

- **Pathway:** Horticulture
- **Lesson:** HC C5–3: Pricing Landscape Maintenance Work
- **Common Core State Standards for Mathematics:** 9-12.A-REI.1 and 3

Domain: Reasoning with Equations and Inequalities A-REI

Cluster: Represent and solve equations and inequalities graphically

Standard: 1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Standard: 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- **Student Objective:** Students will create, solve, and graph inequalities with information about pricing and labor hours of a landscape maintenance company to make informed business decisions.

BACKGROUND KNOWLEDGE for Teachers and Students

➤ **Math Concepts:**

Variable: A symbol for an unknown number. It can be dependent or independent. For an equation such as $y = 3x - 2$, the dependent variable is y . The value of y depends on the value chosen for x . The independent variable is x , which can be freely chosen.

Inequality: An algebraic relation showing that a quantity is greater than or less than another quantity. Ex: $y < 3x + 7$ or $y > x$. The symbol $<$ denotes “less than” and represents all values on the coordinate plane that are below the line. The symbol $>$ denotes “greater than” and represents all values on the coordinate plane above the line.

System of Inequalities: A set of inequalities solved at the same time. One method of solving a system of inequalities is to graph each inequality separately and then find the

“solution zone” where all the inequalities are satisfied. Inequalities are put into slope intercept form in the same way as equations. They are graphed and shaded appropriately.

Khan Academy—Video

(https://www.khanacademy.org/math/algebra/linear_inequalities/inequalities/v/inequalities)

The Purplemath Forums

(<http://www.purplemath.com/modules/sysineq.htm>)

➤ Agriculture Concepts:

Landscape maintenance companies, just like other businesses, need to remain profitable by managing their time and commitments wisely. This will keep their customers happy as well as allow the companies to profit. Common landscape maintenance duties include mowing, trimming, edging, mulching, cleaning planting beds, applying chemicals and fertilizers, and aerating and rolling lawns. Good landscape maintenance businesses must have employees who work diligently and quickly to take care of customers’ outdoor spaces in a timely manner that ensures a value to customers and a profit to the landscape companies.

Guided Practice Exercises: ANSWER KEY

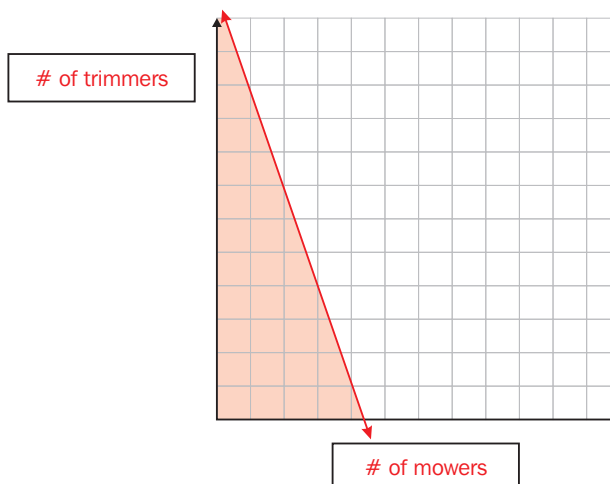
$$\begin{array}{rcl}
 1. & 75 & > 20 + 3(12) + 12x \\
 & 75 & > 56 + 12x \\
 & -56 & \quad -56 \\
 & 19 & > 12x \\
 & /12 & \quad /12 \\
 & 1.58 & > x
 \end{array}$$

2. Let x = number of mowers.

Let y = number of trimmers.

Solve for y to graph, and shade the area below the line.

$$\begin{array}{rcl}
 5,000 & \geq & 1,200x + 400y \\
 -1,200x & & -1,200x \\
 5,000 - 1,200x & \geq & 400y \\
 /400 & & /400 \\
 12.5 - 3x & \geq & y \\
 y & \leq & 12.5 - 3x
 \end{array}$$



3. She could buy six trimmers before running out of money. (Go over two boxes to account for the two mowers; then travel up the vertical line, counting the whole boxes under the inequality line. This gives you the number of trimmers Alexis can buy after she purchases two mowers.)

4. $40 \leq 5x + 3y$ x represents the number of large yards
 $60 \geq 5x + 3y$ y represents the number of small yards

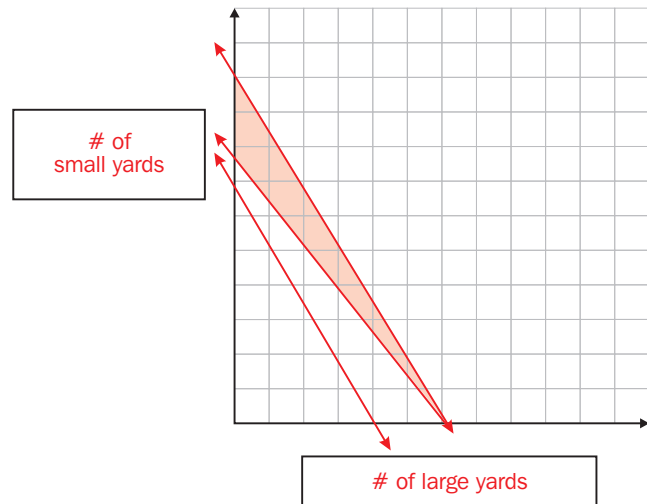
5. $1,200 \leq Lx + Sy$

6. $1,200 \leq 100x + 80y$

$ \begin{array}{rcl} 40 & \leq & 5x + 3y \\ & & - 5x \\ \hline 40 - 5x & \leq & 3y \\ & & / 3 \\ y & \geq & 13\frac{1}{3} - \frac{5}{3}x \end{array} $	$ \begin{array}{rcl} 60 & \geq & 5x + 3y \\ & & - 5x \\ \hline 60 - 5x & \geq & 3y \\ & & / 3 \\ y & \leq & 20 - \frac{5}{3}x \end{array} $
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$$\begin{array}{rcl}
 1,200 & \leq & 100x + 80y \\
 & & - 100x \\
 \hline
 1,200 - 100x & \leq & 80y \\
 & & / 80 \\
 y & \geq & 15 - \frac{5}{4}x
 \end{array}$$

8. Yes. The point (3,15) is within the shaded zone. She will work 60 hours and make \$1,500.
9. No. All possibilities of working only 40 hours occur outside the shaded solution zone.



Independent Practice Exercises: ANSWER KEY

1. The maintenance work will need to be finished in 2.5 hours or less.

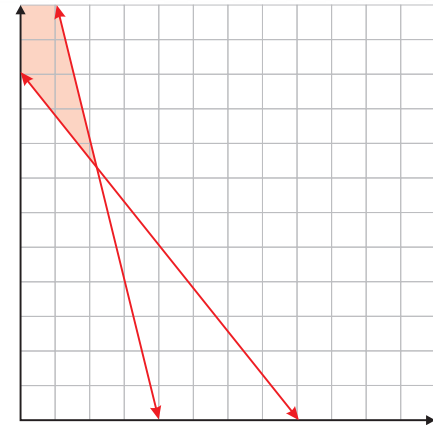
$$\begin{array}{rcl}
 110 & \geq & 20 + 40 + (12 + 8)x \\
 110 & \geq & 60 + 20x \\
 - 60 & & - 60 \\
 \hline
 50 & \geq & 20x \\
 / 20 & & / 20 \\
 2.5 & \geq & x
 \end{array}$$

$$\begin{array}{rcl}
 2. & 4x + 1y & \leq 40 \\
 & -4x & -4x \\
 & y & \leq 40 - 4x
 \end{array}$$

$$\begin{array}{rcl}
 3. & 2,000 & \leq 100x + 80y \\
 & -100x & -100x \\
 & 2,000 - 100x & \leq 80y \\
 & /80 & /80 \\
 & y & \geq 25 - 1.25x
 \end{array}$$

4. Yes, Alexis would make a profit on both arrangements. Both points (1,25) and (5,20) are within the boundaries of the solution zone.

of small yards



of large yards

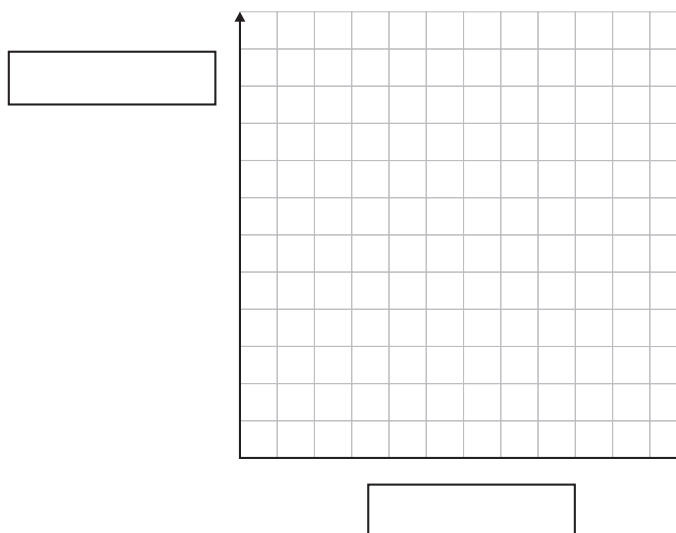
Guided Practice Exercises:

Alexis owns a landscaping company that installs and maintains residential and commercial landscapes throughout the year. She earns \$12 per hour. She has been contracted by a bank to take care of its landscaping, mowing, and trimming for \$75 per visit. Each time she visits, fuel and wear-and-tear on her equipment cost her \$20. If it takes her three hours to mow and trim, how quickly must she finish the other basic maintenance to still make a profit for her company?

1. Write an inequality to represent this problem, with x representing the hours spent performing landscaping duties. Solve for x .

Alexis has \$5,000 to buy new mowers and new trimmers to expand her business. Mowers cost \$1,200 each, and each trimmer costs \$400.

2. Write and graph an inequality to show all the possibilities of spending the money on mowers and trimmers.

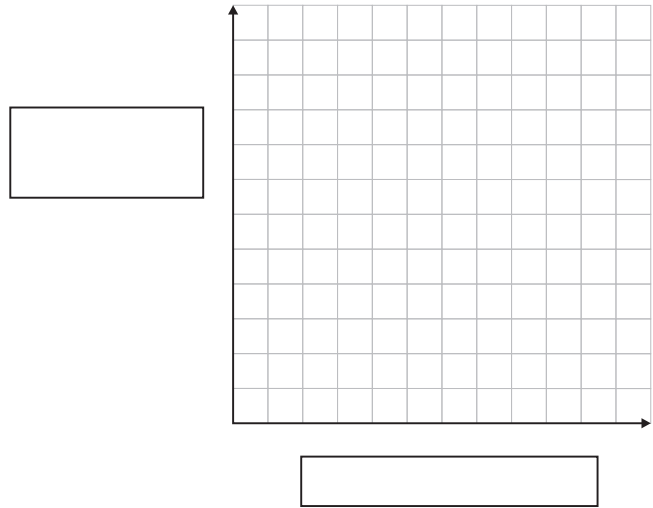


- Using the graph, if Alexis purchased two mowers, how many trimmers could she buy before running out of money?

Alexis needs to earn at least \$1,200 each week to pay herself a salary and pay for her new equipment. She takes five hours to maintain a large yard that contains three or more flower beds and three hours to maintain a yard that contains two or fewer flower beds.

- Write two inequalities to show how many yards she could maintain in a 40-hour work week and a 60-hour work week.
- Write a general inequality for Alexis's business that shows how many yards (large and small) she needs maintain to make at least \$1,200 each week. Represent the fee for a large yard with the letter L and the fee for a small yard with the letter S .
- If she charges \$100 to maintain a large yard and \$80 to maintain a small one, write an inequality to show how many of each size yard she needs to care for to pay herself a salary.

7. Solve the inequalities from #4 and #6 for y , and graph them to show all the possibilities of maintaining yards that will give her the required salary while working between 40 and 60 hours.



8. Can Alexis work 15 small yards and 3 large yards and still make the required money while keeping the hours within the limits? Use the graph to make your determination.

9. Can Alexis make the \$1,200 she needs each week by working only 40 hours?

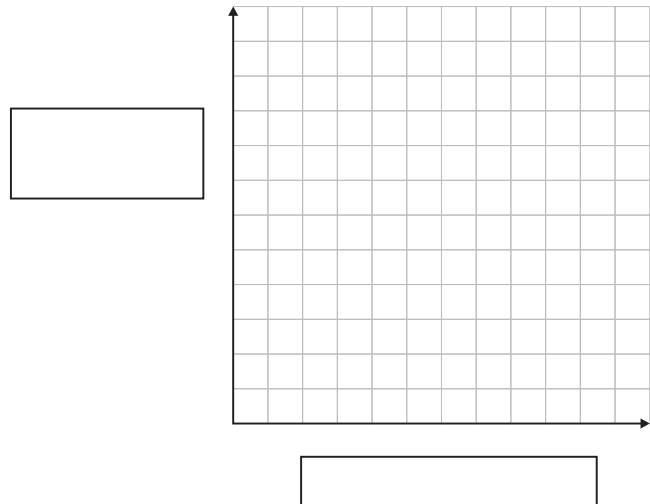
Independent Practice Exercises:

Alexis is hiring two people to help her out in the summer months. Ray will be paid \$12 per hour, and Emily will be paid \$8 per hour. If they are paid \$110 to maintain a property, how fast must they do the job if expenses are \$40 and Alexis wants to profit at least \$20?

1. Write an inequality to represent this problem, with x representing the hours spent performing landscaping duties. Solve for x .

With Ray's and Emily's help, Alexis can expand the business. Alexis knows that with the help, she can maintain more properties. She estimates a large yard will take four hours for Ray and Emily to do together, while a small yard will take Ray and Emily 1 hour to do together. Ray and Emily work only 40 hours per week.

2. Write an inequality to show how many yards Alexis's new hires could maintain each work week. Let x represent large yards and y represent small yards. Solve for y , and graph it below.



3. Alexis charges \$100 for a large yard and \$80 for a small yard and has costs of \$2,000 per week. Write an inequality representing the minimum yards Ray and Emily will have to maintain to keep Alexis profitable. Graph it as well.

4. Shade in the area on the graph where Alexis will make a profit from Ray and Emily. Would Alexis make a profit from Ray and Emily working on 25 small yards and 1 large yard in a week? How about 5 large yards and 20 small yards?