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Take It to the Max . . . or Min
Linear Programming

Vocabulary

Define the term in your own words.

1. linear programming

Problem Set

Write a system of linear inequalities to represent each problem situation. Remember to define your variables.

1. A company is manufacturing two different models of lamps, a table lamp and a floor lamp. A table lamp takes 1 hour to make and a floor lamp takes 2 hours to make. The company has 9 employees working 8-hour days. The total manufacturing capacity is 40 lamps per day.

   Let t represent the number of table lamps.

   Let f represent the number of floor lamps.

   9 employees $\times$ 8 hours per day = 72 work hours per day

   $$\begin{cases} t \geq 0 \\ f \geq 0 \\ t + f \leq 40 \\ t + 2f \leq 72 \end{cases}$$

2. A company is manufacturing calculators. A financial calculator costs \$65 to make and a graphing calculator costs \$105 to make. The budget available for materials is \$2500 per day. The manufacturing capacity is 20 calculators per day.

3. A company is manufacturing computers. A tablet computer costs $300 to make and a laptop computer costs $600 to make. The budget available for materials is $20,000 per day. The manufacturing capacity is 50 computers per day.

4. A furniture company is manufacturing sofas and loveseats. A loveseat takes 5 hours and $650 to make. A sofa takes 8 hours and $950 to make. The company has 30 employees working 8-hour days. The daily operating budget is $25,000 per day for materials to make at most 40 pieces of furniture.

5. An electronics company is manufacturing headphones. In-ear headphones take 2 hours and $65 to make. Around-ear headphones take 3 hours and $85 to make. The company has 14 employees working 12-hour days. The daily operating budget is $5000 per day for materials to make at most 65 pairs of headphones.

6. A company is manufacturing golf clubs. A putter takes 2 hours and $80 to make. A driver takes 2 hours and $120 to make. The company has 6 employees working 12 hour days. The daily operating budget is $3000 per day for materials. The company wants to make at least 10 of each kind of club per day.

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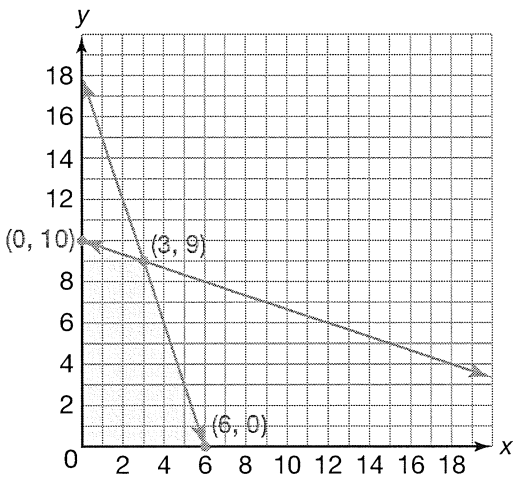
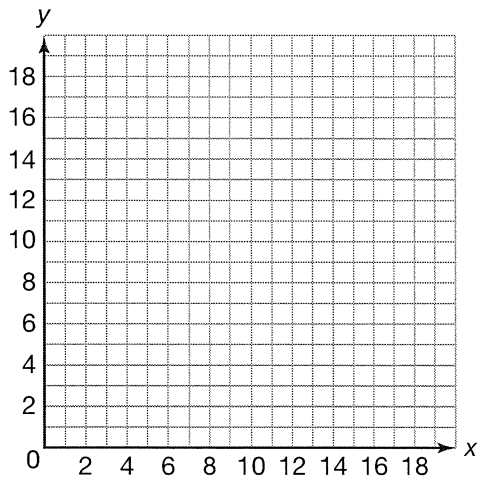
Graph the solution set for each system of linear inequalities. Label all points of intersection of the boundary lines.

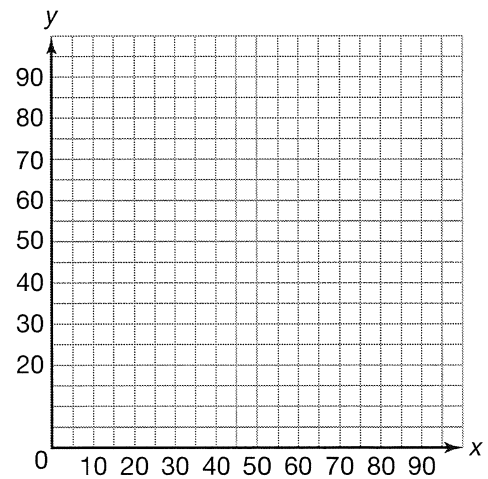
7. $\begin{cases} y \geq 0 \\ x \geq 0 \\ 3x + y \leq 18 \\ x + 3y \leq 30 \end{cases}$



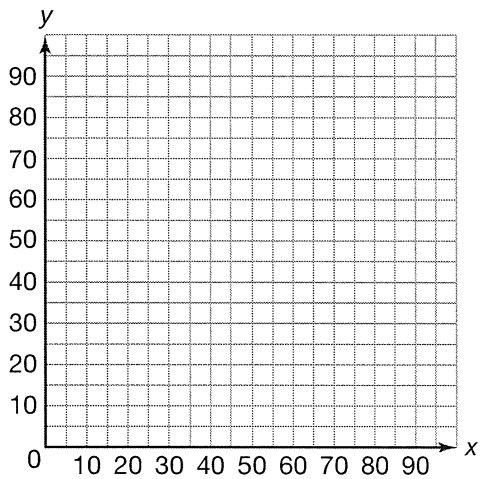
8. $\begin{cases} y \geq 0 \\ x \geq 0 \\ x + y \leq 20 \\ 4x + 9y \leq 135 \end{cases}$



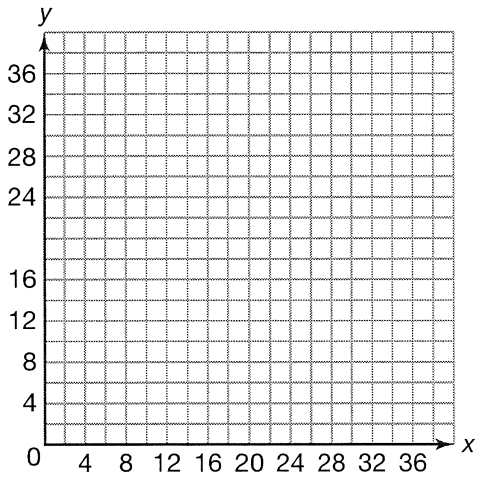
9. $\begin{cases} y \geq 15 \\ x \geq 10 \\ 3x + 2y \leq 90 \\ x + 2y \leq 70 \end{cases}$



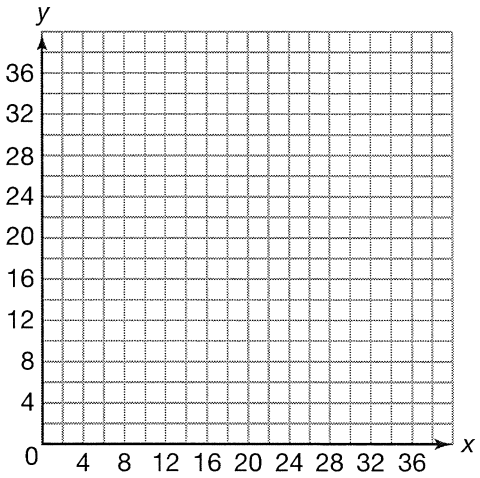
10. $\begin{cases} y \geq 10 \\ x \geq 20 \\ x + y \leq 90 \\ x + 4y \leq 240 \end{cases}$



11. $\begin{cases} y \geq 0 \\ x \geq 0 \\ x + y \leq 26 \\ x + 4y \leq 80 \end{cases}$



12. $\begin{cases} y \geq 14 \\ x \geq 10 \\ x + 5y \leq 130 \\ 2x + 5y \leq 150 \end{cases}$



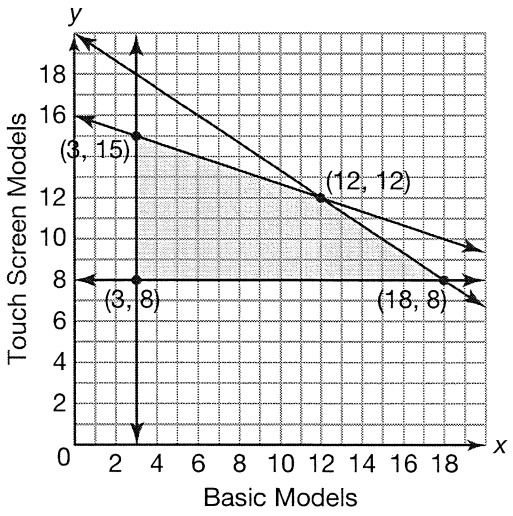
Analyze the solution set for the system of linear inequalities to answer each question.

An electronics company is manufacturing electronic book readers. A basic model takes 4 hours and $40 to make. A touch screen model takes 6 hours and $120 to make. The company has 10 employees working 12-hour days. The daily operating budget is $1920 per day for materials. The company would like at least 3 basic models and 8 touch screen models produced per day. The system of linear inequalities represents the problem situation. The graph shows the solution set for the system of linear inequalities.

Let x represent the number of basic models.

Let y represent the number of touch screen models.

$$\begin{cases} y \geq 8 \\ x \geq 3 \\ 4x + 6y \leq 120 \\ 40x + 120y \leq 1920 \end{cases}$$



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13. How many of each model should the company produce to minimize their daily cost?

$C(x, y) = 40x + 120y$

$C(3, 8) = 40(3) + 120(8) = 1080$

$C(18, 8) = 40(18) + 120(8) = 1680$

$C(3, 15) = 40(3) + 120(15) = 1920$

$C(12, 12) = 40(12) + 120(12) = 1920$

The minimum daily cost is $1080. To minimize their daily cost, the company should produce 3 basic models and 8 touch screen models.

14. How many of each model should the company produce to maximize the number of work hours utilized per day?

15. The company earns $30 for each basic model sold and $50 for each touch screen model sold. How many of each model should the company produce to maximize their profit?

16. How many of each model would have to be produced to maximize the company's daily cost?

17. How many of each model would have to be produced to minimize the number of work hours utilized per day?

18. During a special promotion, the company earns $20 for each basic model sold and $30 for each touch screen model sold. How many of each model should the company produce to maximize their profit?