Algebra 2 Honors (IB) Chapter 3 Test

Multiple Choice
Identify the choice that best completes the statement or answers the question.

Solve the following system of equations by graphing.

1. \(2y + 8x = 58\)
   \(y - 5x = 11\)
   a. (2, 21)
   b. (21, 2)
   c. (4, 20)
   d. (1, 21)

Solve each system of equations by using elimination. MUST SHOW ALL WORK

5. \(6a + 6b = 12\)
   \(6a - 5b = 12\)
   a. (1, 0)
   b. (2, 0)
   c. (3, -0.5)
   d. (2, 0.25)

Solve the system of inequalities by graphing.

6. \(x > 2\)
   \(y > 8\)
   a. 
   b. 
   c. 
   d. 

Solve each system of equations by using substitution. MUST SHOW ALL WORK.

4. \(3r + 3s = 9\)
   \(3r - 6s = 18\)
   a. (4, -0.5)
   b. (5.5, 3)
   c. (4, -1)
   d. (2, -1)
Find the coordinates of the vertices of the figure formed by each system of inequalities.

7. \( y + x \geq -9 \)
\( y \geq x - 7 \)
\( 2y + x \leq 16 \)
   a. \((-1, -8), (-30, 23), (-34, 25)\)
   b. \((-1, 8), (10, 3), (34, 25)\)
   c. \((-1, 25), (-34, 3), (10, -8)\)
   d. \((-1, -8), (10, 3), (-34, 25)\)

8. \( y \geq -2 \)
\( 2x + y \leq 2 \)
\( y \leq 2x + 6 \)
   a. \((2, -2), (-4, -2), (-1, 4)\)
   b. \((2, 4), (-1, -2), (-4, -2)\)
   c. \((2, -2), (4, 2), (1, -4)\)
   d. \((2, -2), (4, -2), (0, -8)\)

Given below are some inequalities. Plot the feasible region graphically.

9. \( x \geq 2.8 \)
\( y \leq 4.8 \)
\( 2.8x + 4.8y \leq 9 \)
\( f(x, y) = x - y \)
   a. \(\text{vertices: } (-5.01, 4.8), (2.8, 0.24)\)
\( \text{max: } f(2.8, 0.24) = 2.56 \)
\( \text{min: } f(-5.01, 4.8) = -9.81 \)
   b. \(\text{vertices: } (2.8, 4.8)\)
\( \text{max: } f(2.8, 4.8) = -2 \)
\( \text{min: } f(2.8, 4.8) = -2 \)
As a receptionist for a hospital, one of Elizabeth’s tasks is to schedule appointments. She allocates 60 minutes for the first visit and 30 minutes for a follow-up. The doctor cannot perform more than eight follow-ups per day. The hospital has eight hours available for appointments. The first visit costs $120 and the follow-up costs $70. Let \( x \) be the number of first visits and \( y \) be the number of follow-ups.

10. Write a system of inequalities to represent the number of first visits and the number of follow-ups that can be performed.
   a. \( 60x + 30y \leq 480 \) and \( y \leq 8 \)
      \( x \geq 0 \) and \( y \geq 0 \)
   b. \( 60x - 30y \leq 480 \) and \( y \geq 8 \)
      \( x \geq 0 \) and \( y \geq 0 \)
   c. \( 30x + 60y \leq 420 \) and \( y \leq 8 \)
      \( x \geq 0 \) and \( y \geq 0 \)
   d. \( 60x + 30y \leq 420 \) and \( y \leq 8 \)
      \( x \geq 0 \) and \( y \geq 0 \)

11. List the coordinates of the vertices of the feasible region to represent the number of first visits and the number of follow-ups that can be performed.
   a. \((0, 0), (16, 0), (8, 8), (0, 8)\)
   b. \((0, 0), (8, 0), (4, 8), (0, 8)\)
   c. \((0, 0), (7, 0), (4.5, 8), (0, 8)\)
   d. \((0, 0), (6, 0), (4, 8), (0, 8)\)

12. Determine the number of first visits and follow-ups to be scheduled to make the maximum income.
   a. 16 first visits and 0 follow-ups
   b. 4 first visits and 7 follow-ups
   c. 8 first visits and 0 follow-ups
   d. 4 first visits and 8 follow-ups

13. What is the maximum income that the doctor receives per day?
   a. $960
   b. $1040
   c. $970
   d. $1920

14. Graph the system of inequalities showing the feasible region to represent the number of first visits and the number of follow-ups that can be performed.
15. The annual sales of two companies, X and Y, are 31,000 units and 28,000 units respectively in 2003. If the growth in annual sales of company X is 1300 units and of company Y is 2200 units, write equations that represent the sales, y units, of company X and Y, after x years after 2003.

Equation #1: __________________________

Equation #2: __________________________

16. A rectangular frame is to be designed in such a way that the sum of three times the length and four times the width is less than or equal to 80 inches and the length of the frame is a maximum of 15 inches. Write a system of inequalities to represent the dimensions of the frame. Use \( l \) for length and \( w \) for width.

Inequality #1: ______________

Inequality #2: ______________

Inequality #3: ______________

Inequality #4: ______________
Solve each system of equations by using substitution. MUST SHOW ALL WORK.

17. \[8x + 7y = 18\]
   \[3x - 5y = 22\]

18. \[3p + 9q = 6\]
   \[5p - 5q = 30\]

Given below are some inequalities. Plot the feasible region graphically.

19. \[y \geq -5\]
   \[x \leq 4\]
   \[y \leq x - 4\]
   \[f(x,y) = x + y\]

Solve the following system of equations by graphing.

20. \[y = 11x - 6\]
    \[y = -6x + 11\]
    Label your graph units
Essay

21. The money spent by a particular country on scientific research can be modeled by \( y = 1020x + 46,700 \), and money spent on defense can be modeled by \( y = 5920x + 32,000 \). Here \( x \) represents the number of years in which money is spent and \( y \) represents dollars. Use the information to explain how a system of equations can be used to predict future investments by the government. How reasonable would it be to use this system of equations to predict the money spent in research and defense in 20 years.

Graph and Explain: Label your graph with appropriate units

IB Question 2pts + 3 Extra Credit
Algebra 2 Honors (IB) Chapter 3 Test
Answer Section

MULTIPLE CHOICE

1. ANS: A
   Graph the equations and find their point of intersection.

<table>
<thead>
<tr>
<th>Feedback</th>
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<tbody>
<tr>
<td>A Correct!</td>
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<tr>
<td>B Did you plot the graphs correctly?</td>
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<tr>
<td>C Did you read the intersection of the graphs correctly?</td>
</tr>
<tr>
<td>D What is the x-coordinate of the intersection?</td>
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</table>

   PTS: 1    DIF: Average    REF: Lesson 3-1
   OBJ: 3-1.1 Solve systems of linear equations by graphing.   STA: MA.912.A.3.14 | MA.912.A.3.15
   TOP: Solve systems of linear equations by graphing.    KEY: System of Linear Equations | Graphs

2. ANS: B
   Graph the equations and check the number of solutions.

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<tbody>
<tr>
<td>A Did you check the number of solutions?</td>
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<tr>
<td>B Correct!</td>
</tr>
<tr>
<td>C Are the y-intercepts equal?</td>
</tr>
<tr>
<td>D Did you find the slope of each line?</td>
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</tbody>
</table>

   PTS: 1    DIF: Average    REF: Lesson 3-1
   OBJ: 3-1.2 Determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.   STA: MA.912.A.3.14 | MA.912.A.3.15
   TOP: Determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.   KEY: System of Linear Equations | Consistent System | Inconsistent System
3. **ANS:** B

Graph the equations and check the number of solutions.

<table>
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<tbody>
<tr>
<td>A Are the slopes equal?</td>
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<td>D Did you plot the graphs correctly?</td>
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**PTS:** 1  **DIF:** Average  **REF:** Lesson 3-1  
**OBJ:** 3-1.2 Determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.  
**STA:** MA.912.A.3.14 | MA.912.A.3.15

**TOP:** Determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.  
**KEY:** System of Linear Equations | Consistent System | Inconsistent System

4. **ANS:** C

By using the method of substitution, solve one equation for one variable in terms of the other variable. Then, substitute this expression for the variable in the other equation.

<table>
<thead>
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<tbody>
<tr>
<td>A Recalculate the value of s.</td>
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<tr>
<td>B Did you calculate correctly?</td>
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<tr>
<td>C Correct!</td>
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<tr>
<td>D Recalculate the value of r.</td>
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**PTS:** 1  **DIF:** Average  **REF:** Lesson 3-2  
**OBJ:** 3-2.1 Solve systems of linear equations by using substitution.  
**STA:** MA.912.A.3.14 | MA.912.A.3.15

**TOP:** Solve systems of linear equations by using substitution.  
**KEY:** System of Linear Equations | Substitution

5. **ANS:** B

Use the method of elimination to obtain the required answer.

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<tr>
<td>A Recalculate the value of a.</td>
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<td>B Correct!</td>
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<tr>
<td>C Did you calculate the values correctly?</td>
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<tr>
<td>D Recalculate the value of b.</td>
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</tbody>
</table>

**PTS:** 1  **DIF:** Average  **REF:** Lesson 3-2  
**OBJ:** 3-2.2 Solve systems of linear equations by using elimination.  
**STA:** MA.912.A.3.14 | MA.912.A.3.15

**TOP:** Solve systems of linear equations by using elimination.  
**KEY:** System of Linear Equations | Elimination
6. **ANS: C**  
Both the inequalities should be plotted and the region common to both should be shaded.

<table>
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<tbody>
<tr>
<td>A You have plotted the first inequality incorrectly.</td>
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<td>B You have plotted the second inequality incorrectly.</td>
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<tr>
<td>C Correct!</td>
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<tr>
<td>D You have plotted the inequalities incorrectly.</td>
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PTS: 1 DIF: Average REF: Lesson 3-3  
OBJ: 3-3.1 Solve systems of inequalities by graphing. STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Solve systems of inequalities by graphing. KEY: System of Inequalities | Graphs

7. **ANS: D**  
Solve the system of inequalities by graphing the inequalities on the same coordinate plane. The solution set is represented by the intersection of the graphs.

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<tr>
<td>A Did you plot the inequalities correctly?</td>
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<tr>
<td>B Did you check the sign of the coordinates?</td>
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<tr>
<td>C You have interchanged the coordinates.</td>
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<tr>
<td>D Correct!</td>
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PTS: 1 DIF: Advanced REF: Lesson 3-3  
OBJ: 3-3.2 Determine the coordinates of the vertices of a region formed by the graph of a system of inequalities. STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Determine the coordinates of the vertices of a region formed by the graph of a system of inequalities. KEY: System of Inequalities | Graphs

8. **ANS: A**  
Solve the system of inequalities by graphing the inequalities on the same coordinate plane. The solution set is represented by the intersection of the graphs.

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<td>D Did you plot the inequalities correctly?</td>
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PTS: 1 DIF: Advanced REF: Lesson 3-3  
OBJ: 3-3.2 Determine the coordinates of the vertices of a region formed by the graph of a system of inequalities. STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Determine the coordinates of the vertices of a region formed by the graph of a system of inequalities. KEY: System of Inequalities | Graphs
9. **ANS: D**
Plot all the four graphs and shade the feasible region. Then find the coordinates of the feasible region, maximum value, and minimum value.

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<td>D</td>
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PTS: 1  DIF: Average  REF: Lesson 3-4  
OBJ: 3-4.1 Find the maximum and minimum values of a function over a region.  
STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Find the maximum and minimum values of a function over a region.  
KEY: Maximum Values | Minimum Values

10. **ANS: A**
Form the system of inequalities using the appropriate values.

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<td>D</td>
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PTS: 1  DIF: Average  REF: Lesson 3-4  
OBJ: 3-4.2 Solve real-world problems using linear programming.  
STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Solve real-world problems using linear programming.  
KEY: Linear Programming | Real-World Problems

11. **ANS: B**
Write the system of inequalities and then graph them. Plot the feasible region to find the vertices.

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PTS: 1  DIF: Advanced  REF: Lesson 3-4  
OBJ: 3-4.2 Solve real-world problems using linear programming.  
STA: MA.912.A.3.14 | MA.912.A.3.15  
TOP: Solve real-world problems using linear programming.  
KEY: Linear Programming | Real-World Problems
12. ANS: D
Find out the vertices of the feasible region that represents the number of the first visits and the number of the follow-ups. Then, substitute the vertices in the required function.

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PTS: 1  DIF: Advanced  REF: Lesson 3-4
OBJ: 3-4.2 Solve real-world problems using linear programming.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve real-world problems using linear programming.
KEY: Linear Programming | Real-World Problems

13. ANS: B
Substitute the coordinates of the vertices of the feasible region into the required function.

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PTS: 1  DIF: Advanced  REF: Lesson 3-4
OBJ: 3-4.2 Solve real-world problems using linear programming.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve real-world problems using linear programming.
KEY: Linear Programming | Real-World Problems

14. ANS: A
Write the system of inequalities and then plot the graph.

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PTS: 1  DIF: Advanced  REF: Lesson 3-4
OBJ: 3-4.2 Solve real-world problems using linear programming.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve real-world problems using linear programming.
KEY: Linear Programming | Real-World Problems
SHORT ANSWER

15. ANS:

\begin{align*}
  y &= 31,000 + 1300x \\
  y &= 28,000 + 2200x
\end{align*}

Write a system of equations for the number of years and the annual sales of the companies.

PTS: 1    DIF: Basic    REF: Lesson 3-1
OBJ: 3-1.3 Solve systems of linear equation by graphing and determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve multi-step problems.
KEY: Multistep Problems

16. ANS:

\begin{align*}
  l &\geq 0 \\
  w &\geq 0 \\
  3l + 4w &\leq 80 \\
  l &\leq 15
\end{align*}

\( l \) represents the length and \( w \) represents the width of the frame.

Read each statement carefully and write a system of inequalities for the situation.

PTS: 1    DIF: Basic    REF: Lesson 3-3
OBJ: 3-3.3 Solve systems of inequalities by graphing and determine the coordinates of the vertices of a region formed by the graph of a system of inequalities.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve multi-step problems.
KEY: Multistep Problems

17. ANS:

\((4, -2)\)

By using the method of substitution, solve one equation for one variable in terms of the other variable. Then, substitute this expression for the variable in the other equation.

PTS: 1    DIF: Average    REF: Lesson 3-2
OBJ: 3-2.1 Solve systems of linear equations by using substitution.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve systems of linear equations by using substitution.
KEY: System of Linear Equations | Substitution

18. ANS:

\((5, -1)\)

Use the method of elimination to obtain the required answer.

PTS: 1    DIF: Average    REF: Lesson 3-2
OBJ: 3-2.2 Solve systems of linear equations by using elimination.
STA: MA.912.A.3.14 | MA.912.A.3.15
TOP: Solve systems of linear equations by using elimination.
KEY: System of Linear Equations | Elimination
19. **ANS:**

![Graph showing vertices and feasible region](image)

vertices: \((4, -5), (4, 0), (-1, -5)\)

max: \(f(4, 0) = 4\)

min: \(f(-1, -5) = -6\)

Plot all the four graphs and shade the feasible region. Then find the coordinates of the feasible region, maximum value, and minimum value.

**PTS:** 1  
**DIF:** Average  
**REF:** Lesson 3-4

**OBJ:** 3-4.1 Find the maximum and minimum values of a function over a region.

**STA:** MA.912.A.3.14 | MA.912.A.3.15

**TOP:** Find the maximum and minimum values of a function over a region.

**KEY:** Maximum Values | Minimum Values

20. **ANS:**

\((1, 5)\)

Graph the equations and find their point of intersection.

**PTS:** 1  
**DIF:** Average  
**REF:** Lesson 3-1

**OBJ:** 3-1.1 Solve systems of linear equations by graphing.

**STA:** MA.912.A.3.14 | MA.912.A.3.15

**TOP:** Solve systems of linear equations by graphing.

**KEY:** System of Linear Equations | Graphs
ESSAY

21. ANS:
We can make use of the system of equations to find the money spent on scientific research and defense, and can also make predictions about future spending by looking at the trends in the graph. The coordinate (3, 49,760) represents that in 3 years, both the investment in scientific research and defense will be $49,760. It is unreasonable to use the system of equations to predict the money that will be spent on scientific research and defense in 20 years. The predictability is accurate only for short periods of time.

Plot and interpret the given system of equations.

Assessment Rubric

Level 3 Superior
* Shows thorough understanding of concepts.
* Uses appropriate strategies.
* Computation is correct.
* Written explanation is exemplary.
* Diagram/table/chart is accurate (as applicable).
* Goes beyond requirements of problem.

Level 2 Satisfactory
* Shows understanding of concepts.
* Uses appropriate strategies.
* Computation is mostly correct.
* Written explanation is effective.
* Diagram/table/chart is mostly accurate (as applicable).
* Satisfies all requirements of problem.

Level 1 Nearly Satisfactory
* Shows understanding of most concepts.
* May not use appropriate strategies.
* Computation is mostly correct.
* Written explanation is satisfactory.
* Diagram/table/chart is mostly accurate (as applicable).
*Satisfies most of the requirements of problem.

**Level 0 Unsatisfactory**
*Shows little or no understanding of the concept.
*May not use appropriate strategies.
*Computation is incorrect.
*Written explanation is not satisfactory.
*Diagram/table/chart is not accurate (as applicable).
*Does not satisfy requirements of problem.

PTS: 1  DIF: Advanced  REF: Lesson 3-1
OBJ: 3-1.3 Solve systems of linear equation by graphing and determine whether a system of linear equations is consistent and independent, consistent and dependent, or inconsistent.
KEY: Problem Solving