This examination has four parts, with a total of 37 questions. You must answer all questions in this examination. Your examination will be invalidated and no score will be calculated for you. The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Student Name __________________________________________________________
School Name __________________________________________________________

Thursday, June 16, 2022 — 9:15 a.m. to 12:15 p.m., only

ALGEBRA I

RECENTS HIGH SCHOOL EXAMINATION
The University of the State of New York
Large-Type Edition
A graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions. A sheet of scrap paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. Any work done on this sheet of scrap graph paper will not be scored.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet. You may remove this sheet from this booklet. Any formulas that you may need to answer some questions in this examination are found at the end of this booklet.
Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Record your answers on your separate answer sheet.

1. Which correlation shows a causal relationship?
   (1) The more minutes an athlete is on the playing field, the more goals she scores.
   (2) The more gasoline that you purchase at the pump, the more you pay.
   (3) The longer a shopper stays at the mall, the more purchases she makes.
   (4) As the price of a gift increases, the size of the gift box increases.

2. Given $f(x) = 3x - 5$, which statement is true?
   (1) $f(0) = 0$
   (2) $f(3) = 4$
   (3) $f(4) = 3$
   (4) $f(5) = 0$
At Benny's Café, a mixed-greens salad costs $5.75. Additional toppings can be added for $0.75 each. Which function could be used to determine the cost, \( c(s) \), in dollars, of a salad with \( s \) additional toppings?

(1) \( c(s) = 5.75 + 0.75s \) (2) \( c(s) = 0.75 + 5.75s \) (3) \( c(s) = 5.75 + 0.75s \) (4) \( c(s) = 0.75 + 5.75s \)

Peter has $100 to spend on drinks for his party. Bottles of lemonade cost $2 each, and juice boxes cost $0.50 each. If \( x \) is the number of bottles of lemonade and \( y \) is the number of juice boxes, which inequality models this situation?

(1) \( 0.50y + 2x \leq 100 \) (2) \( 2x + 0.50y \geq 100 \) (3) \( 2x + 0.50y \leq 100 \) (4) \( 0.50y + 2x \geq 100 \)

Which expression is equivalent to \( x^2 - 5x + 6 \)?

(1) \( (x - 1)(x + 6) \) (2) \( (x + 1)(x - 6) \) (3) \( (x - 3)(x + 1) \) (4) \( (x + 3)(x - 1) \)
Which domain is most appropriate for a function that represents the number of items, \( f(x) \), placed into a laundry basket each day, \( x \), for the month of January?

(1) integers  (1) integers
(2) whole numbers  (2) whole numbers
(3) rational numbers  (3) rational numbers
(4) irrational numbers  (4) irrational numbers

What is the solution to \( \frac{3}{2}b + 5 < 17 \)?

(1) \( b < 8 \)  (2) \( b > 8 \)
(3) \( b < 18 \)  (4) \( b > 18 \)
Which table of values represents an exponential relationship?

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
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<td>3</td>
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<td>5</td>
<td>5</td>
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<td>2</td>
</tr>
<tr>
<td>-9.5</td>
<td>1</td>
</tr>
</tbody>
</table>
8

Use this space for computations.

Which expression is not equivalent to \((5^2x)^3\)?

- (1) \((5x)^6\)
- (2) \((5^3x^2)^2\)
- (3) \((5^5)x\)
- (4) \((5^2)^3x\)

Which relation is a function?

- (1) \(\{(0,1), (2,3), (3,2), (3,4)\}\)
- (2) \(\{(1,2), (2,1)\}\)
- (3) \(\{(0,0), (1,1), (1,0), (2,1)\}\)
- (4) \(\{(0,1), (1,1), (1,0)\}\)

10 Which relation is a function?

\(x \in \mathbb{R}, y \in \mathbb{R}\)

\(\{(4,3), (2,1)\}\) (4)

\(\{(2,1), (1,1)\}\) (3)

\(\{(0,0), (1,1), (1,0), (2,1)\}\) (1)

\(\{(0,1), (1,1), (1,0)\}\) (6)
The formula \( Ax + By + C = 0 \) represents the equation of a line in standard form. Which expression represents \( y \) in terms of \( A \), \( B \), and \( x \)?

- \( \text{(1)} \ \frac{B}{x} + \frac{C}{x} = \frac{C}{x} \)  
- \( \text{(2)} \ \frac{B}{x} = \frac{C}{x} \)  
- \( \text{(3)} \ \frac{B + x}{V - C} \)  
- \( \text{(4)} \ \frac{B}{x} = \frac{C}{x} \)

What are the zeros of \( f(x) \) if \( (x + 3)(x - 2) = 0 \)?

- \( \text{(1)} \ \{ -2, 4 \} \)  
- \( \text{(2)} \ \{ -3, 2 \} \)  
- \( \text{(3)} \ \{ -3, 4 \} \)  
- \( \text{(4)} \ \{ 2, 4 \} \)

Joe has dimes and nickels in his piggy bank totaling $1.45. The number of nickels he has is 5 more than twice the number of dimes, \( n \). Which equation could be used to find the number of dimes he has?

- \( \text{(1)} \ 0.10d + 0.05(2d + 5) = 1.45 \)  
- \( \text{(2)} \ 0.10(2d + 5) + 0.05d = 1.45 \)  
- \( \text{(3)} \ d(2d + 5) + 1.45 \)  
- \( \text{(4)} \ (d + 5)2d + 1.45 \)
Donna and Andrew compared their math final exam scores from grade 8 through grade 12. Their scores are shown below.

Which statement about their final exam scores is correct?

(1) Andrew has a higher mean than Donna.
(2) Donna and Andrew have the same median.
(3) Andrew has a larger interquartile range than Donna.
(4) The 3rd quartile for Donna is greater than the 3rd quartile for Andrew.

The first term in a sequence is 5 and the fifth term is 17. What is the common difference?

The first term in a sequence is 5 and the fifth term is 17. What is the common difference?

Grade 8 through Grade 12. Their scores are shown below.

### Donna

<table>
<thead>
<tr>
<th>Grade</th>
<th>8th</th>
<th>9th</th>
<th>10th</th>
<th>11th</th>
<th>12th</th>
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<tbody>
<tr>
<td>Score</td>
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<td>96</td>
<td>94</td>
<td>92</td>
<td>95</td>
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</table>

### Andrew

<table>
<thead>
<tr>
<th>Grade</th>
<th>8th</th>
<th>9th</th>
<th>10th</th>
<th>11th</th>
<th>12th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>93</td>
<td>111</td>
<td>101</td>
<td>94</td>
<td>95</td>
</tr>
</tbody>
</table>

Use this space for computations.
A quadratic function and a linear function are graphed on the same set of axes. Which situation is not possible?

(1) The graphs do not intersect.

(2) The graphs intersect in one point.

(3) The graphs intersect in two points.

(4) The graphs intersect in three points.

17 The expression \( m - \frac{m^2}{9} \) is equivalent to

(1) \( m^2 - \frac{m}{9} \)

(2) \( m^2 - \frac{m^2}{9} \)

(3) \( m^2 - \frac{m}{6} \)

(4) \( m^2 - \frac{m^2}{6} \)

16 A quadratic function and a linear function are graphed on the same set of axes. Which situation is not possible?
Mrs. Rossano asked her students to explain why \((3, \frac{4}{18})\) is a solution to \(\frac{2}{3}x - 4 = y\). Three student responses are given below.

Andrea: "When the equation is graphed on a calculator, the point can be found within its table."  

Bill: "Substituting \(x = 3\) and \(y = \frac{4}{18}\) into the equation makes it true."  

Christine: "The graph of the line passes through the point \((3, \frac{4}{18})\)."

Which students are correct?  

(1) Andrea and Bill, only  
(2) Bill and Christine, only  
(3) Andrea and Christine, only  
(4) Andrea, Bill, and Christine  

Use this space for computations.
Which statement is true?

(1) The maximum of $f(x)$ is less than the maximum of $j(x)$.

(2) The maximum of $g(x)$ is less than the maximum of $h(x)$.

(3) The maximum of $f(x)$ equals the maximum of $g(x)$.

(4) The maximum of $h(x)$ equals the maximum of $j(x)$.

$\forall x + x + \frac{c}{1} = (x)f$

$\exists 4 + (4 - x) = (x)g$

Use this space for computations.
An example of a sixth-degree polynomial with a leading coefficient of 4 is 

\[ 6x^6 + x^5 + 2x^4 + 9x^3 + x^2 + \frac{9}{2}x - 4 \]
It takes Tim 4.5 hours to run 50 kilometers. Which expression will allow him to change this rate to minutes per mile?

(1)  \( \frac{4.5 \text{ hr}}{50 \text{ km}} \times \frac{1 \text{ mi}}{1.099 \text{ km}} \times \frac{60 \text{ min}}{1 \text{ hr}} \)

(2)  \( \frac{4.5 \text{ hr}}{50 \text{ km}} \times \frac{1 \text{ mi}}{1.099 \text{ km}} \times \frac{60 \text{ min}}{1 \text{ hr}} \)

(3)  \( \frac{4.5 \text{ hr}}{50 \text{ km}} \times \frac{1 \text{ mi}}{1.099 \text{ km}} \times \frac{60 \text{ min}}{1 \text{ hr}} \)

(4)  \( \frac{4.5 \text{ hr}}{50 \text{ km}} \times \frac{1 \text{ mi}}{1.099 \text{ km}} \times \frac{60 \text{ min}}{1 \text{ hr}} \)

When the equation \( \frac{\text{km}}{\text{min}} \times \frac{\text{mi}}{\text{km}} \times \frac{\text{hr}}{\text{mi}} = \frac{\text{mi}}{\text{hr}} \) is solved for \( x \) in terms of \( a \), the solution is

(1)  \( \frac{a}{3} \)

(2)  \( \frac{a}{2} \)

(3)  \( \frac{a}{4} \)

(4)  \( 2 \frac{a}{4} \)

If a sequence is defined recursively as \( u_1 = 1 \) and \( u_n = u_{n-1} - 1 \), then \( u_n \) is

\[ u_n = \frac{1 + n}{1 + n^2} \]

Use this space for computations.
Is the product of \( \sqrt{1024} \) and \(-3.4\) rational or irrational? Explain your answer.

Part II
Describe the transformations performed on the graph of \( f(x) \) to obtain the graph of \( g(x) = (x-3)^2 - 4 \). Work space for question 26 is continued on the next page.
The total profit earned at a garage sale during the first five hours is modeled by the graph shown below.

The profit increases as the hours increase.
Determine the average rate of change, in dollars per hour, over the interval $1 \leq x \leq 4$. Question 27 continued
Work space for question 28 is continued on the next page.

Subtract \(3x(x^2 - 2y)\) from \(6x^2 - 7x\) and express your answer as a monomial.
A function is graphed on the set of axes below.
State the domain of this function.

State the range of this function.
Work space for question 30 is continued on the next page.

30 Solve \(6x^2 + 2x - 6 = 0\) algebraically for the exact values of \(x\).
31. Factor the expression $x^4 - 36x^2$ completely.

Work space for question 31 is continued on the next page.
32. Determine the exact values of \( x \) for \( x^2 - 8x - 5 = 0 \) by completing the square.
33. The graph below models the height of Sam’s kite over a period of time.

The graph shows a change in the kite's height over time, indicating multiple peaks and troughs. The scales on the graph are as follows:

- **Time (in minutes)**: ranging from 1 to 40 (minimum to maximum).
- **Height (in feet)**: ranging from 1 to 20 (minimum to maximum).

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil.
Explain what the zeros of the graph represent in the context of the situation.
On the set of axes below, graph $f(x) = \frac{1}{x^2}$ and $g(x) = 3x$. Question 34 is continued on the next page.
Question 34 continued

Based on your graph, for how many values of $x$ does $f(x)$ equal $g(x)$? Explain your reasoning.
An insurance agent is looking at records to determine if there is a relationship between a driver’s age, \( x \), and the percentage of accidents caused by speeding, \( y \). The table below shows this data.

<table>
<thead>
<tr>
<th>Age (x)</th>
<th>17</th>
<th>18</th>
<th>21</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Accidents (y)</td>
<td>49</td>
<td>47</td>
<td>45</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>21</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

State the linear regression equation that models the relationship between the driver’s age, \( x \), and the percentage of accidents caused by speeding, \( y \). Round all values to the nearest hundredth.
37

Question 35 continued

State the value of the correlation coefficient to the nearest hundredth. Explain what this means in the context of the problem.
Solve the system of inequalities graphically on the set of axes below.

Label the solution set $S$.

$I. 9 + 4x < -y$

$II. 6 > -3y + 2x$

Label the solution set $S$. Solve the system of inequalities graphically on the set of axes on the next page.
Determine if the point \((0,3)\) is a solution to this system of inequalities. Justify your answer.
At an amusement park, the cost for an adult admission is $a$, and for a child the cost is $c$. For a group of six that included two children, the cost was $325.94. For a group of five that included three children, the cost was $256.95. All ticket prices include tax.

Write a system of equations in terms of $a$ and $c$ that models this situation.

Question 37 is continued on the next page.
Determine the cost for a group of four that includes three children.

Use your system of equations to determine the exact cost of each type of ticket algebraically.
Scrap Graph Paper — this sheet will not be scored.
Scrap Graph Paper — this sheet will not be scored.
### High School Math Reference Sheet

#### Triangle

\[ A = \frac{1}{2} \cdot \text{bh} \]

#### Parallelogram

\[ A = \text{bh} \]

#### Circle

- **Area**
  \[ A = \pi r^2 \]
- **Circumference**
  \[ C = \pi d \text{ or } 2\pi r \]

#### General Prisms

\[ V = \text{Bh} \]

#### Pythagorean Theorem

\[ a^2 + b^2 = c^2 \]

#### Quadratic Formula

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

#### Arithmetic Sequence

\[ a_n = a_1 + (n - 1)d \]

#### Geometric Sequence

\[ a_n = a_1 \cdot r^{n-1} \]

#### Geometric Series

\[ S_n = a_1 \cdot \frac{r^n - 1}{r - 1} \]

Where \( r \neq 1 \)

\[ S = \frac{u}{1 - u} \]

- **Sequence** Geometric
- **Sequence** Arithmetic

The Reference Sheet is continued on the next page.
<table>
<thead>
<tr>
<th></th>
<th>Cylinder</th>
<th>Sphere</th>
<th>Cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V = \pi r^2 h$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exponential Growth/Decay</strong></td>
<td>$A = A_0 e^{rt}$</td>
<td></td>
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</tr>
<tr>
<td><strong>Radians to Degrees</strong></td>
<td>$\frac{\pi}{180}$ radians = $\frac{\pi}{\text{degree}}$</td>
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<tr>
<td><strong>Degrees to Radians</strong></td>
<td>$\frac{\pi}{180}$ degrees = $\frac{\pi}{\text{radian}}$</td>
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**Reference Sheet — concluded**