Optimization Unit Summative Project

This summative project is made up of two sections (Annotated Solution and Create Your Own Question), designed to determine your understanding of linear optimization. A summary of each section is given in the table below.

Please be aware of deadlines as some sections require you to get peer feedback.

1) **Annotated solution – due Oct. 11, 2023**
   a. Draft
      i. In pairs or groups of 3
      ii. Each person in your group works on a different question (A, B, or C)
      iii. Individually solve your question
      iv. In your solution, make sure to:
         1. Label each step
         2. Explain (in words) what you are doing in that step and why
   b. Peer Feedback
      i. Look at a solution from someone in your group who worked on a different question
      ii. Identify anything that is incorrect and/or unclear
         1. Write at least 2 things that make the solution or explanation great
         2. Write at least 2 things that could be changed to make the solution or explanation even better
   c. Final
      i. Fix your solution and explanation based on your group feedback and write a final copy
      ii. Turn in your draft, peer feedback, and final copy

2) **Create Your Own Question – Due Oct. 11, 2023**
   a. Draft
      i. Fill in the draft assignment sheet for this section. Note: This must be **your own** example and not one from class or your notes.
   b. Peer Feedback
      i. In pairs or groups of 3
      ii. Read through the draft assignment sheet for someone else in your group. Do the statements translate to the inequalities? Graph the inequalities. Do they form a polygon of constraints?
      iii. Complete the feedback sheet.
   c. Final
      i. Complete the final assignment sheet for this section
      ii. Turn in your draft, peer feedback, and final copy
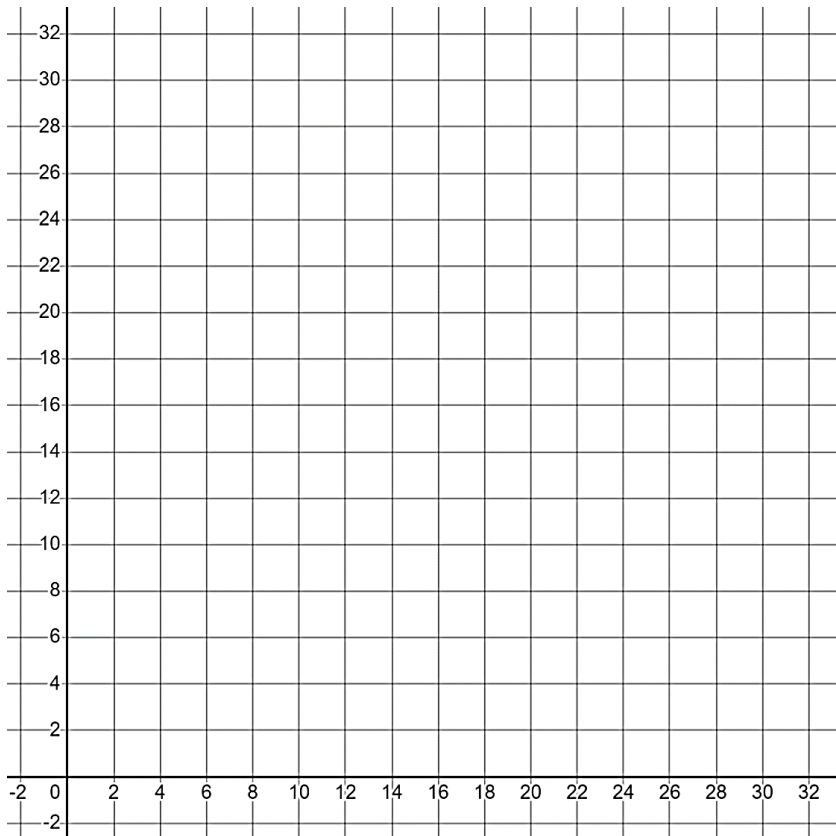
Annotated Solution Assignment A

Draft

Solve the following linear optimization question. Make sure to: 1) label each step; 2) explain what you are doing in each step; 3) explain why you are doing it.

Mackenzie is selling tulip bulbs as part of the school band fundraiser.   They will offer a choice between red tulip bulbs and orange tulip bulbs. Mackenzie's sales are limited by the following constraints:

- Mackenzie can sell a maximum of 30 bulbs per day.
- Mackenzie must sell a minimum of 8 red bulbs per day.
- Mackenzie sells at most twice as many red bulbs as orange bulbs.

Mackenzie earns $1 for every red bulb sold and $2 for every orange bulb sold.

What is the maximum profit Mackenzie can earn each day?

PEER FEEDBACK

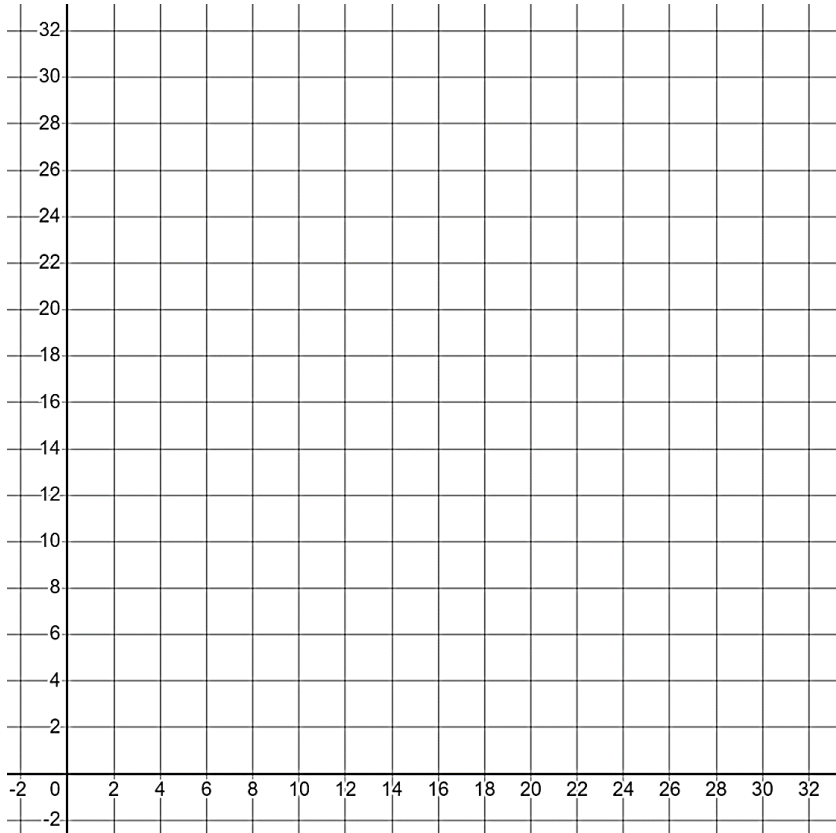| Reviewer's Name:	
2 Positive Comments (be specific)	**2 Suggestions for Improvement (be specific)**

Solve the following linear optimization question. Make sure to: 1) label each step; 2) explain what you are doing in each step; 3) explain why you are doing it.

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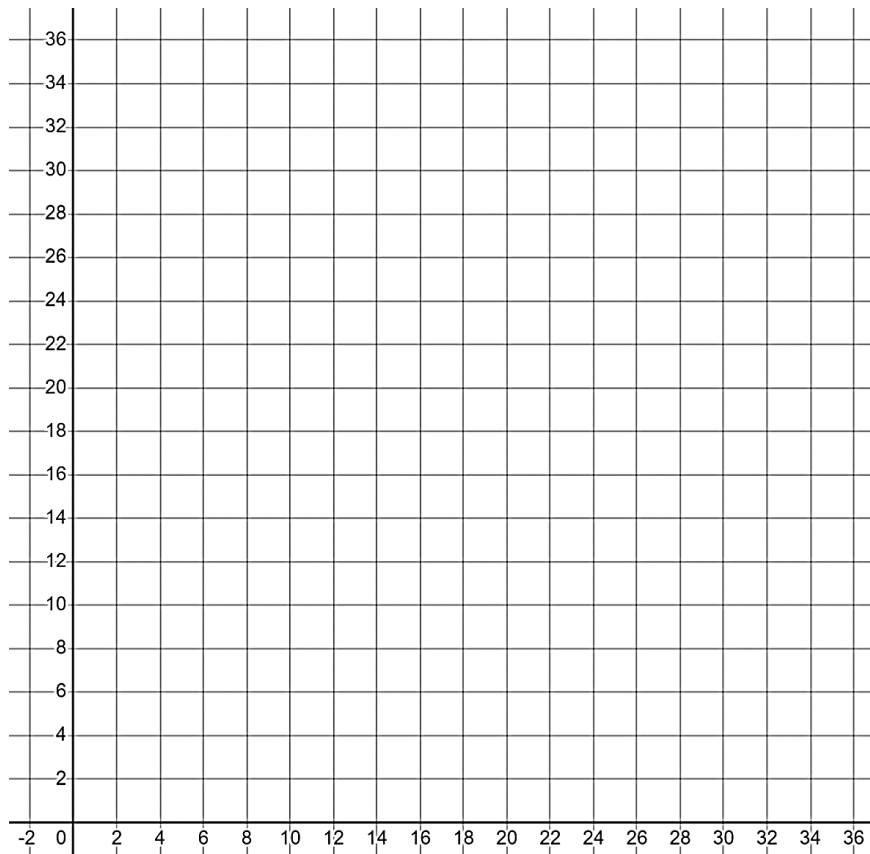**What is the maximum profit Mackenzie can earn each day?**

Annotated Solution Assignment B

Draft

Solve the following linear optimization question. Make sure to: 1) label each step; 2) explain what you are doing in each step; 3) explain why you are doing it.

Mohammad loves to read and has been building a collection of his favorite books. Mohammad's favorite genres of books are graphic novels and historical biographies. While Mohammad does not know precisely how many of each type of book he has, he does know the following:

- Mohammad has a maximum of 36 books
- Mohammad has at least 8 historical biographies
- Mohammad has no fewer than half as many graphic novels as historical biographies

Mohammad paid an average of $18 for each graphic novel and $22 for each historical biography.

What is the minimum amount of money Mohammad could have spent on his collection?

PEER FEEDBACK

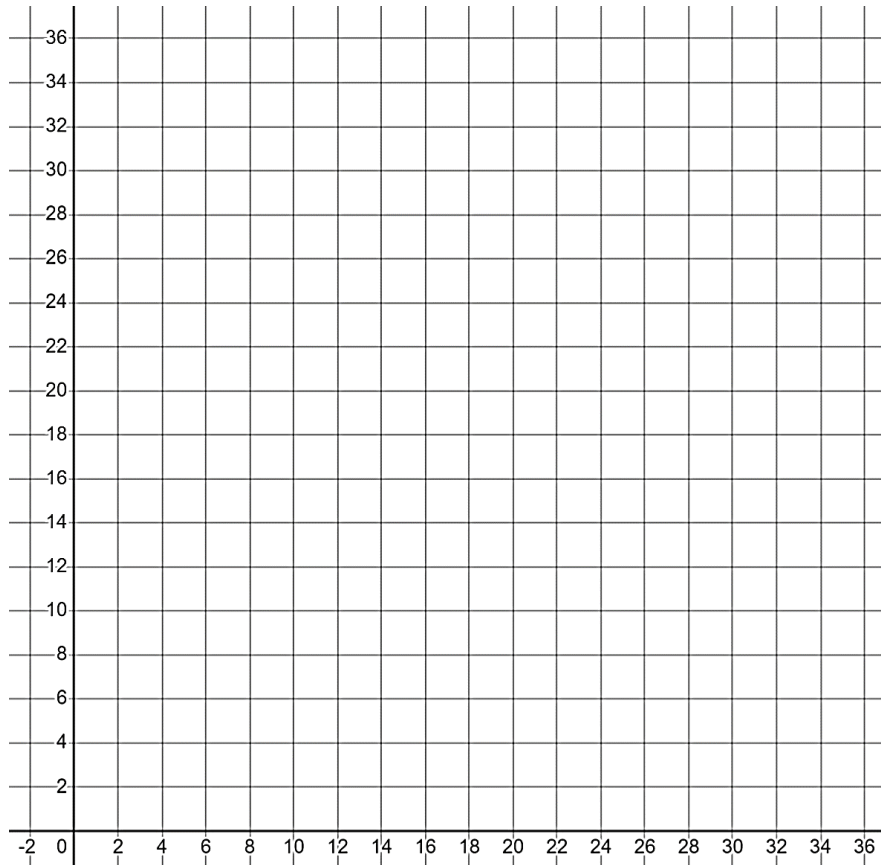| Reviewer's Name:	
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Final

Solve the following linear optimization question. Make sure to: 1) label each step; 2) explain what you are doing in each step; 3) explain why you are doing it.

Mohammad loves to read and has been building a collection of his favorite books. Mohammad's favorite genres of books are graphic novels and historical biographies. While Mohammad does not know precisely how many of each type of book he has, he does know the following:

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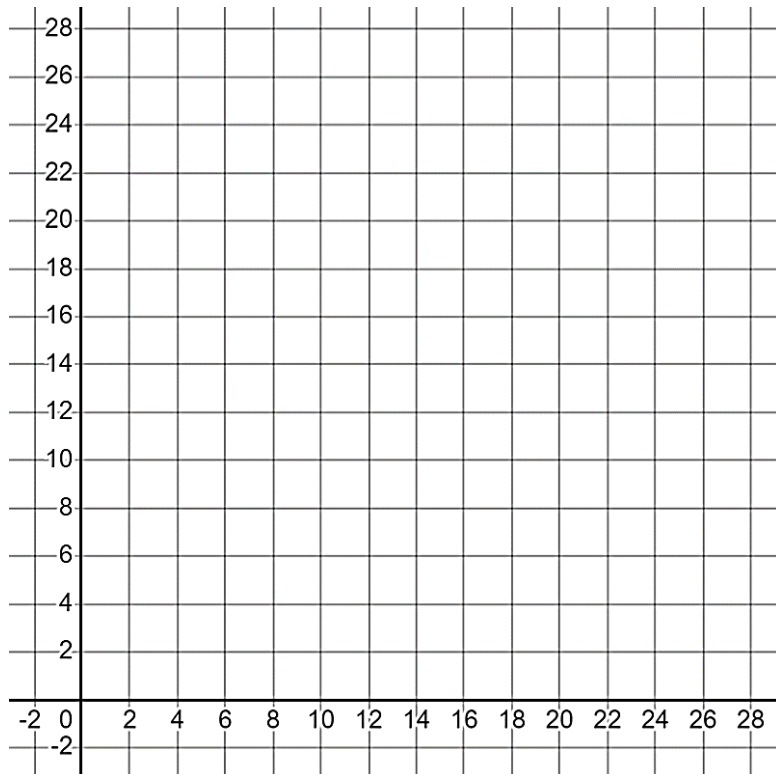**What is the minimum amount of money Mohammad could have spent on his collection?**

Annotated Solution Assignment C

Draft

Solve the following linear optimization question. Make sure to: 1) label each step; 2) explain what you are doing in each step; 3) explain why you are doing it.

Vikram is a talented artist and has created designs to screen print on clothing. He will screen print on t-shirts and hoodies, which he will then sell. The numbers of t-shirts and hoodies Vikram can make each month must adhere to the following constraints:

- He can screen print no more than 24 pieces of clothing each month
- He can screen print a maximum of three times as many t-shirts as hoodies
- He can screen print a minimum of 6 t-shirts

Vikram will sell each t-shirt for a profit of $12 and each hoodie for a profit of $23.

What is the maximum profit Vikram can earn each month?

PEER FEEDBACK

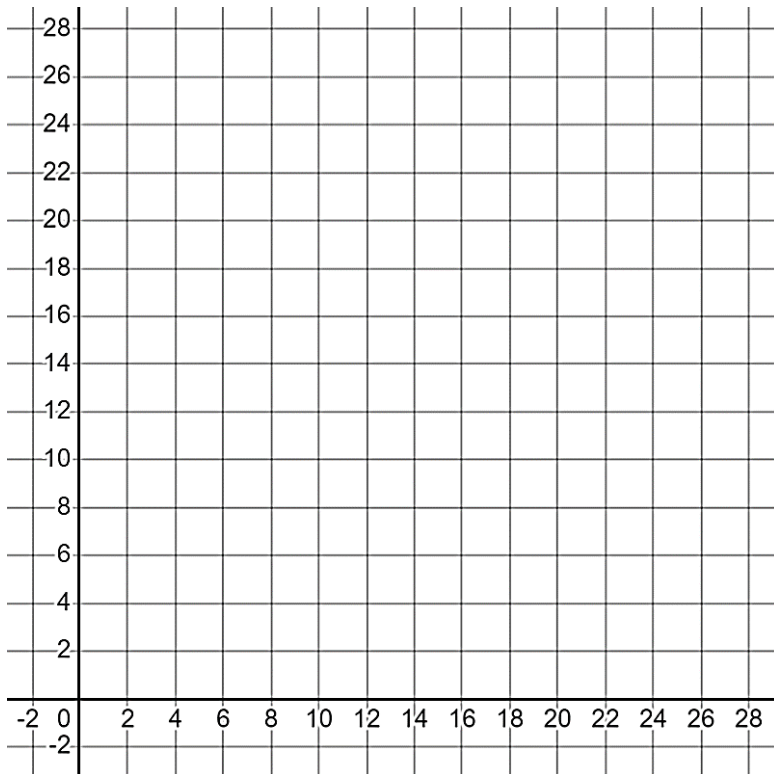| Reviewer's Name:	
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Vikram will sell each t-shirt for a profit of $12 and each hoodie for a profit of $23.

What is the maximum profit Vikram can earn each month?

CREATE YOUR OWN QUESTION

Draft

1) Linear optimization often deals with buying, selling, or collecting two things. Do you want your question focused on buying, selling, or collecting?
   Ex: My scenario will focus on selling.

2) For linear optimization, we can only have two variables. This means your situation can only involve buying, selling, or collecting *two different things*. What two things are you buying, selling, or collecting?
   Ex: I will be selling <u>cupcakes</u> and <u>cookies</u>.

3) Write 2-3 sentences to describe your scenario.
   Ex: PWHS students are holding a bake sale fundraiser for Prom. They are selling cupcakes and cookies. The number of each item the students sell must follow the constraints below.

4) Create at least 4 different linear inequalities that combine to create a polygon of constraints. You can either come up with your inequalities and then graph them to check that they make a polygon, or you can first graph inequalities that create a polygon and then find the rule of each inequality. Use the graph below.
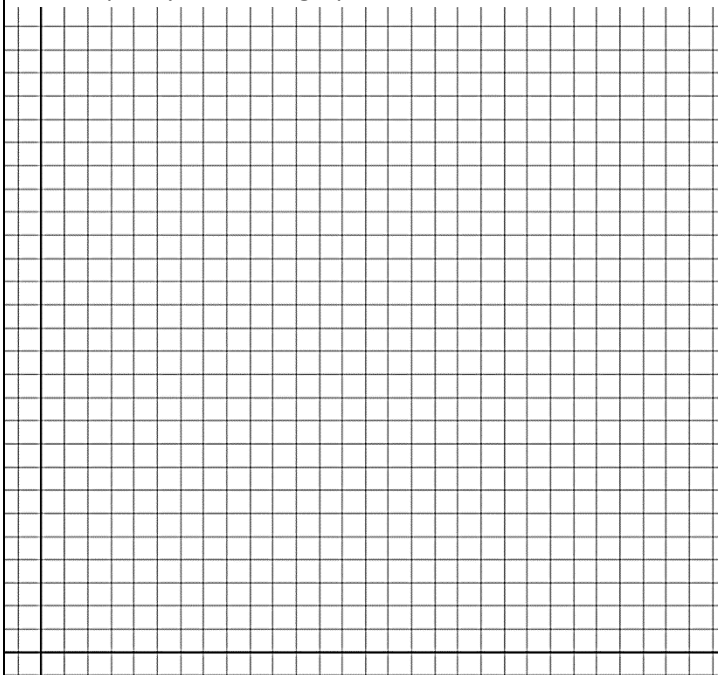
   Inequality 1:

   Inequality 2:

   Inequality 3:

   Inequality 4:

5) Create a statement corresponding to each inequality.
   Ex: If I had the inequality:$x + y \leq 20$, I could write: The students sell a maximum of 20 treats.

   Statement 1:

   Statement 2:

   Statement 3:

   Statement 4:

6) What is the cost of profit for each item you are buying, selling, or collecting? You get to make up these values.
   Ex: The students earn a profit of $1 for every cupcake they sell and $0.75 for every cookie they sell.

7) Write an equation for profit or cost (depending on your question).
   Ex: $Profit = 1x + 0.75y$

8) Ask a question about the maximum or minimum cost or profit.
   Ex: What is the maximum profit the students could earn on this bake sale?

PEER FEEDBACK

Reviewer's Name:

Change each statement into an inequality. Are these the same inequalities as your partner created? If not, how can you change the statement to match the inequality?

Graph the inequalities. Do they create a polygon of constraints? If not, what needs to change in order to have a polygon of constraints?
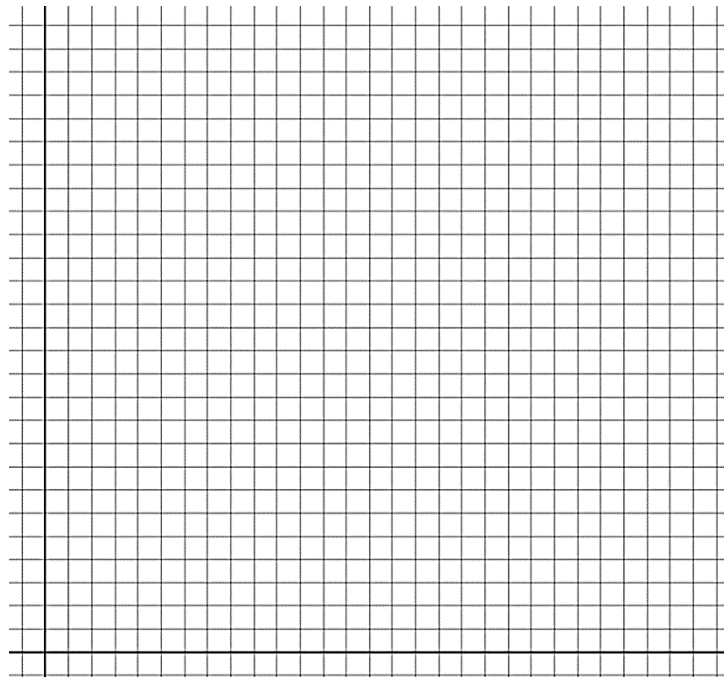
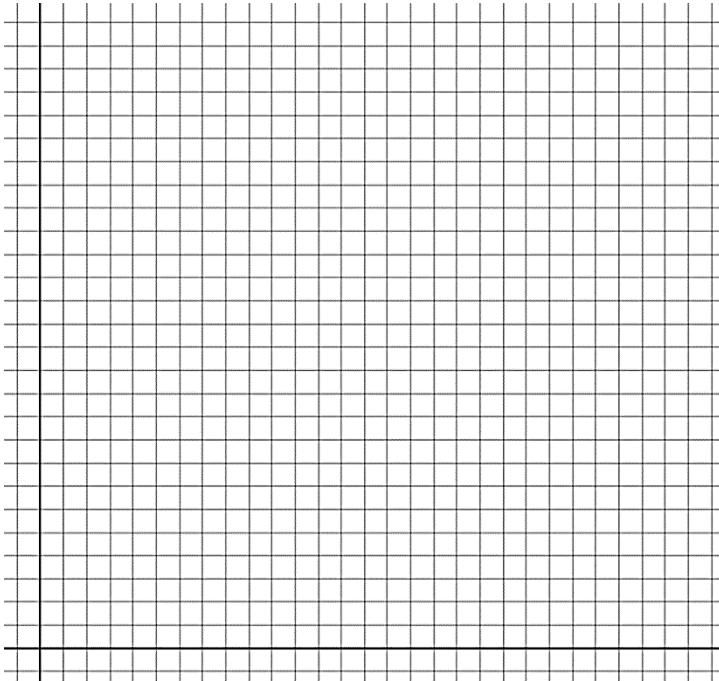| 2 Positive Comments (be specific)	2 Suggestions for Improvement (be specific)

CREATE YOUR OWN QUESTION

Final

Write out your complete question (making any necessary changes from the feedback) **_and solve it_**.

Explanation of situation (question 3 on draft):

Constraint statements (question 5 on draft) :

Profit/Cost statement (question 6 on draft) :

Ask a Question (question 8 on draft) :