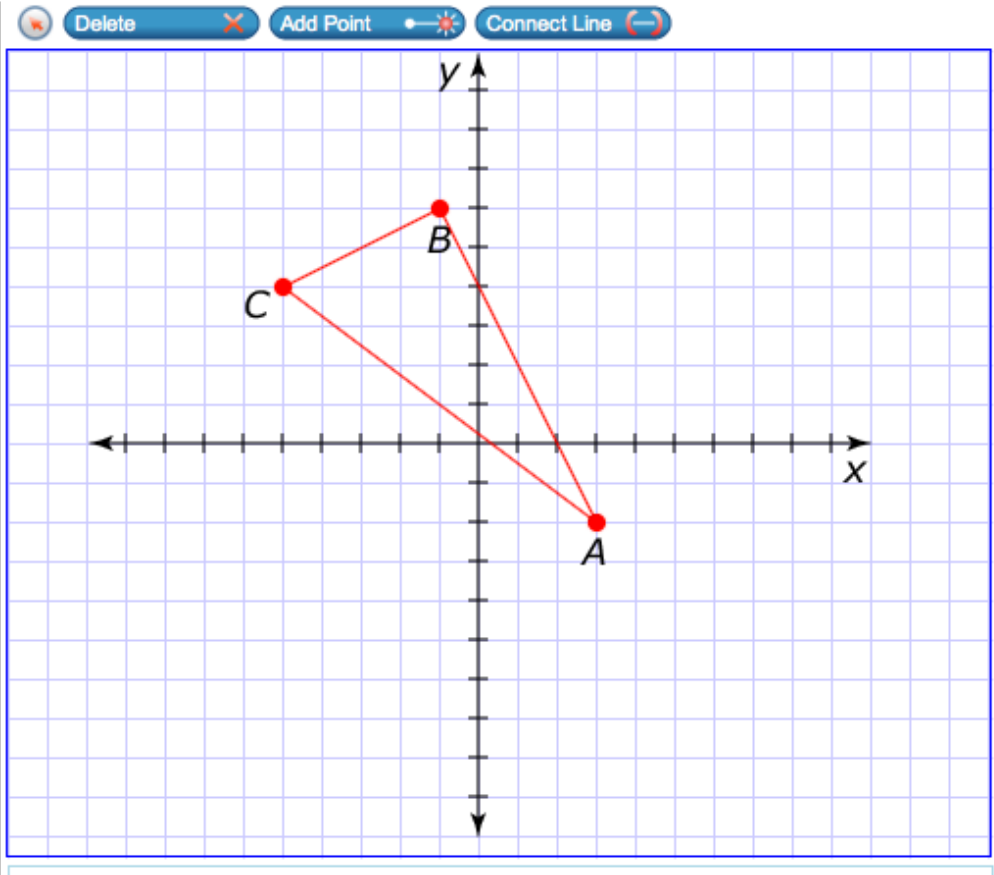
Add Point



Add Arrow



Items could combine more than one item type.



Calculator interface showing a toolbar with navigation and editing icons, and a grid of mathematical functions and operators.

| | | | | | | | | | | | |
|-----|---|-----|---------------------------|-------------------|-------------------|--------|---|------------------|---------------------------|-------|-----|
| ← | → | ↶ | ↷ | ✖ | | | | | | | |
| 1 | 2 | 3 | x | $g(x)$ | | | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^\square | \square_\square | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π | i |
| sin | | cos | tan | arcsin | arccos | arctan | | | | | |



Algebra 1 Lessons Learned

Algebra 1 EOC

Students are doing well on the following standards

- **S-ID.2.6 a and S-ID.2.6 c** – modeling linear functions given data and interpreting the slope and y-intercept (Students appear to be struggling with **S-ID.2.6 b**)
- **F-IF.2.4** – interpreting key features of graphs and tables
- **F-IF.1.1** – understanding a function
- **F-IF.1.2** – evaluating functions

Writing equations and functions given a real-world context

A-CED.1.1

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions.

A-CED.1.2

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

F-LE.1.2

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (including reading these from a table).

F-BF.1.1a

Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

The population of rabbits on a large island doubles every year. On January 1, the population is 150 rabbits.

Which equation can be used to find the number of years, x , it will take for the population to reach 4,800?

Ⓐ $4,800 = 2x + 150$

Ⓑ $4,800 = 2 \cdot 150^x$

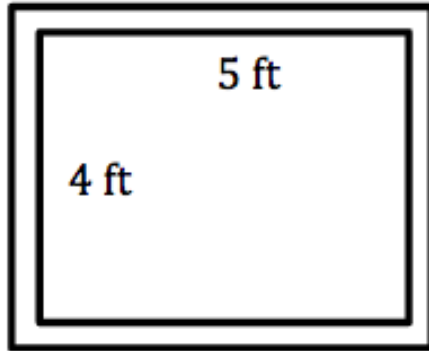
Ⓒ $4,800 = 2^x + 150$

Ⓓ $4,800 = 150 \cdot 2^x$

Equation

Suggestion: Using the same scenario ask students to write an equation that can be used to solve (CED.1.1), an equation using two variables (CED.1.2) or to write a function (LE.1.2 or BF.1.1a).

Regina has started making baby quilts to sell at a craft fair. The inside of each quilt will measure four feet by five feet and will be surrounded by a border of uniform width. She wants each quilt to have a total area (including the border) of 30 square feet.



Write and solve an equation to find the width of the border. Show your work and define any variable(s) used.

Suggestion: Also ask students to write an equation for the perimeter of the quilt.

http://www.cpalms.org/uploads/resources/70667/MFAS_Quilts_Worksheet.pdf

The water company that serves St. George Island charges a base facility fee of \$32.00 each month. In addition, they charge \$6.53 per kilogallon (1000 gallons) of water used. Write a function that can be used to calculate the monthly charge for water service when x kilogallons of water are used. Explain your work.

Suggestion: Provide students with contexts where the student has to recognize that the rate is a negative.

http://www.cpalms.org/uploads/Resources/final/60540/Document/32839/MFAS_TheCostOfWater_Worksheet.pdf

Suppose you bought an antique desk for \$650. Each year the value of the desk increases by 5%. Write an exponential function that models the value, V , after t years.

Suggestion: Provide students with contexts where the student has to recognize that the function would be exponential decay.

http://www.cpalms.org/uploads/resources/59826/MFAS_WritingAnExponentialFunctionFromADescription_Worksheet.pdf

At some moment in time, a culture of Bacteria A contains 100 bacteria. After two hours, there are 300 bacteria, and after 4 hours, 900 bacteria are found. It continues to grow at this rate as long as conditions are favorable. In the same environment, 900 nonreproducing bacteria of another type (Bacteria B) are found.

1. Write a function describing the number of Bacteria A in the culture after t hours. Use function notation and show your work in the space below.
2. Write a function to describe the total number of bacteria (Bacteria A and Bacteria B) in the culture after t hours. Use function notation and show your work in the space below.

This MFAS task requires the student to consider an exponential function and a constant function from a context. Requiring students to think about what rate means for exponential functions versus rate for linear functions will help students with the LE standards. This item requires the student to recognize that nonreproducing means there is no rate.

According to Wikipedia, the International Basketball Federation (FIBA) requires that a basketball bounce to a height of 1300 mm when dropped from a height of 1800 mm.

a. Suppose you drop a basketball and the ratio of each rebound height to the previous rebound height is 1300:1800. Let h be the function that assigns to n the rebound height of the ball (in mm) on the n^{th} bounce. Complete the chart below, rounding to the nearest mm.

| n | $h(n)$ |
|-----|--------|
| 0 | |
| 1 | |
| 2 | |
| 3 | |

Suggestion: Have students create exponential functions from real-world contexts where a table of values are provided or where the context is described verbally.

b. Write an expression for $h(n)$.

c. Solve an equation to determine on which bounce the basketball will first have a height of less than 100 mm.

F-IF.1.3

Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.



Clarification: Students will write a recursive definition for a sequence that is presented as a sequence, a graph, or a table.

F-BF.1.1a

Write a function that describes a relationship between two quantities.

- Determine an explicit expression, a recursive process, or steps for calculation from a context.

S is an example of a sequence defined recursively.

$$S(1) = 27$$

$$S(n) = S(n - 1) - 5 \text{ for all } n \geq 2$$

1. Write out the first five terms of this sequence by completing the table.

| n | 1 | 2 | 3 | 4 | 5 |
|--------|---|---|---|---|---|
| $S(n)$ | | | | | |

2. Explain why this sequence is a function.

Students struggle with knowing that recursive definitions have two parts. This task may provide a good classroom discussion on the difference between a recursive definition and an arithmetic sequence.

The first five terms of a sequence are shown.

4, 12, 36, 108, 324, ...

Write an explicit function to model the value of the n th term in the sequence such that $f(1) = 4$.

$f(n) =$

| | | | | | | | | | | | |
|-----|---|-----|---------------------------|---------------------|---------------------|--------|---|------------------|---------------------------|-------|-----|
| ← | → | ↶ | ↷ | ✕ | | | | | | | |
| 1 | 2 | 3 | n | | | | | | | | |
| 4 | 5 | 6 | + | - | • | ÷ | | | | | |
| 7 | 8 | 9 | < | ≤ | = | ≥ | > | | | | |
| 0 | . | - | $\frac{\square}{\square}$ | \square^{\square} | \square_{\square} | () | | $\sqrt{\square}$ | $\sqrt[\square]{\square}$ | π | i |
| sin | | cos | tan | arcsin | arccos | arctan | | | | | |

Make connections between exponential equations, functions, geometric sequences and recursive functions. Use both mathematical and real-world contexts and address the difference in the domain of these equations and functions (IF.1.3).

A-REI.3.5

Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

The system $\begin{cases} Px + Qy = R \\ Fx + Gy = H \end{cases}$ has the solution $(3, -1)$, where $F, G, H, P, Q,$ and R are nonzero real numbers.

Select all the systems that are also guaranteed to have the solution $(3, -1)$.

- $\begin{cases} (P + F)x + (Q + G)y = R + H \\ Fx + Gy = H \end{cases}$
- $\begin{cases} (P + F)x + Qy = R + H \\ Fx + (G + Q)y = H \end{cases}$
- $\begin{cases} Px + Qy = R \\ (3P + F)x + (3Q + G)y = 3H + R \end{cases}$
- $\begin{cases} Px + Qy = R \\ (F - 2P)x + (G - 2Q)y = H - 2R \end{cases}$
- $\begin{cases} Px + Qy = R \\ 5Fx + 5Gy = 5H \end{cases}$

S-ID.2.6

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
b. Informally assess the fit of a function by plotting and analyzing residuals.

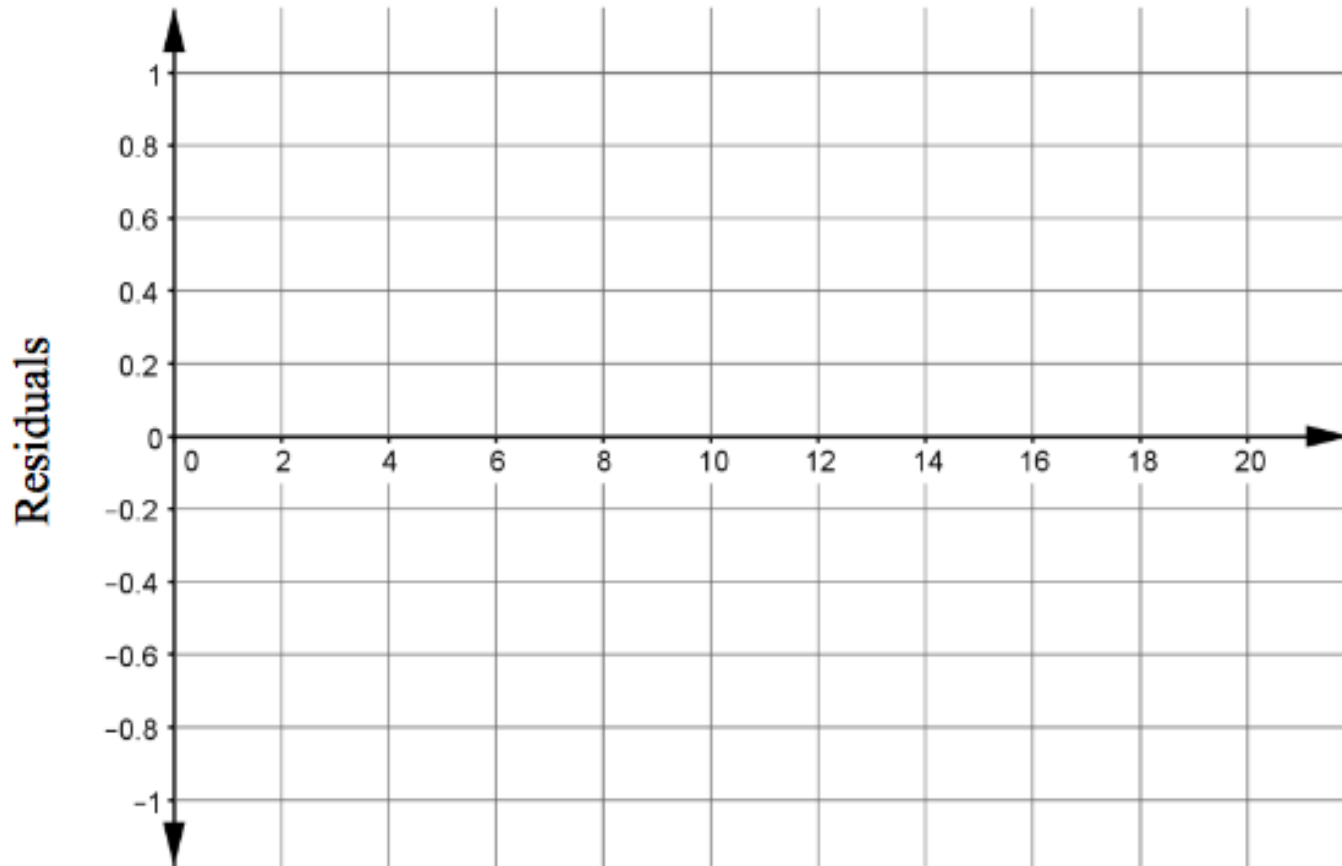
A researcher collected data on two variables, A and B, from five subjects as shown in the table. The researcher calculated the equation of a line of fit as $b = 18.0 - 1.34a$.

| Subject | A | B | C | D | E |
|---------------------------|----|----|----|---|----|
| $a =$ value of variable A | 2 | 4 | 5 | 8 | 10 |
| $b =$ value of variable B | 16 | 12 | 11 | 7 | 5 |
| Predicted Values | | | | | |
| Residuals | | | | | |

1. Use the linear model to calculate a predicted value and the residual for each subject. Record each value in the table above.

Suggestion: Help students understand there is a difference between the graph of the line and a residual plot.

2. Create a residual plot by graphing the residuals below. The horizontal axis is the a -axis.



Suggestion: Help students understand the characteristics of a good residual plot.

3. What does your residual plot indicate about the fit of the equation?



N-RN.1.1

Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

N-RN.1.2

Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Write an equivalent expression without using a radical.

$$\sqrt[3]{7x^5y}$$

$$(7x^5y)^{\frac{1}{3}}$$

$$7^{\frac{1}{3}}x^{\frac{5}{3}}y^{\frac{1}{3}}$$

F-IF.3.8b

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions.

The function shown give the value of a piece of equipment for each quarter of a year after the equipment was bought.

$$f(t) = 142(1 - 0.32)^{\frac{t}{4}}$$

To the nearest hundredth, which function is equivalent to $f(t)$?

$$g(t) = 142\left((1 - 0.32)^{\frac{1}{4}}\right)^t$$

$$g(t) = 142(0.91)^t$$



Contact Information

www.FLDOE.org

Mathematics Contact Information

- Travis Barton, Content Specialist, Grades 3-5
 - travis.barton@fldoe.org
 - (850) 922–2584 Ext. 2242
- Sarah Devereaux, Content Specialist, Grades 6-8
 - sarah.devereaux@fldoe.org
 - (850) 922-2584 Ext. 2249
- Terri Sebring, Content Specialist, Algebra 1, Geometry & Algebra 2
 - terri.sebring@fldoe.org
 - (850) 922-2584 Ext. 2226

Other TDC Contact Information

- Sally Rhodes, English Language Arts Coordinator
 - sally.rhodes@fldoe.org
 - (850) 922–2584 Ext. 2228
- Stacy Skinner, Social Studies Coordinator
 - stacy.skinner@fldoe.org
 - (850) 922–2584 Ext. 2250

Steve Ash

Executive Director

Test Development Center

steve.ash@fldoe.org

(850) 922-2584

Ext. 2225



www.FLDOE.org



www.FLDOE.org