Checkpoint Results Interpretation Guide

Algebra I

Tennessee Department of Education | August 2020

The Checkpoint

The Checkpoint can be used at the beginning of the school year to measure retention on **key standard-aligned skills that are most essential** for students to be able to **access, and engage in, on-grade-level content** for the current year. Because of this, the Checkpoints are smaller than a summative TCAP assessment and do not cover all the standards from the previous year. Instead, as recommended by experts[1], they focus on fewer, **prioritized vertically-aligned standards**, with the intent of providing educators more meaningful and actionable information about student needs so you can support your students' ability to access grade-level learning throughout the year.

The Algebra I Math Checkpoint should be given to students who completed Algebra I in 2019-20 to help plan for students learning advanced math content (such as Algebra II or Geometry) this year.

To help students in their learning and teachers with their planning, Checkpoints come with fully **annotated questions** that help to understand trends and pinpoint misconceptions that may inhibit student progress. ***Using this Checkpoint Results Interpretation Guide (the Guide) and your student results data found in the Schoolnet platform, you and your students can plan for great academic success this year.***

It is best to use these results to identify any needed pre-requisite learning and incorporate it throughout the year to ensure students can access grade-level content or can build upon their current strengths. After you administer the Checkpoint and use this Guide to better meet student needs at the beginning of the year, **continue monitoring** your students' progress on **grade-appropriate assignments** for the rest of the year to ensure that these core foundations are continually strengthened.

The Checkpoint IS:

- an investigative tool to determine student readiness for the major work of the current grade
- aligned to the Tennessee State Academic Standards, using TN-educator reviewed questions from previous TCAP exams
- designed to identify student misconceptions and learning needs
- providing actionable next steps for informing instructional decisions

The Checkpoint IS NOT:

- a replacement for the performance level determinaions a student would have received on the TCAP assessment
- predictive of, or comparable to, summative TCAP results
- a replacement for RTI[2] diagnostics or universal screeners
- used to evaluate teacher, school, or district performance
- a tool to change student placement decisions (e.g. retake a course, advance to honors)

[1] https://tntp.org/assets/covid-19-toolkit-resources/TNTP_Learning_Acceleration_Guide.pdf

Contents of this Guide

"When the COVID-19 pandemic forced prolonged school building closures and canceled spring assessments, it became even more important that districts and schools can reliably gather student data and understand student readiness for the next school year. These free and optional tools are one way the department can support the needs of our district partners in serving all students"

-Commissioner Penny Schwinn

Checkpoint Design

The Checkpoint assessments were designed using **real TCAP questions** from previous summative exams. This ensured each question was aligned to Tennessee state standards and had been reviewed by **Tennessee educators**. The Checkpoint was designed to be quick to access and administer, not requiring complicated adjustments to existing school schedules; with **flexibility for online or paper administration** based on school/district need.

The Math Checkpoint assessments:

1. **are quick easy to administer**: contain two subparts (separated by a section break and new instructions screen) in one short (less than 30 questions) assessment in Schoolnet
2. **include prioritized content:** standards, concepts, and skills from the designated grade-level/course that are considered essential pre-requisite content for accessing the next grade-level's work

Less than 60 minutes

Less than 30 questions

Two subparts: Calculator & Non-Calculator

Interpreting and Using Results

Automatic Reporting in Schoolnet

In order to support teachers in using these assessments, students who take the assessment online in the Schoolnet platform will have their Checkpoints scored automatically. Teachers have multiple scoring options for students who take the Checkpoints on paper, and you can find how-to documents and videos at https://tn.mypearsonsupport.com/schoolnet/. **Checkpoint assessment scoring in Schoolnet requires all answers to be submitted by the student for results to be produced.** The following automated reports can be found in Schoolnet:

- Individual student results
- Classroom level reports
- Standards analysis reports
- Item analysis
- Test comparison reports (e.g., student, class, school, district, and state)
- Shared reporting (e.g., district to school admin, school admin to educators in same content/grade-level)
- Aggregate and disaggregation of demographics

Overall Scores

The score groups on the checkpoint assessment are ***not* meant to represent performance levels or the blueprints of the TCAP summative assessments** (e.g., below, approaching, on track, and mastered). The score groups were designed to **share student preparedness for next grade level content** and provide guidance around the **level of support** students may need to access that content.

Score Group	% Correct	Results	Recommended Next Steps
Orange	**0 – 55%**	**Likely Needs More Targeted Support**	Use other sources of data for deeper insight; use identified misconceptions to offer targeted re-teaching, plan differentiation and intervention as needed as grade-level concepts are introduced.
Yellow	**56 – 73%**	**Likely Able to Engage in Grade Level Content with Some Support**	Investigate trends in student responses using the most important errors, to support differentiation on grade-level assignments and scaffolding when introducing new content; provide opportunities to check for understanding throughout the lesson to determine differentiation needs.
Green	**74 – 99%**	**Likely Ready for Grade Level Content**	Move directly into grade-level content.
Blue	**100%**	**Ready for Grade Level Content**	

Overall scoring is automatically available in the Schoolnet platform. This may help with you use the results of the student and class level reports to develop an overall summary and conclusion about your students' readiness for grade-level content. In responding to the Checkpoint assessments, we recommend addressing the learning needs of students **while engaging with on grade-level content**. For more information and tools for using assessment data to drive instructional decision making, review the Assessing Learning Toolkit, pages 18-21, and the Learning Loss PLC Guide.

While overall scoring is provided and can be helpful in planning for group instruction, the most actionable information in these Checkpoints can be found by analyzing at the question-level results.

Actionable Insights: Annotated Questions and Reporting Tools

Each question on the Checkpoint is fully annotated with information that describes the questions as they were used on previous TCAP tests, and automated scoring tools in Schoolnet that make getting that information easier. The most helpful and actionable information is in the **Item Annotations in this Guide** when combined with the **Item Analysis reports in Schoolnet**.

When we need more time *in the school year, the best way to get it is to spend less time on things they've already mastered and more time on the specific gaps that students need.*

Answer Choice Rationales in each Question Annotation

It is possible that we have multiple students who may not have mastered some of the foundational content required to fully engage in this year's content. We are most effective at addressing these needs when we can pinpoint, as specifically as possible, the conceptual understanding that would most efficiently close this gap. That way we spend less time on previous content by focusing just on the piece that they need to be successful with this concept during the year. The Question Annotations are designed to help with that process.

To help teachers be more efficient in planning for the year, each question on the Checkpoint is accompanied by a set of answer choice rationales **which offers an explanation for each choice**. These annotations are not definitive: we know there may be many reasons for why students might select different answer choices. However, each rationale listed provides an explanation for why students may have selected a given answer choice, including what mis-steps may have caused them to select an incorrect answer (a "distractor"). These distractor rationales provide an instructional target to improve student understanding by breaking down and diagnosing the likely conceptual mistake, allowing you to **follow up with targeted instruction based on the most common mathematical errors you identify** for your specific group of students. These annotations assume that students tried their best and cannot provide information about whether students selected an option at random.

Item Annotations and Planning for Instruction

The department recommends in using this guide that educators look for trends in incorrect answers using the Item Analysis reporting on Schoolnet and then use the annotations using this process:

1. Find the highest-leverage error trend.
    A. This can mean comparing the frequency of each student error or understanding the group of students represented by that trend.
2. Unpack the conceptual misunderstanding that led to the most important error, and then use the annotations to support analyzing the incorrect answer by thinking through these questions in order:
    A. What DO these students understand?
    B. Based on what students do understand, why might a student think their error was a reasonable choice?
    C. What specific concept, if they had understood it clearly, would have made them recognize that the error was not a reasonable approach?
3. Put it all together to check your thinking by restating the answers to each of the three questions to articulate this sentence stem:

"Students understood [question A] but made the error of [student error], because they thought [question B] made sense. If they had understood [question C], they would have avoided the error."

This practice of pinpointing misconceptions and target understandings can help with long term planning to support students in accessing year-long content and making the most of the start of year Checkpoint.

Sample Set of Rationales

Rationales	
Incorrect – 1	Students choosing this answer likely skipped a step in multiplying (7×10). Students choosing this answer may need additional support in setting up the multiplication algorithm and tracking that they multiply each multiplicand by the multiplier.
Incorrect – 2	Students choosing this answer likely skipped multiplying 7 by the tens place, instead adding the regrouped 30 to the ten in the multiplicand. Students choosing this answer may need additional support in multiplying with regrouping.
Correct – 3	This problem requires students to understand the process involved to multiply a whole number of four digits by a one-digit whole number and using strategies based on place value and the properties of operations. To determine the correct product, students should have multiplied the multiplicand (2,815) by the multiplicator (7) while remembering to regroup correctly.
Incorrect – 4	Students choosing this answer likely added the regrouped tens (30) before multiplying by 7. Students choosing this answer may need additional support or practice in the order of operations while multiplying a whole number of four digits by a one-digit whole.

Algebra I Checkpoint Item Annotations

Item Information

Item Code: TN914348 Grade Level: Algebra I

Standard Code: A1.A.CED.A.2 Position No: 1

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

Calculator: N

Correct Answer: B

Jackson paints murals on walls. In order to paint one of his murals, he needs a rectangular area that is at least 4 feet wide and 3 feet high. The width and height have to increase by the same amount of feet, x.

Which equation represents all the possible areas for the rectangular murals?

A. $A = x^2 + 7x + 12$, where x is any real number

B. $A = x^2 + 7x + 12$, where x is any nonnegative real number

C. $A = 2x + 7$, where x is any real number

D. $A = 2x + 7$, where x is any nonnegative real number

Rationales	
Incorrect – 1	Students correctly created an equation to represent an increase by the same amount to each given value, then used their understanding of multiplication to find area and chose an equivalent equation that would result. They incorrectly identified the value of x as potentially any real number. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world constraints.
Correct – 2	Students correctly created an equation to represent an increase by the same amount to each given value, then used their understanding of multiplication to find area and chose an equivalent equation that would result. They also demonstrated an understanding of the constraints in the given situation that would eliminate all negative numbers as values for x.
Incorrect – 3	Students created an equation in which all terms were combined using addition rather than the required multiplication for finding area. Additionally, they incorrectly identified the value of x as potentially any real number. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world constraints.
Incorrect – 4	Students created an equation in which all terms were combined using addition rather than the required multiplication for finding area. They did recognize the constraints in the situation which limited the possible values of x to non-negative numbers. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world constraints.

Item Information

Item Code: TN914359 Grade Level: Algebra I

Standard Code: A1.A.CED.A.3 Position No: 2

Standard Text: Represent constraints by equations or inequalities and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

Calculator: N

Correct Answer: B

Larissa is on vacation and wants to rent a bicycle to explore the town. She pays a $10 flat fee and then $12 per hour for the rental.

If Larissa has $45 to spend, what is the greatest number of full hours she can rent the bicycle?

A. 1

B. 2

C. 3

D. 4

Rationales	
Incorrect – 1	Students may have found a value that represents the number of additional dollars needed for Larissa to purchase another hour. These students may need practice articulating what each value and variable represents in real-world problems in order to set up mathematical expressions using those variables.
Correct – 2	Students correctly used an inequality to determine that the amount of money which could be spent could not exceed 45 and applied the rate correctly to maximize rental time of 2 hours in addition to the fee of $10 without exceeding the available $45.
Incorrect – 3	Students may have correctly used an inequality using the rate and initial fee to determine that the amount of money which could be spent could not be greater than 45 but incorrectly found the number of hours to be 3. The solution to the inequality was a rational number very close to 3, so they may have rounded the number of hours up to 3. These students may need practice articulating what a computation represents in real-world problems in order to interpret its reasonableness.
Incorrect – 4	Students may have created an inequality to represent the situation and applied all given values correctly but may have reversed the inequality sign and solved the inequality resulting in a solution suggesting values greater than, leading them to choose the highest available value greater than 2 rather than less than 2. These students may need practice articulating what each value and variable represents in real-world problems in order to set up mathematical expressions using those variables.

Item Information

Item Code: TN214318 | Grade Level: Algebra I

Standard Code: A1.A.CED.A.1 | Position No: 3

Standard Text: Create equations and inequalities in one variable and use them to solve problems.

Calculator: N

Correct Answer: C

Tara sells her paintings for $328 each. A 6% sales tax is added to the sale price.

Which equation can be used to calculate the total number of paintings sold, x, if the total sales amount, including tax, is $1390.72?

A. $328 = 1390.72(1 + 0.06)x$

B. $1390.72 = (328 + 0.06)x$

C. $1390.72 = 328(1 + 0.06)x$

D. $1390.72 = 328(1 + 6)x$

Rationales	
Incorrect – 1	Students correctly created an expression to calculate sales tax but confused the total sales amount and the price per painting to create an incorrect equation. These students may need practice articulating what each value and variable represents in real-world problems in order to use appropriate formulas from the reference sheet.
Incorrect – 2	Students incorrectly applied the 6% sales tax leading to an incorrect equation. These students may need practice articulating what each value and variable represents in real-world problems in order to use appropriate formulas from the reference sheet
Correct – 3	Students correctly created an equation that can be used to find the total number of paintings sold when given the price per painting, the sales tax rate, and the total sales amount.
Incorrect – 4	Students correctly arranged the given values but used the given value for the percent instead of its decimal equivalent. These students may need practice articulating what each value and variable represents in real-world problems in order to use appropriate formulas from the reference sheet, particularly with the representations of percentages in interest.

Item Information

Item Code: TN214374 Grade Level: Algebra I

Standard Code: A1.A.REI.A.1 Position No: 4

Standard Text: Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Calculator: N

Correct Answer: D

Tanika booked a banquet hall for a party. The hall charged $15 per person, with a required tip of $60 for the waiters. Tanika knows that the total bill was $315 without tax, but she lost track of how many people attended. She writes and solves an equation, where p represents the number of people who attended.

Step 1: $315 = 15p + 60$

Step 2: $\boxed{\quad ? \quad}$

Step 3: $255 = 15p$

Step 4: $\frac{255}{15} = \frac{15p}{15}$

Step 5: $p = 17$

Which operation describes Tanika's missing work in Step 2?

A. added 60 to both sides

B. multiplied both sides by 15

C. divided both sides by 15

D. subtracted 60 from both sides

Rationales	
Incorrect – 1	Students correctly recognized that 60 was removed from the right-hand side of the equation but applied a property of equality that would not have resulted in the given values for Step 3. Students may need support in understanding how the structure of an equation represents mathematical equality, and how manipulation of an equation help to interpret the meaning of its variables and the operations that can be performed with them.
Incorrect – 2	Students used the variable coefficient of 15 to incorrectly conclude that multiplication must have been applied in Step 2. Students may need support in understanding how the structure of an equation represents mathematical equality, and how manipulation of an equation help to interpret the meaning of its variables and the operations that can be performed with them.
Incorrect – 3	Students incorrectly chose an operation that is displayed in Step 4 of solving the equation. Students may need support in understanding how the structure of an equation represents mathematical equality, and how manipulation of an equation help to interpret the meaning of its variables and the operations that can be performed with them.
Correct – 4	Students correctly recognized the need for an opposite operation and used the subtraction property of equality for Step 2, which resulted in the given values for Step 3.

Item Information

Item Code: TN048129 | Grade Level: Algebra I

Standard Code: A1.S.ID.C.6 | Position No: 5

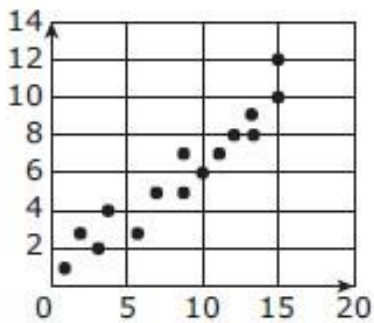
Standard Text: Use technology to compute and interpret the correlation coefficient of a linear fit.

Calculator: N

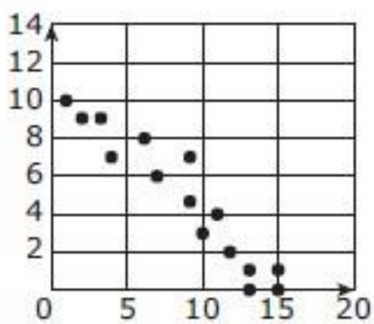
Correct Answer: 3,4,8

The three scatter plots show relationships between two variables.

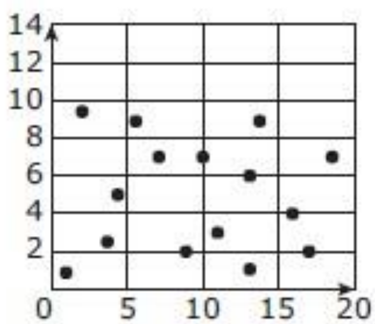
Scatter plot A:



Scatter plot B:



Scatter plot C:



The table shows columns marked with three linear correlation coefficients.

Mark the box showing which scatter plot **most closely** matches that linear correlation coefficient.

	−0.9	**0**	**0.9**
Scatter plot A	O	O	O
Scatter plot B	O	O	O
Scatter plot C	O	O	O

Option:	Rationale Text	-0.9	0	0.9
A	3, Students correctly identified the scatter plot as having a positive correlation coefficient that is most close to 1.			Correct
B	4, Students correctly identified the scatterplot as having a correlation coefficient that is most accurately described as negative and close to -1.	Correct		
B	8, Students correctly recognized the scatterplot shows no correlation and therefore is most close to zero.		Correct	

Item Information

Item Code: TN015991 Grade Level: Algebra I

Standard Code: A1.A.SSE.B.3.a Position No: 6

Standard Text: Factor a quadratic expression to reveal the zeros of the function it defines.

Calculator: N

Correct Answer: B

What are the zeros of the function defined by the expression $x^2 - 7x - 30$?

A. 3 and -10

B. 10 and -3

C. 15 and 2

D. 15 and -2

Rationales	
Incorrect – 1	Students may have factored the expression to find the correct terms but may have assigned the incorrect operation of addition or subtraction to each. Then when solving for the zeros the result was the incorrect integer value of the term. It is also possible students correctly assigned the operations within the factors but did not complete the final steps to solve for the zeros correctly. Students may need support in understanding the definition and the concept of zeros of a function and the steps required to find them.
Correct – 2	Students correctly factored the given expression and used those factors to correctly solve for the zeros of the function defined by the expression.
Incorrect – 3	Students used factors of 30 that did not result in zeros of the function. Students may need support in understanding the definition and the concept of zeros of a function and the steps required to find them.
Incorrect – 4	Students used factors of 30 that did not result in zeros of the function. Students may need support in understanding the definition and the concept of zeros of a function and the steps required to find them.

Item Information

Item Code: TN0002775 Grade Level: Algebra I

Standard Code: A1.A.SSE.A.2 Position No: 7

Standard Text: Use the structure of an expression to identify ways to rewrite it.

Calculator: Y

Correct Answer: C

Which expression is equivalent to $(16x^2 - 9)$?

A. $(4x - 3)^2$

B. $\left(8x - \frac{9}{2}\right)^2$

C. $(4x - 3)(4x + 3)$

D. $(8x - 9)(2x + 1)$

Rationales	
Incorrect – 1	Students correctly recognized each term as a perfect square, but incorrectly factored the given expression to use the same sign for each term which does not result in an equivalent expression. Students may need support recognizing expressions which are the difference of perfect squares that can lead to patterns that result in equivalent expressions.
Incorrect – 2	Students incorrectly applied the operation of division to each term in the expression. Students may need support understanding rules of exponents. Students may benefit from support recognizing expressions which are the difference of perfect squares that can lead to patterns that result in equivalent expressions.
Correct – 3	Students correctly factored the given expression to create an equivalent expression based upon the given difference of perfect squares.
Incorrect – 4	Students found factors of the given binomial to create two binomials that were not equivalent to the given expression. Students may benefit from support recognizing expressions which are the difference of perfect squares that can lead to patterns that result in equivalent expressions.

Item Information

Item Code: TN0033076 Grade Level: Algebra I

Standard Code: A1.A.APR.A.1 Position No: 8

Standard Text: Understand that polynomials forma system analogous to the integers, namely, They are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Calculator: Y

Correct Answer: B

Select the expression equivalent to $(-4x + 3) - (-2x + 5)$.

A. $-2x$

B. $-2x - 2$

C. $-6x - 2$

D. $-6x + 8$

Rationales	
Incorrect – 1	Students correctly combined terms containing a variable but disregarded the resulting constant values when combining terms. Students may benefit from support understanding the operations for combining terms apply to all terms in a given expression.
Correct – 2	Students correctly applied mathematical operations to combine terms in a manner resulting in an equivalent expression.
Incorrect – 3	Students correctly combined constant values but did not correctly subtract $-2x$ from $-4x$. Students may need support applying the concepts related to the addition and subtraction of integers to terms containing variables.
Incorrect – 4	Students incorrectly applied the rules for addition and subtraction of integers when combining all terms in the given expression. Students may benefit from support in applying integers operations requiring multiple steps.

Item Information

Item Code: TN140079 Grade Level: Algebra I
Standard Code: A1.A.REI.D.5 Position No: 9
Standard Text: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
Calculator: Y
Correct Answer: A,C,F

Consider the equation $y = \frac{1}{4}x^2 - x + 3$.

Select **all** ordered pairs that are solutions to the equation.

A. (–8, –5)

B. (–4, –3)

C. (–2, 4)

D. (2, 2)

E. (3, 0)

F. (4, –5)

Rationales	
Correct – 1	Students correctly identified this as a point that is on the graph of the given equation.
Incorrect – 2	Students may have misidentified the point (–4, 3) as the point given here to incorrectly indicate a point on the graph of the line. Students may need support in understanding the location and identification of coordinate pairs on the coordinate plane.
Correct – 3	Students correctly identified this as a point that is on the graph of the given equation.
Incorrect – 4	Students may have neglected to include the negative sign for the first term thereby creating a positive value for *y*, giving the ordered pair (2, 2). Students may benefit from more understanding of the impact of signs of terms in equations.
Incorrect - 5	Students may have used the *y*-intercept of (0, 3) and misinterpreted the coordinates to incorrectly choose (3, 0) as a point on the graph of the equation. Students may need support in understanding the location and identification of coordinate pairs on the coordinate plane.
Correct - 6	Students correctly identified this as a point that is on the graph of the given equation.

Item Information

Item Code: TN0002772 Grade Level: Algebra I

Standard Code: A1.F.IF.B.4 Position No: 10

Standard Text: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

Calculator: Y

Correct Answer: C

A child throws a penny upward out of a window and watches it fall to the ground. The function $f(t) = -16t^2 + t + 10$ represents the penny's distance in feet above the ground t seconds after the penny is thrown.

Approximately how many seconds does it take the penny to hit the ground?

A. 0.03

B. 0.76

C. 0.82

D. 1.32

Rationales	
Incorrect – 1	Students may have graphed the function using an incorrect value of 1 rather than 10. This led to a zero of 0.3 which may have led them to select this incorrect value for the zero of the graph. These students may need practice articulating what a computation represents in real-world problems in order to interpret its reasonableness.
Incorrect – 2	Student may have correctly graphed the equation but incorrectly used the negative zero of the function in this situational problem. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world domain from functional domain.
Correct – 3	Students correctly graphed the equation of the situation to determine the approximate value of the positive zero of the function.
Incorrect – 4	Students may have theorized the time required must be greater than 1 second negating the need to use the equation to create a graph to find the zeros. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world domain from functional domain.

Item Information

Item Code: TN848170 Grade Level: Algebra I

Standard Code: A1.S.ID.C.7 Position No: 11

Standard Text: Distinguish between correlation and causation.

Calculator: Y

Correct Answer: D,F

During a series of storms, a meteorologist recorded data about different outcomes during the storms. He identified the following positive correlations:

- The number of fallen tree limbs is strongly correlated with wind speed.
- The number of car accidents is weakly correlated with wind speed.
- The number of fallen tree limbs is moderately correlated with total rainfall.
- The number of car accidents is strongly correlated with total rainfall.

Which of the following claims are **most likely** true based on this data?

Select the **two best** answers.

A. An increase in the number of falling tree limbs causes an increase in wind speed.

B. An increase in the number of car accidents causes an increase in total rainfall.

C. High wind speed cannot cause a car accident.

D. High wind speed causes an increase in the number of fallen tree limbs.

E. An increase in rainfall causes an increase in the number of fallen tree limbs.

F. An increase in rainfall causes an increase in the number of car accidents.

Rationales	
Incorrect – 1	Students incorrectly reversed the causation relationship indicated by the highly correlated data in the given situation. Students may need support understanding the definition of causation and its logical application in real world situations.
Incorrect – 2	Students incorrectly reversed the causation relationship indicated by the highly correlated data in the given situation. Students may need support understanding the definition of causation and its logical application in real world situations.
Incorrect – 3	Students incorrectly extended the weak correlation between wind speed and car accidents to also indicate an unsupported causation relationship. Students may need support understanding the definition of causation and its application in correlated real-world situations.
Correct – 4	Students correctly extended the strong correlation to also be relative to causation in the given situation.
Incorrect – 5	Students incorrectly extended the moderate correlation between rain fall and fallen tree limbs to also indicate an unsupported causation relationship. Students may need support understanding the definition of causation and its application in correlated real-world situations.
Correct - 6	Students correctly extended the strong correlation to also be relative to causation in the given situation.

Item Information

Item Code: TN0002773 Grade Level: Algebra I

Standard Code: A1.A.REI.B.3.a Position No: 12

Standard Text: Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form (x – p)^2 = q that has the same solutions. Derive the quadratic formula from this form.

Calculator: Y

Correct Answer: D

Which equation has the same solutions as $(x - 5)^2 = 9$?

A. $x^2 - 25 = 9$

B. $x^2 - 5x + 16 = 0$

C. $x^2 - 10x - 16 = 0$

D. $x^2 - 10x + 16 = 0$

Rationales	
Incorrect – 1	Students incorrectly applied the exponent of 2 in finishing the process of completing the square to the terms within the binomial to produce an equation not equivalent to the given equation. Students may need support understanding why exponentiation of a binomial and distribution of a multiplicand on a binomial require different processes.
Incorrect – 2	In completing the steps to rewrite the given equation students may have incorrectly combined the coefficient terms leading to an equation that is not equivalent. Students may need support understanding why some terms can be combined during additional practice with multiplying polynomials.
Incorrect – 3	In completing the steps to rewrite the given equation students may have incorrectly combined the constant terms leading to an equation that is not equivalent. Students may need practice with problems that involve keeping track of negative signs during computation in order support efficiently applying the rules of mathematical operations and their use in simplifying polynomials.
Correct – 4	Students correctly finished the process of completing the square by squaring the given binomial and applied the subtraction property of equality to produce an equivalent equation.

Item Information

Item Code: TN815862 | Grade Level: Algebra I

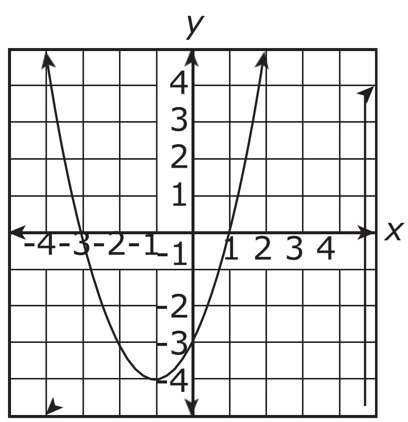
Standard Code: A1.A.REI.D.6 | Position No: 13

Standard Text: Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the approximate solutions using technology.

Calculator: Y

Correct Answer: B,E

The coordinate plane shows the graph of the functions $f(x) = x^2 + 2x - 3$ and $g(x) = x - 1$.



What are the solutions to the system of equations?

Select **all** that apply.

A. $(-3, 0)$

B. $(-2, -3)$

C. $(0, -1)$

D. $(0, 1)$

E. $(1, 0)$

Rationales	
Incorrect – 1	Students identified a point that is a zero of the function and therefore a solution to the quadratic and not the system. Students may need support understanding the definition and concept of a solution to a system of equations.
Correct – 2	Students correctly identified a point which is on the graph of both equations and is therefore a solution to the system of equations.
Incorrect – 3	Students identified a point that is the y intercept of the linear graph and may have incorrectly associated that with a solution to the system. Students may need support understanding the definition and concept of a solution to a system of equations.
Incorrect – 4	Students may have mistakenly reversed the coordinates in the ordered pair (1, 0) which is a solution to the system. These students may need support in understanding the appropriate placement of the *x*- and *y*-coordinates in an ordered pair.
Correct - 5	Students correctly identified a point which is on the graph of both equations and is therefore a solution to the system of equations.

Item Information

Item Code: TN0002776 Grade Level: Algebra I

Standard Code: A1.A.CED.A.1 Position No: 14

Standard Text: Create equations and inequalities in one variable and use them to solve problems.

Calculator: Y

Correct Answer: A

Javier has a part-time job and saves $10 of his hourly pay for the purchase of a new laptop that costs $648. He has $80 saved already.

Which inequality represents the number of hours, x, Javier must work to buy the laptop?

A. $10x + 80 \geq 648$

B. $10x + 80 \leq 648$

C. $10 + 80x \geq 648$

D. $10 + 80x \leq 648$

Rationales	
Correct – 1	Students correctly assigned the given values within the context of the situation to create an inequality to find the number of hours required to reach the stated goal.
Incorrect – 2	Students correctly assigned the given values within the context of the situation but incorrectly used the inequality symbol in the creation of the inequality. These students may need practice articulating what a computation represents in real-world problems in order to interpret the reasonableness of the inequality symbols.
Incorrect – 3	Students incorrectly assigned the given values in creating an inequality. These students may need practice articulating what each value and variable represents in real-world problems in order to describe mathematical relationships and real-world constraints.
Incorrect – 4	Students incorrectly assigned the given values in creating an inequality. Students may need support in identifying a constant in a real-world situation and distinguishing that value from a rate in the same situation. In addition, these students may have incorrectly used the inequality symbol in the creation of the inequality. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world constraints.

Item Information

Item Code: TN453833 Grade Level: Algebra I

Standard Code: A1.F.IF.C.8 Position No: 15

Standard Text: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Calculator: Y

Correct Answer: C,E

Ezra bought a new motorcycle three years ago. The value of his motorcycle, , in dollars, t years after the purchase, can be determined by the following equation.

$$v = 10{,}400(0.82)^t$$

Gina purchased a motorcycle at the same time. The value of Gina’s motorcycle at the end of each year is shown in the table.

Years Since Purchase	Value
0	\$8,000
1	\$6,800
2	\$5,780
3	\$4,913

Which statements comparing the values of the two motorcycles are true?

Select **all** that apply.

A. The value of both motorcycles decreases by the same percentage each year.

B. The value of Gina’s motorcycle decreases by a greater percentage each year than Ezra’s.

C. The value of Ezra’s motorcycle decreases by a greater percentage each year than Gina’s.

D. The purchase price of Gina’s motorcycle is greater than the purchase price of Ezra’s.

E. The purchase price of Ezra’s motorcycle is greater than the purchase price of Gina’s.

Rationales	
Incorrect – 1	Students incorrectly found the rates of decrease for both functions to be equal. Students may need practice transitioning between and interpreting different representations of a mathematical relationship, going to and from each of the following: words, tables, graphs, and equations/expressions.
Incorrect – 2	Students incorrectly interpreted the comparison between the rates of change for the two given functions. Students may need support interpreting parts of an expression as well as using values in a table to determine rate of change.
Correct – 3	Students correctly determined rate of decrease for each function and identified the function with the higher rate of decrease. Students missing this may need practice transitioning between and interpreting different representations of a mathematical relationship, going to and from each of the following: words, tables, graphs, and equations/expressions.
Incorrect – 4	Students may have reversed the initial values of the given functions to incorrectly identify the greatest initial value. These students may need practice articulating what each value and variable represents in real-world problems in order to interpret their mathematical relationships and real-world constraints.
Correct- 5	Students correctly identified the initial value of each function and identified the function with the highest initial value.

Item Information

Item Code: TN048208 Grade Level: Algebra I

Standard Code: A1.S.ID.C.5 Position No: 16

Standard Text: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Calculator: Y

Correct Answer: A

Suppose the relationship between high school GPA and college GPA is modeled by the linear equation $y = 0.9 + 0.7x$, where y is college GPA and x is high school GPA.

Which statement is the **best** interpretation of this relationship?

A. If high school GPA increases by 1, then college GPA is expected to increase by 0.7.

B. If high school GPA increases by 1, then college GPA is expected to increase by 0.9.

C. If high school GPA increases by 0.7, then college GPA is expected to increase by 1.

D. If high school GPA increases by 0.9, then college GPA is expected to increase by 1.

Rationales	
Correct – 1	Students correctly applied the rate of change in the given function to determine its effect on the real-world situation.
Incorrect – 2	Students may have incorrectly identified the initial value and the rate of change. These students may need support interpreting parts of an expression that represent a quantity in terms of its context.
Incorrect – 3	Students incorrectly interpreted the effect of the rate of change on the quantity in the situation. Students may benefit from additional support interpreting the effect of a rate of change.
Correct – 4	Students mistakenly confused the initial value in the situation with the rate of change. These students may need support interpreting parts of an expression that represent a quantity in terms of its context.

Item Information

Item Code: TN639838 Grade Level: Algebra I

Standard Code: A1.A.SSE.B.3.c Position No: 17

Standard Text: Use the properties of exponents to rewrite exponential expressions.

Calculator: Y

Correct Answer: C,E

Select **all** expressions equivalent to $16(2)^{n-3}$.

A. $(2)^{4n-12}$

B. $(2)^{4n-3}$

C. $(2)^{n+1}$

D. $8(2)^{n-1}$

E. $8(2)^{n-2}$

Rationales	
Incorrect – 1	Students found the value of 16 to be equivalent to 2 to the 4th power but incorrectly distributed the 4 both terms *n* and –3 in the exponent. These students may need support distinguishing between the rules used in simplifying exponential expressions.
Incorrect – 2	Students found the value of 16 to be equivalent to 2 to the 4th power but incorrectly distributed the 4 to the variable in the exponent *n* - 3. These students may need support applying the rules used in simplifying exponential expressions.
Correct – 3	Students correctly applied the properties of exponents to determine an equivalent expression.
Incorrect – 4	Students may have incorrectly simplified 16 to 8 times 2 to the power of 2 and subsequently created an expression not equivalent when combining exponents to simplify the entire expression. Students may benefit from a greater understanding of using exponents to express equivalent numerical values.
Correct - 5	Students correctly applied the properties of exponents to determine an equivalent expression.

Item Information

Item Code: TN216231 | Grade Level: Algebra I

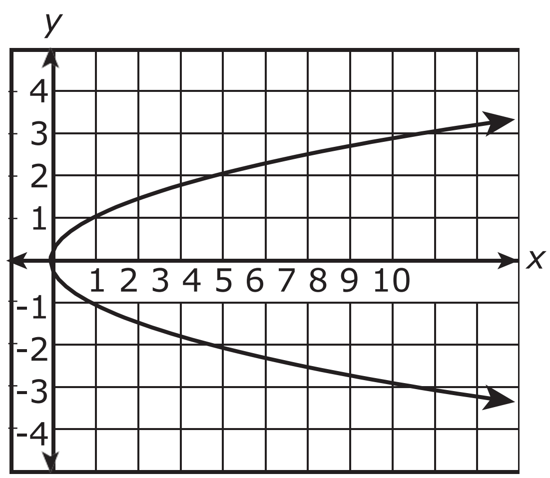
Standard Code: A1.F.IF.A.1 | Position No: 18

Standard Text: 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).

Calculator: Y

Correct Answer: D

The graph of *f* is shown.



Is *f* a function and why?

A. Yes, because the graph represents a relation between an input and an output.

B. Yes, because each output corresponds to one input.

C. No, because the function has negative values.

D. No, because each input does not correspond to only one output.

Rationales	
Incorrect – 1	Students incorrectly associated a relation with being a function. Students may need additional support understanding the characteristics of a relation which determine a function.
Incorrect – 2	Students mistakenly reversed the values for input and output, leading them to incorrectly label the relation as a function. Students may benefit from additional understanding of the relationship between *x*- and *y*-values and input and output in a function.
Incorrect – 3	Students incorrectly associated only positive values with functions. Students may need additional support understanding the characteristics of a relation which determine a function.
Correct – 4	Students correctly applied the requirements for determining a function to eliminate the given relation from being a function.

Item Information

Item Code: TN515678 | Grade Level: Algebra I

Standard Code: A1.A.REI.B.3.b | Position No: 19

Standard Text: Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.

Calculator: Y

Correct Answer: D,F

Which values are solutions to the equation $0 = (x - 3)^2 - 1$?

Select **all** that apply.

A. -4

B. -3

C. -2

D. 2

E. 3

F. 4

Rationales	
Incorrect – 1	Students may have factored the resulting equation to find the correct terms but assigned the incorrect operation of addition to each. Then when finding the solutions, the result was an incorrect integer value of the term. It is also possible students correctly assigned the operations within the factors but did not complete the final steps to find the solutions correctly. Students may need support in understanding the definition and the concept of solutions of a quadratic and the steps required to find them.
Incorrect – 2	Students may have incorrectly associated the constant of the binomial in the given equation with the solutions to the equation. These students may need support in understanding the definition and the concept of solutions of a quadratic and the steps required to find them.
Incorrect – 3	Students may have factored the resulting equation to find the correct terms but assigned the incorrect operation of addition to each. Then when finding the solutions, the result was an incorrect integer value of the term. It is also possible students correctly assigned the operations within the factors but did not complete the final steps to find the solutions correctly. Students may need support in understanding the definition and the concept of solutions of a quadratic and the steps required to find them.
Correct – 4	Students correctly factored to solve the given equation and used those factors to correctly find a solution.
Incorrect - 5	Students may have incorrectly associated the constant of the binomial in the given equation with the solutions to the equation. These students may need support in understanding the definition and the concept of solutions of a quadratic and the steps required to find them.
Correct - 6	Students correctly factored to solve the given equation and used those factors to correctly find a solution.

Item Information

Item Code: TN448215 Grade Level: Algebra I

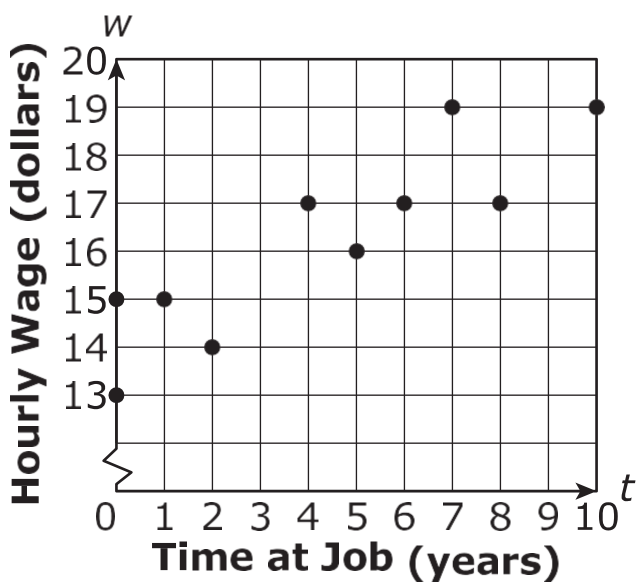
Standard Code: A1.S.ID.B.4.b Position No: 20

Standard Text: Fit a linear function for a scatter plot that suggests a linear association.

Calculator: Y

Correct Answer: B

A small business has 10 employees. The time, t, in years they have worked for the company and w, their hourly wages, are shown as pairs of values in the scatter plot below.



Which equation **best** models the data?

A. $w = \frac{1}{4}t + 15$

B. $w = \frac{1}{2}t + 14$

C. $w = t + 13$

D. $w = t + 14$

Rationales	
Incorrect – 1	Students may have mistakenly associated the point at (0, 15) as the *y*-intercept of a linear function that best represents the scatterplot. These students may need support in understanding the need to use more than one data point provided to develop a linear function.
Correct – 2	Students correctly used given data points to create a linear function to model the data.
Incorrect – 3	Students may have used the point (0, 13) to mistakenly identify 13 as the y intercept of the linear function that best represents the scatterplot. These students may need support in understanding the need to use more than one data point provided to develop a linear function.
Incorrect – 4	Students may have correctly chosen (0, 14) as a point that would fall on a line of best fit but incorrectly found 1 as a rate of change for the linear function. Students may need additional support in the steps required to use multiple points in the calculation of a linear function for a scatter plot.

Item Information

Item Code: TN216384 Grade Level: Algebra I

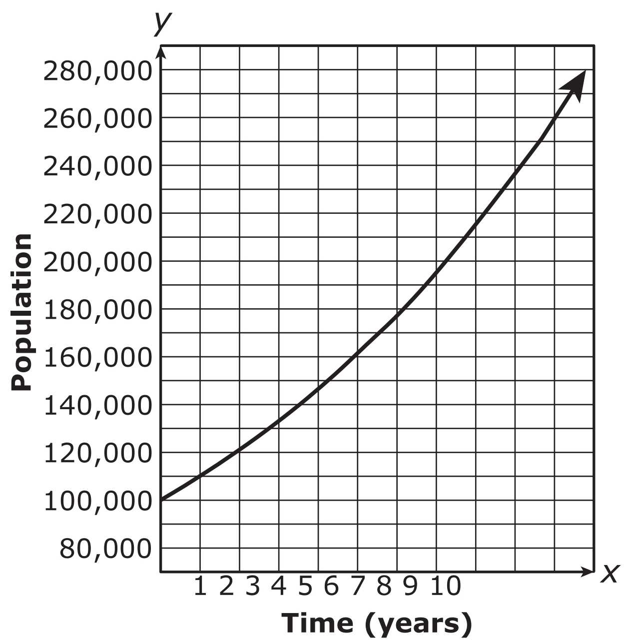
Standard Code: A1.F.IF.B.3 Position No: 21

Standard Text: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

Calculator: Y

Correct Answer: B

The graph shows the predicted population of a town, *x* number of years after 2020.



According to the graph, which statement is true?

A. The population will increase by 10,000 people each year.

B. The population will increase more each year than the previous year.

C. The population for the year 2025 is predicted to be less than 160,000.

D. From 2020 to 2030, the population will increase by approximately 260,000.

Rationales	
Incorrect – 1	Students may have examined the values for only the first two years which led to an incorrect conclusion that the population would increase at the same rate throughout. Students may need support in distinguishing between features in the graphs of linear and exponential functions.
Correct – 2	Students correctly associated the features of the given graph to an exponential function and applied the characteristics of an exponential function to the given situation.
Incorrect – 3	Students may not have correctly interpreted the *x*-values as the years after 2020 which led them to an incorrect population value for the year 2025. Students may benefit from support with making sense of problems.
Incorrect – 4	Students may have - determined the population was 260,000 in the year 2030, but did not subtract the initial population, which incorrectly led to a population change of 260,000. Students may benefit from support with making sense of problems.

Additional Resources

- Information on Tennessee's Assessment Program
- Tennessee Academic Standards for Mathematics
- The eight Standards for Mathematical Practice
- Best for All Central
- Assessing Student Learning Reopening Toolkit
- Assessment Development LiveBinder Resource Site

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