Grade/ Grade Band: 11-12th grade college algebra	**Topic/Title: Linear Programming**

Brief Class Description (contextual information including number of students, subject, level, IEP/ELL/GT or other special considerations):. Mod 4: 12:55-2:15

There are no more than 30 students in this class. The classroom is set up in tables of 4, but in this class not all the seats are taken. There are also a few students with 504s in this class. The first student needs strategies to keep his attention, notes from the teacher, a check in/check out, and reduction of distractions. The second student needs alternative sharing methods than in front of the entire class, and has a nurse/counselor pass if needed. The third student needs chunking, visual cues, and computer access when needed. All of the students get extended time for tests as well. There are a couple tables of students that are all friends; therefore they talk quite a bit. There is also a student on the football team who recently got a concussion and therefore has sensitivity to light, abnormal sleeping patterns, and other symptoms. This student can choose to have a lighter load of content if needed but seems to be doing pretty well. If this student does not participate as much during the lesson that is acceptable.

Brief Lesson Description (Overview/Abstract):
Students are exploring how to solve linear programming problems and then practicing what they discovered using technology

Objective(s): I can extend my knowledge of solving systems of inequalities by solving linear programming problems

Prior Student Knowledge:	**Possible Preconceptions/Misconceptions:**
Solving systems of equations given as equations and as word problems Solving systems of inequalities in equation format Graphing inequalities Graphing equations	Students will not realize that the optimum value of a linear programming problem is at the coordinate of one, two, or a line between vertices of the region of feasible solutions.
Common Core Standards: CCSS.MATH.CONTENT.HSA.REI.D.10 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). CCSS.MATH.CONTENT.HSA.REI.D.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	**Standards for Mathematical Practices:** Use appropriate tools strategically. Make sense of problems and persevere in solving them.

Required materials:	**Safety considerations:**	**Technology Integration/Needs:**
Graph paper Colored pencils Desmos app Qr code reader or online app for padlet and kahoot Kahoot app Graphing calculator Math notes (student possession)	N/A	Projector Document Camera Student cell phones: Desmos app, QR code reader, Padlet, kahoot

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions. Include timing/pacing, adaptations (IEP, ELL, culture, other) and transitions.
(7 minutes)(73 minutes left)
Setup: Students should have already downloaded the Desmos app on their phones as homework. They may need a quick explanation of how it works.
Materials: Powerpoint is shown on board.
Task: Use powerpoint and a projector to show a more simple and relatable linear programming problem, do a Notice and Wonder with the students. What do they notice about the problem, what are their questions about it? The powerpoint is titled Linear Programming at the top, and students will be instructed to write the title along with the problem in their notes.
Have students read the problem out loud
If students don't notice or wonder enough, ask how can algebra help solve this problem (how can we use math to figure out the answer? We can come back to this) (if they don't recognize where we are going form this)
Problem: A movie theater contains 500 seats. For an upcoming showing of It, the theater sells $11 and $15 dollar tickets. They must sell at least 200 $11 dollar tickets and 100 $15 dollar tickets for the movie to be shown, and the theater must make at least $2000 dollars to break even. How many tickets at each price should be sold to maximize income? What is the maximum income?

Instructions:

- *"You had instructions to download Desmos on your phone for homework, right? If you haven't already do it now."*
- *"Look at this problem on the board. Who can read it out loud for me?"*
- *"What do you notice about it, and what do you wonder? What questions do you have? Talk with your tables for a minute and be prepared to share your thoughts."*
    - "It's asking for a value"
    - "Those are expensive movie tickets"
    - "This is kindof like a word problem for system of equations"
    - "Since we learned about systems of inequalities yesterday this is probably a word problem for that"
- If students do not have a lot to say *"How can we use algebra or other types of math to figure out the solution to this?"*
- *"Does everyone know how to use desmos, or do we need a real quick tutorial?"*

Transition: "Let's explore how to solve a problem like this."
Differentiation: Having a student read the problem out loud will help students in the back of the classroom, and also students that need verbal cues. Notice and Wonder is an instructional strategy that centers on students and their inquisitive thinking. Students may discover more if they can talk out their thoughts to others. Turn and Talk is also an instructional strategy that helps students relax in whole group discussion because they have already talked their answers out with their peers and have confidence in their thoughts.

Comment [CT1]: The projector screen in this classroom is relatively close to the wall, therefore the screen projected is small. In the future, I need to make the font of my powerpoint slides bigger so that I can guarantee students can see it. This would ensure that students can read the slides in order to process and comprehend the information on them.

EXPLORE/EXPLAIN Cycle(s)

EXPLORE: Include description of student centered tasks with information on timing/pacing, differentiation, material management, grouping, adaptations (IEP, ELL, culture, other), probing or clarifying questions with answers, and transitions.

(20 minutes including instruction)(53 minutes left)

Setup: Students are in tables of three or four, so they are being let go to explore how to solve a linear programming problem. The problem being solved along with the questions "What are the steps to solving this?" and "think about what might be the definition of linear programming?" will be projected so students have a goal. They are familiar with the steps of solving systems of equations and inequalities, so they know how to start the step process. They can use graphing calculators, Desmos, graph paper, and their table mates to find the steps.

Materials: Students have been told to bring graph paper and colored pencils to class; this class in particular knows to get a graphing calculator at the beginning of class; and they will be using their phones with the Desmos app.

Task: A problem will be projected on the board (not the engagement problem). Students will take 5 minutes to figure out the constraints of the problem, and then they will stop. These 5 minutes will be timed with a timer. After their time is up, groups will switch papers with another (assigned) table and check, compare, and critique the constraints. After 3 minutes of comparing and critiquing with instructions to write down what they found, the groups will get their papers back. Then they will graph the constraints using Desmos or a graphing calculator and find the steps to solving a linear programming problem.

If there are groups that already have all 5 steps, they can move on to the second question of "What might be the definition of linear programming?" and/or "What is the difference of solving a system of inequalities and a linear programming problem?"

Most groups will get stuck when they need to substitute in values to get the optimum value. Ideally students will start to pick random points and substitute them into the objective function to see if they find a pattern. This is where we will stop the exploration.

Instructions:

- *"On the board is a linear programming problem. In your groups, take 5 minutes to figure out any inequalities that would be constraints or limitations on a graph. Write these constraints on graph paper,* ***and each person in the group should be writing.*** *After those 5 minutes, we will switch papers with a table next to you and compare or contrast your constraints with theirs. Think about what they did! Does it make sense? Would it help solve the problem?"*
- *"5 minutes are up! Switch papers with the table next to you and compare your limitations to theirs. You should write down what you think! You have 3 minutes."* Use names
- *"3 minutes are up, now switch back papers and start to explore and try to discover how to solve this problem. You can use Desmos, a graphing calculator, and your notes to figure it out."*
- *"Is everyone at the point where you may need to substitute in points to find the maximum value?"*

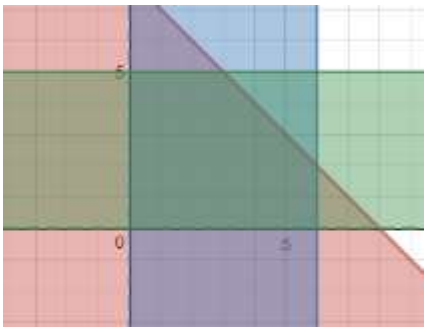
1. A machine can produce Iphone 7 or Iphone X, but not at the same time. The machine can be used for at most 8 hours a day. Also, at most 6 hours a day can be used for making Iphone 7s and at most 5 hours a day can be used for making Iphone Xs. There is a $50 profit for each hour the machine makes Iphone 7s and a $75 profit for each hour the machine makes Iphone Xs. How many hours per day should the machine make each item in order to maximize profit? What is the maximum profit per day?

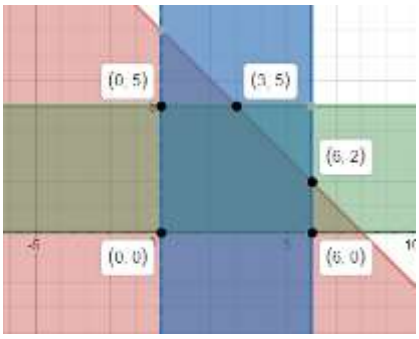
    a. Constraints: x=hours per day machine makes iphone 7; y-=hours per day machine makes iphone X. $x+y \leq 8$, $x \leq 6$, $y \leq 5$

Comment [CT2]: Since the board is difficult to read, have a handout with this problem on it so that students have a hard copy to write on as they explore the steps of solving. This will allow them to write and articulate their thoughts. This will allow students to achieve more of the discovery part of the lesson.

Comment [CT3]: At this time during the implementation of the lesson I made this part very chunked, but I should have made it more explorative and let students have a longer time by themselves to struggle and discover. That way they comprehend more of why they need to do what they do to solve.

b. Objective function is P=50x+75y

c. 

d. 

e. P=50(0)+75(5)=375

P=50(3)+75(5)=525

P=50(6)+75(2)=450

P=50(6)+75(0)=300

f. The feasible maximum profit lies at the point (3,5), and the value is $525.

Transition: "Don't you wish someone would tell you the secret to solving this?"
Differentiation: Using a timer and telling the students how much time they have left is a good way to chunk material so that students don't get overwhelmed. Use of technology brings engagement into what the students are doing, and the problem is relatable to them by the topic of cell phones. The students in this class are all attached to their phones. Then when students start to get stuck or frustrated with finding the optimum value, stopping the exploration will prevent any irrational frustration or stress.

EXPLAIN (STUDENT CENTERED): Include description of cognitive outcome (concepts and vocabulary), student centered explanation (tasks) with information on timing/pacing, grouping, adaptations (IEP, ELL, culture, other), probing or clarifying questions with answers, and transitions. Also include "look fors" and how this part helps students "bring the pieces together". (30 minutes)(23 minutes left)
Setup: Shown on the board will be the problem students were just exploring along with the question

"What steps did you do to solve this?" Also prepared is a slide about why testing the vertices works, so students have a more in depth understanding than just telling them "hey this works just trust me"

Materials: Students are still using the graph paper that they previously worked with along with colored pencils. The powerpoint is prepared with practice problems for students to work on with their tables, and students have their math notes to copy things from the powerpoint down.

Task: We will discuss and explore how the different groups solved the problem and/or came up with the steps. When I call on a student, they have the option of explaining what steps they came up with and how, or coming up to the front and explaining to the class what they did to solve this problem, and show the graph under the document camera on their Desmos app or graphing calculator. If a student chooses the latter, they will explain what they did to solve the problem. After they are done, the whole class will try and come up with the formal steps to solve a linear programming problem. Students will get stuck at substituting in the vertices for optimum values, so I will tell them that if we were to pick a random optimum value for our objective function and then add or subtract to it to get a point in the region of feasible solutions, that point would end up being one of the vertices or a line between two of the vertices. To explain this, I will have Example 3 from the book shown on the powerpoint with figures showing this proof. Students also need to figure out that since there are infinitely many points in the region they cannot possible test each point.

Then after the students have discovered all the steps to solve, they will be projected

g. Write constraints
h. Graph
i. Identify vertices
j. Test the value of objective function at vertices
k. Determine optimal value

After the steps have been projected, students will be instructed to write them down in their notes. Also, students will take their graph paper and plot the line of optimum value (the objective function = optimum value) to practice finding y-intercepts and slope of an inequality After that, more practice problems that are from book (cause curriculum) or very relatable (like cell phones or cars) will be projected one at a time and students will use Desmos to solve each problem. For each problem, a student will come up to the board and write what they did and show their graph on Desmos under the document camera.

After all the problems are solved, I will ask the students "What do you think the definition of a linear programming problem is?" They can make conjectures based on the problems they just solved, what they have in common, and the steps to solving that they discovered. Students will turn and talk for a few minutes with their tables and be instructed "prepare to share your answer" and then after 1-2 minutes, a student from each table will share the group answer. For the definition of linear programming have them get to finding the coordinate pair that will give the optimum value.

Then the definition of linear programming will be projected onto the board when all groups have shared their answers.

Instruction:

- *"What did you come up with as steps to solve this problem?"*
  - "Write what x and y are."
  - "Translate the numbers and words into inequalities."
  - "Graph the inequalities"
  - "Find the value should be the last step."
- *"Who tried to find coordinates to substitute into the main inequality in order to find the maximum profit?"* [raise hands] *What did you find?"*
  - "The bigger x and y are, the bigger the maximum value is"
  - MAYBE: "The biggest value happened at a corner point of the really shaded region."
- *"This is the secret to solving for the optimum value: The minimum or maximum will always happen at a vertex or a line between two vertexes. Test this! Take a couple minutes to find the*

Comment [CT4]: This slide has two pictures from the book on it, but they are small and hard to read from the back of the classroom. Therefore these slides or just the pictures themselves should be on a handout so that students can take notes and see it up close to comprehend what I am saying. This is the key part of solving for linear programming so it is important that they understand and know how to do it.

Comment [CT5]: During implementation I gave them 2 minutes to write them down, but I should have either given them more time or had them on a handout. Since I wanted them to write it down to really process the steps and their thinking, in the future I should give them more time, about 5-6 minutes instead of 2. I should also not tell them they have limited time at the beginning so that they are not rushsed to just write and not process; I will walk around the classroom and observe how far along writing they are and then when most students are at step 4 I will give them 1.5 more minutes to write and process.

Comment [CT6]: Again have these on a handout so that students can have the words in front of them to underline key information and read it easier.

vertexes of the shaded region and see what the maximum profit is."

- *"What maximum value did everyone get?"*
  - "The maximum profit is $525 and it was at (3,5)"
  - "That means that the machine needs to make Iphone 7s for 3 hours and Iphone Xs for 5 hours to get maximum profit."
- *"To show how this works, I have here an example from the book. See this image is the really shaded region between all the intersections of the constraints. Can anyone tell me how many points are in this region?"*
  - "Infinite."
- *"Exactly, so it is impossible to test every single one!"*
- *"But if we choose some random number for our equation to be equal to, here they have 7000, then the points aren't in the REGION OF FEASIBLE SOLUTIONS (the shaded region). But then see here they lower it until they get a line that hits a point that IS in the region of feasible solutions and that point is the vertex."*
- *"Who can explain this proof and what it means to me in their own words?"*
  - "If we pick a random point and then move it around until it get to where it both hits the shaded region and it is the biggest number it can be, the point the line hits is the corner point."
  - "It means that whatever value we are looking for will always be at a vertex of the shaded region."
- *"On the board now are the formal steps of solving a linear programming problem. You should definitely write it in your notes."*
- *"Now that you know the steps and have seen the answer to our problem, what is the inequality for amount of profit that could be made?"*
  - "$50x+75y \leq 525$"
- *"Graph that by on your graph paper with colored pencils."*
- *"Make sure your name is on that graph paper because Mrs. Pahr is collecting it."*
- *"Now that we know all the steps, let's solve some more problems! Who recognizes this problem? It's the one we looked at the beginning of class, that's right! "*
- *"Using the steps we know, take the next few minutes to solve this with your tables."*
- *"[student A], would you come up to the board and write how you solved this? You can put your phone under the document camera to show us your graph."*
- *"Did anyone come up with something different?"*
- *"Who wants to read the next problem out loud?"*
- *"Go ahead and solve this at your tables."*
- *"[student B], want to come up and show how you solved this? Bring your phone so we can see your graph."*
- *"Based on the problems we've done and reviewed, which all used linear programming to find a solution, revisit what you think linear programming is. Talk with your tables for a minute and be prepared to share your answer."*
- *"[student D] what did your table say?"*
- *"Did anyone's table say something different?"*
- *"[student C] I heard some good things from your table. What did you all come up with as a definition?"*
  - "We said it was trying to find the maximum value of something."
  - "But the last problem we just did had minimum cost, so it's trying to find some kind of minimum or maximum value."
  - "It's definitely finding a number."

Comment [CT7]: During implementation I did not give the students enough time to explore through the vertices and come up with a conclusion. In the future I should give them more than enough time and also do some small group differentiation for students that still do not understand. This way students will not get as frustrated and annoyed.

Comment [CT8]: MORE TIME

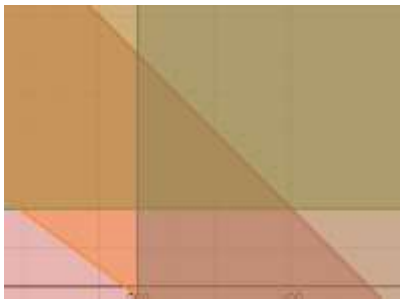
- "Using systems of inequalities to find some really great number."

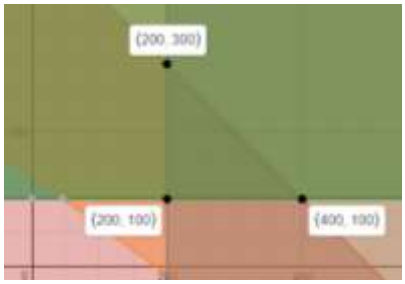
- *"All of those were wonderful definitions, all leading up to the definition in your textbook! Here it is. Who wants to read it?"*
- *"How is this the same or different from what you just said?"*

1. A movie theater contains 500 seats. For an upcoming showing of [movie], the theater sells $11 and $15 dollar tickets. They must sell at least 200 $11 dollar tickets and 100 $15 dollar tickets for the movie to be shown, and the theater must make at least $2000 dollars to break even. How many tickets at each price should be sold to maximize income? What is the maximum income?

a. Constraints: x=number of tickets sold at $11; y=number of tickets sold at $15; $x+y \leq 500$, $x \geq 200$, $y \geq 100$, $11x+15y \geq 2000$

b. Objective function is I=11x+15y

c. 

d. 

e. I=11(200)+15(300)=6700

I=11(400)+15(100)=5900

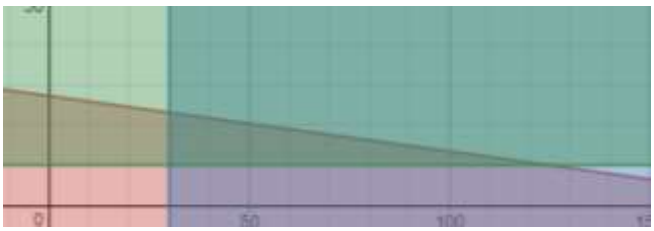
I=11(200)+15(100)=3700

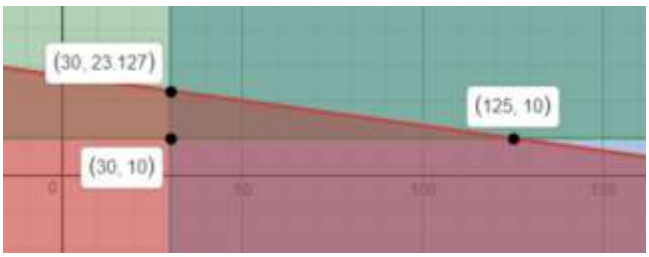
f. The feasible maximum income lies at the point (200,300) and the value is $6700.

2. Shawn has to buy some Chick Fil A for his friends get together. He needs at least 30 chicken nuggets and at least 10 milkshakes. He can choose between the nuggets which cost $0.38 per nugget and small milkshakes for $2.75 each. Shawn has a total of $75 to spend. How many of each should he buy to minimize his cost yet get enough food for his friends?

a. Constraints: x=number of nuggets to buy; y=number of milkshakes to buy, $x \geq 30$, $y \geq 10$, $.38x+2.75y \leq 75$

b. Objective function is C=.38x+2.75y

c. 

d. 

e. C=.38(30)+2.75(23.127)=74.99

C=.38(30)+2.75(10)=38.90

C=.38(125)+2.75(10)=75.00

f. The most feasible minimum cost is at the point (30,10) and the minimum cost is $38.90

"Linear programming is an application of math used to find an optimum value such as minimum cost or maximum profit. It was first developed to solve problems in allocating supplies for the US Air Force during World War II." (from their College Algebra book)
Transition: "So now I know what the definition of linear programming is. How does it relate to me?"
Differentiation: Having all the practice problems use Turn and Talk helps students help each other and relaxes them. Also it encourages collaborative work which is important because this class likes to talk. Also having a student come up to the front and show their answer and having a short discussion afterward helps students comprehend further and compare their methods.

Comment [CT9]: This is part of the definition in the book, and I know that there are some students in the classes I taught that are interested in history and the World Wars. Therefore I kept this in the definition because I thought it was cool and the students would think so as well.

ELABORATE: Include description of applications and extensions tasks with information on timing/pacing, differentiation, grouping, adaptations (IEP, ELL, culture, other), probing or clarifying questions with answers, and transitions.
(15 minutes)(8 minutes left)
Setup: I will instruct students on what they are going to do before going to the slide showing them where to go.
Materials: A premade Padlet for students to go to, and students use their phones to somehow get to the page whether it be the QR code or just typing in the link.
Task: Students will create a RAFT where they are describing a real life situation where linear

programming can be used such as minimum cost or maximum profit. They do not have to come up with the equations or anything like that, just a situation that would require linear programming. The R-role the student writer is presenting; A-audience: the world, the Padlet, or twitterverse; F-format which is a tweet (140 characters!); T-topic: relating a real life situation to linear programming. The students must come up with something creative without using more than 140 characters just like a real tweet. "This is a 140 character tweet. Linear programming is awesome and also is great 2 know for real life problems for optimum value of situations" notice in order to complete the tweet and not go over 140 characters I had to change "to" to "2" and not put a period at the end. THEY MUST PUT THEIR NAME ON IT
Then the next slide will be a link to a padlet where students can publish their RAFT tweets and a QR code that automatically takes their phone to the same page.
https://padlet.com/ectcollege/5dvpxrtu2c0i
After most of the students have put their RAFTs up, I will ask some students to share either theirs or one they see that looks interesting.

Instruction:

- From transition *"You're going to tell me!"*
- *"You've seen a few example problems here, and now you are going to describe a scenario where linear programming can be used.* ***You should not make up any numbers or inequalities!*** *All you need to do is relate linear programming to your life or community."*
- *"How are we going to do that? You are creating a 140 character tweet describing your scenario and how it relates to your life."*
- *"After you come up with your situation, use your phone to go to this link. I can write it up on the board if you need it larger, or you can use a QR code scanner to get to the link. While you are posting your tweet, look at other tweets people have posted.* ***MAKE SURE YOU PUT YOUR NAME SOMEWHERE ON THE POST!*** *Be prepared to share your tweet or a tweet you find interesting."*
- *"[student M] will you share a tweet? It can be yours or one you found interesting for some reason."*
  - "I liked…"
- *"Why did you like that one in particular?"*

Repeat for 2 other students who either volunteer or are called on.
Transition: "And to finish up class today…"
Differentiation: Including technology allows students to feel more comfortable with the content, and having them come up with ways to relate linear programming to their own personal lives is a great instructional strategy to really solidify the concept. As well, limiting students to only 140 characters brings out their fun and creative side in a class where they may not feel creativity is used.

COGNITIVE CLOSURE (aligned with objective(s):
Reminder: A learning ticket is not considered a cognitive closure by itself.
(8 minutes)(0 minutes left)
Setup: Prepared kahoot with the following questions.

Materials: Students will be using the kahoot app or an online app to get to kahoot.it on their phones.

Task: Kahoot. Before the kahoot starts,

Instruction:

- *"Write down the problem on the board. You'll need it!"*
- *"Use your phones to get on kahoot.it. Projected is the Pin number, and I can write it on the board if needed."*

Comment [CT10]: After the first 2 implementations, I also added to the slide that they should post on the padlet a rank of how comfortable they are with solving linear programming problems. That way Mrs. Pahr and I know where the students stand. I did not get to this during observation implementation.

Comment [CT11]: Could have this problem on the handout instead of having students write it down, this would give more time to the kahoot.

1. What is the first step to solving a linear programming problem?
    a. Graph the inequalities
    b. Find the optimal value
    c. Write the constraints and main function
    d. Use Desmos
2. What are the constraints of this problem? (adapted from book) Robin takes vitamin pills each day. She wants at least 16 units of Vitamin A and at least 5 units of Vitamin B. She can choose between red pills, costing $.10 each that contain Vitamin A or she can choose the blue pills costing $.20 each, containing B. Robin has room in her container for 50 pills. How many of each pill should she buy to minimize her cost and yet fulfill her daily requirements? X=number of red pills she should buy Y=number of blue pills she should buy
    a. $x \geq 16$, $y \geq 5$, $x+y \leq 50$
    b. $y \geq 16$, $x \geq 5$, $x+y \geq 50$
    c. I don't know
    d. $x \geq .10$, $y \geq .20$, $x+y \leq .30$
3. What is the objective function of this problem?
    a. .10x+.20y=Cost
    b. 16x+5y=Number
    c. 16x+5y=Cost
    d. .10x+.20y=Number

Pause at this time, to look at the premade graph so students can see what the region of feasible solutions looks like for this problem.

4. These are the vertices of the region of feasible solutions. (16,34), (45,5), (16,5). Which of the vertices yields the minimum cost?
    a. (16,34)
    b. (45,5)
    c. (16, 5) yes
    d. I don't have any clue
5. What is the minimum cost?
    a. $8.40
    b. $5.50
    c. None of these
    d. $2.60
6. How do we graph an inequality by hand?
    a. Find the y-intercept and the slope, find a point to see where we shade
    b. Use Desmos

c. Find the y-intercept and the slope, and guess where we need to shade
d. I don't know

7. Which of these is an objective function?
    a. 3x+7y=10
    b. 7x+8y=1500 and 14x+16y=700
    c. 15x+3y=P where P is profit
    d. 15x+3y=70 where $70.00 is the profit
8. What is the definition of linear programming?
    a. Applying math to find an optimum value
    b. I don't know
    c. Finding minimum cost
    d. Finding efficient ways to help the Air Force
9. What can we do to find an optimal value in any situation (class, a test, etc)?
    a. Find a random point in the shaded region and guess that one is right
    b. Test the vertices of the shaded region in the function
    c. Use Desmos
    d. I don't know
10. Let the objective function be 7x+2y=P, where P is profit, with coordinates (2, 3), (1, 15), and (5, 8). What coordinate pair gives the maximum value?
    a. (2,3)
    b. (1,15)
    c. (5,8) yes
    d. I don't know
11. Let the objective function be x+6y=M where M is minimum cost, with coordinates (19,25), (7, 3), (9,12). Which coordinate pair represents the minimum cost?
    a. (19, 25)
    b. (7,3) yes
    c. (9,12)
    d. I don't know
12. Let the objective function be 10x+2y=P where P is profit, with coordinates (1, 2), (2, 8), (6, 15). At what coordinate pair is the maximum profit?
    a. (1, 2)
    b. (2,8)
    c. (6,15) yes
    d. I don't know

Differentiation: Using kahoot is another strategy of using technology to engage students. As well, in the

past students have complained about how short kahoots are so in this lesson I have created the kahoot to have more time than perhaps needed to complete a question. For this, kahoot automatically moves on when all participators have answered.

EVALUATE:

Diagnostic Assessment(s): Students will notice and wonder about a linear programming problem and show what they know about applying system of inequality solving skills to word problems about optimum value

Formative Assessment(s): Students will show their work on graph paper during the exploration phase and create a tweet RAFT on a padlet. They will also show their knowledge by solving a linear programming problem step by step on Kahoot.

Summative Assessment(s): NA

Timing/Pacing Adjustments (Slinky Time): Include a plan for how to adjust instruction if tasks take longer/shorter than anticipated:
The kahoot will have more questions than we have time for so that students get more practice.
This will add more time (about 5 mins)
If we run short on time we can skip the solve part of elaboration and just have students write their raft on paper and turn it in instead of putting it online (7 minutes)

Name: Date: Mod:

Linear Programming

1. A movie theater contains 500 seats. For an upcoming showing of It, the theater sells $11 and $15 dollar tickets. They must sell at least 200 $11 dollar tickets and 100 $15 dollar tickets for the movie to be shown, and the theater must make at least $2000 dollars to break even. How many tickets at each price should be sold to maximize income? What is the maximum income?

2. A machine can produce Iphone 7 or Iphone X, but not at the same time. The machine can be used for at most 8 hours a day. Also, at most 6 hours a day can be used for making Iphone 7s and at most 5 hours a day can be used for making Iphone Xs. There is a $50 profit for each hour the machine makes Iphone 7s and a $75 profit for each hour the machine makes Iphone Xs. How many hours per day should the machine make each item in order to maximize profit? What is the maximum profit per day?

3. Shawn has to buy some Chick Fil A for his friends get together. He needs at least 30 chicken nuggets and at least 10 milkshakes. He can choose between the nuggets which cost $0.38 per nugget and small milkshakes for $2.75 each. Shawn has a total of $75 to spend. How many of each should he buy to minimize his cost yet get enough food for his friends?

4. Robin takes vitamin pills each day. She wants at least 16 units of Vitamin A and at least 5 units of Vitamin B. She can choose between red pills, costing $.10 each that contain Vitamin A or she can choose the blue pills costing $.20 each, containing B. Robin has room in her container for 50 pills. How many of each pill should she buy to minimize her cost and yet fulfill her daily requirements? X=number of red pills she should buy Y=number of blue pills she should buy