Ohio’s State Tests

ITEM RELEASE

SPRING 2016

INTEGRATED MATHEMATICS I
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<td>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. (A.REI.5)</td>
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<td>Interpret functions that arise in applications in terms of the context.</td>
<td>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. (F.IF.6)</td>
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Integrated Math I
Item Release

Question 1

Question and Scoring Guidelines
Question 1

A system of linear equations is shown.

\[ \begin{align*}
-3x + y &= K \\
2x + 3y &= L 
\end{align*} \]

Which system has the same solution as the system shown?

(A) \[ \begin{align*}
-9x + 3y &= -3K \\
2x + 3y &= L 
\end{align*} \]

(B) \[ \begin{align*}
6x - 2y &= -2K \\
2x + 3y &= L 
\end{align*} \]

(C) \[ \begin{align*}
-3x + y &= K \\
3x + 4.5y &= L 
\end{align*} \]

(D) \[ \begin{align*}
-3x + y &= K \\
-8x - 12y &= L 
\end{align*} \]

Points Possible: 1

Content Cluster: Solve systems of equations.

Content Standard: 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. (A.REI.5)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may not have realized that the left side of the first equation in the original system was multiplied by 3, and that the right side was multiplied by \((-3)\), which produced a pair of non-equivalent equations and thus a system with different solutions than the original system.

Rationale for Option B: Key – The student correctly recognized that a system of two equations in two variables will have the same solutions if one (or both) equation(s) is replaced by an equivalent equation (e.g., a product of the original equation and any real number). According to the Multiplication Property of Equality, the first equations in both systems are equivalent because \(6x - 2y = -2K\) is a product of \(-3x + y = K\) and \((-2)\).

Rationale for Option C: This is incorrect. The student may not have realized that the left side of the second equation in the original system was multiplied by 1.5, and that the right side was multiplied by 1, which produced a pair of non-equivalent equations and thus a system with different solutions than the original system.

Rationale for Option D: This is incorrect. The student may not have realized that the left side of the second equation in the original system was multiplied by \((-4)\), and that the right side was multiplied by 1, which produced a pair of non-equivalent equations and thus a system with different solutions than the original system.
A system of linear equations is shown.

\[-3x + y = K\]
\[2x + 3y = L\]

Which system has the same solution as the system shown?

- **A)** \[-9x + 3y = -3K\]
  \[2x + 3y = L\]

- **B)** \[6x - 2y = -2K\]
  \[2x + 3y = L\]

- **C)** \[-3x + y = K\]
  \[3x + 4.5y = L\]

- **D)** \[-3x + y = K\]
  \[-8x - 12y = L\]
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Question 2

Question and Scoring Guidelines
Question 2

A town planner models the population of a town using a linear function \( f(t) \), where \( t \) represents the number of years after 2005. The table shows the population of the town at different years.

<table>
<thead>
<tr>
<th>( t )</th>
<th>( f(t) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>48.709</td>
</tr>
<tr>
<td>7</td>
<td>51.691</td>
</tr>
<tr>
<td>9</td>
<td>53.779</td>
</tr>
</tbody>
</table>

Which value is closest to the population in 2005 predicted by \( f(t) \)?

A. 43,700
B. 44,700
C. 45,700
D. 46,700

Points Possible: 1

Content Cluster: Interpret functions that arise in applications in terms of the context.

Content Standard: 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. (F.IF.6)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have estimated the difference between year 9 and year 4 as 5070 and subtracted this number from year 4, since 48,709 – 5070 is 43,639, or about 43,700.

Rationale for Option B: Key – The student correctly identified that, if the town population is modeled by a linear function \( f(t) \), the change in population per year is the slope of \( f(t) \). This slope can be found by calculating the ratio of the difference between any two function values \( f(t) \) to the difference of the corresponding values of \( t \). For example, \( \frac{f(9) - f(4)}{9 - 4} = \frac{53,779 - 48,709}{5} = 1014 \) people/year. If in every year after 2005 the population grows by about 1014 people, then in 2005, or 4 years prior to \( t = 4 \), the population was four times 1014 less than 48,709, or 48,709 – 4 \( \times \) 1014 = 44,653. The number closest to this value is 44,700.

Rationale for Option C: This is incorrect. The student may have estimated the difference between year 7 and year 4 as 3000 and subtracted this number from year 4, since 48,709 – 3000 is 45,709, or about 45,700.

Rationale for Option D: This is incorrect. The student may have estimated the difference from year 9 and year 7 as 2000 and subtracted this number from year 4, since 48,709 – 2,000 is 46,709, or about 46,700.

Sample Response: 1 point
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Question 3

Question and Scoring Guidelines
Question 3

To start her collection of comic books, Joylin’s uncle gives Joylin a box of comic books and several monthly subscriptions to comic books. The number of comic books in her collection, \( y \), after \( x \) months is modeled by the equation shown.

\[ y = 40 - 6x \]

What does the number 40 represent in this equation?

A. the price of a comic book subscription  
B. the number of months of Joylin’s subscriptions  
C. the number of comic books in the box she received  
D. the number of title subscriptions Joylin received each month

Points Possible: 1

Content Cluster: Interpret expressions for functions in terms of the situation they model.

Content Standard: Interpret the parameters in a linear or exponential function in terms of a context. (F.LE.5)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may not have realized that the equation models the total number of books that Joylin received from her uncle and from the subscription, not the price of the book subscription.

Rationale for Option B: This is incorrect. The student may have believed that the constant term, 40, represents the length of the subscription, in months.

Rationale for Option C: Key – The student correctly recognized that the constant term, 40, represents the number of comic books in the box that Joylin initially received from her uncle and that the variable term is $6x$, which represents the number of subscription comic books that Joylin received during $x$ months.

Rationale for Option D: This is incorrect. The student may have confused the meaning of the constant term, 40, which represents the number of books in the box, with the coefficient 6, which represents the number of comic books (title subscriptions) that Joylin receives each month.

Sample Response: 1 point

To start her collection of comic books, Joylin’s uncle gives Joylin a box of comic books and several monthly subscriptions to comic books. The number of comic books in her collection, $y$, after $x$ months is modeled by the equation shown.

$$y = 40 + 6x$$

What does the number 40 represent in this equation?

A. the price of a comic book subscription
B. the number of months of Joylin’s subscriptions
C. the number of comic books in the box she received
D. the number of title subscriptions Joylin received each month