Algebra 2 3.3

Find the maximum and minimum values of a function over a region

Solve optimization problems using linear programming

maximum

minimum

constraints

feasible region

bounded

unbounded

optimize

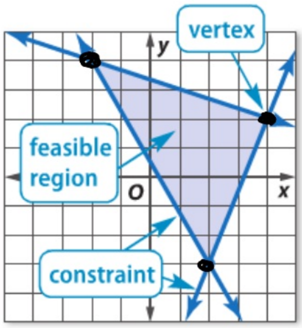
linear programming

$f(x, y) =$

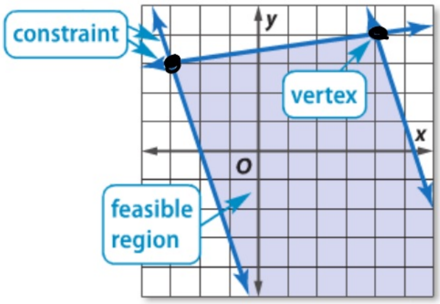
Quiz 3.1-3.2

whiteboards

KeyConcept Feasible Regions



The feasible region is enclosed, or **bounded**, by the constraints. The maximum or minimum value of the related function *always* occurs at a vertex of the feasible region.



The feasible region is open and can go on forever. It is **unbounded**. Unbounded regions have either a maximum or a minimum.

2 Optimization

To **optimize** means to seek the best price or amount to minimize costs or maximize profits. This is often obtained with the use of linear programming.

KeyConcept Optimization with Linear Programming

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If you're stuck...
try these steps!

Step 1 Define the variables.

Step 2 Write a system of inequalities.

Step 3 Graph the system of inequalities.

Step 4 Find the coordinates of the vertices of the feasible region.

obj **Step 5** Write a linear function to be maximized or minimized.

Step 6 Substitute the coordinates of the vertices into the function.

Step 7 Select the greatest or least result. Answer the problem.

What is the object of the game?
(write objective function first)

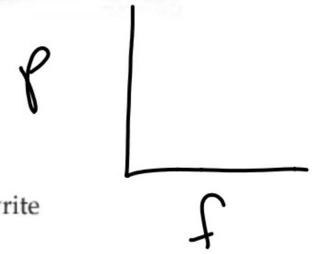
7. **CCSS PRECISION** The total number of workers' hours per day available for production in a skateboard factory is 85 hours. There are 40 hours available for finishing decks and quality control each day. The table shows the number of hours needed in each department for two different types of skateboards.

Skateboard Manufacturing Time		
Board Type	**Production Time**	**Deck Finishing/Quality control**
Pro Boards	1.5 hours	2 hours
Specialty Boards	1 hour	0.5 hour

$1.5p + 1s \leq 85$ (P)
$2p + 0.5s \leq 40$ (F)

a. Write a system of inequalities to represent the situation.

b. Draw the graph showing the feasible region.



c. List the coordinates of the vertices of the feasible region.

d. If the profit on a pro board is \$50 and the profit on a specialty board is \$65, write a function for the total profit on the skateboards.

e. Determine the number of each type of skateboard that needs to be made to have a maximum profit. What is the maximum profit?

$f(p, s) = 50p + 65s$ (max)

$f(s, y) = 35s + 25y$

23. **COOKING** Jenny's Bakery makes two types of birthday cakes: yellow cake, which sells for $25, and strawberry cake, which sells for $35. Both cakes are the same size, but the decorating and assembly time required for the yellow cake is 2 hours, y while the time is 3 hours for the strawberry cake. s There are 450 hours of labor available for production. How many of each type of cake should be made to maximize revenue?

$2y + 3s \leq 450$

$f(b,f) = 0{,}08b + 0{,}04f$ min

24. **BUSINESS** The manager of a travel agency is printing brochures and fliers to advertise special discounts on vacation spots during the summer months. Each brochure costs \$0.08 to print, and each flier costs \$0.04 to print. A brochure requires 3 pages, and a flier requires 2 pages. The manager does not want to use more than 600 pages, and she needs at least 50 brochures and 150 fliers. How many of each should she print to minimize the cost?

b f

$3b + 2f \leq 600$

$b \geq 50$

$f \geq 150$

(How long does it take to paint each?)

25. CCSS **PRECISION** Sean has 20 days to paint as many play houses and sheds as he is able. The sheds can be painted at a rate of 2.5 per day, and the play houses can be painted at a rate of 2 per day. He has 45 structures that need to be painted.

a. Write a system of inequalities to represent the possible ways Sean can paint the structures.

b. Draw a graph showing the feasible region and list the coordinates of the vertices of the feasible region.

c. If the profit is \$26 per shed and \$30 per play house, how many of each should he paint?

d. What is the maximum profit?