6 Mid-Chapter Review

FREQUENTLY ASKED Questions

Q: When graphing a linear inequality, what process should you use?

A: When graphing on graph paper, use the following process:

Step 1. Decide how much of the coordinate plane to include by determining the domain and range of the inequality.

Step 2. Graph the boundary:

- Determine two points that are solutions to the equation of the boundary.
- Plot the points to draw the boundary:
  - Make the boundary a solid green line if equality is possible ($\geq$ and $\leq$) and the solution set is continuous.
  - Draw a dashed line if equality is not possible ($<$ or $>$). Use green if the solution set is continuous and orange if it is discrete.
  - If equality is possible ($\leq$ or $\geq$) and the solution set is discrete, plot green points to stipple the boundary.

Step 3. Shade the appropriate half plane:

- You can test a point on either side of the boundary to see if it is in the solution region for the linear inequality. Point (0, 0) is often used.
  - If the solution set is continuous, shade the correct half plane green.
  - If the solution set is discrete, shade the correct half plane orange, and then plot green points that have integer, whole-number, or natural-number coordinates (as appropriate) to stipple it.

When using graphing technology to graph, use this process:

Step 1. Decide how much of the coordinate plane to include by determining the domain and range.

Step 2. Isolate y in the linear inequality.

Step 3. Graph the linear inequality.

Step 4. Verify that the linear inequality has been represented correctly:

- Use a test point, such as (0, 0), to check that the correct half plane is shaded.
- Check the boundary against the inequality sign.

Study *Aid*

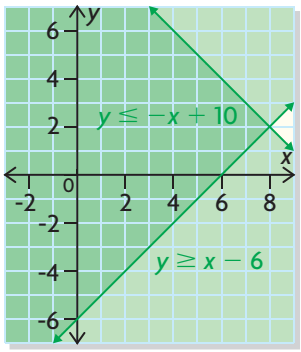
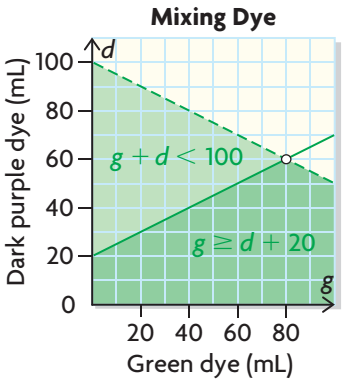
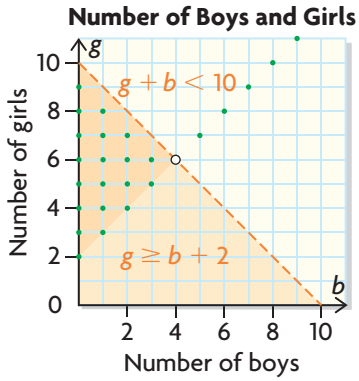
- See Lesson 6.1, Examples 1 to 3.
- Try Mid-Chapter Review Questions 1 to 3.

Study Aid

- See Lessons 6.2 and 6.3, Examples 1 to 3.
- Try Mid-Chapter Review Questions 4 to 7.

Q: How can you determine if all the points or only some of the points in the solution region are part of the solution set?

A: Whether a solution set for a system of linear inequalities includes discrete or continuous values depends on the restrictions placed on the domain and range of the variables. Consider these examples:

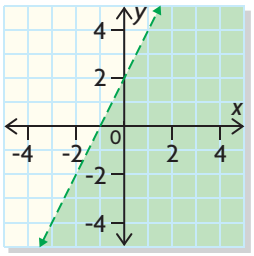
Graph the solution set for this system of linear inequalities: $y \leq -x + 10$ $y \geq x - 6$ 	Starr is mixing green, g, and dark purple dye, d, to make a brown dye. She needs less than 100 mL of the brown dye. She wants to use at least 20 mL more of the green dye than the dark purple dye. What combinations of dye are possible? $g + d < 100$ $g \geq d + 20$ 	A group has fewer than 10 students, and there are at least 2 more girls, g, than boys, b. What combinations of girls and boys are possible? $g + b < 10$ $g \geq b + 2$ 
Since no context is given and the domain and range are not stated, the variables are assumed to be real numbers and the graph could be in all four quadrants. The solution set is represented by all points in the solution region, which includes the solid boundaries.	Measurements are continuous. The solution set is represented by all points in the solution region in the first quadrant, which includes the solid boundary, but not the intersection of the two boundaries.	Numbers of students are whole numbers. The solution set is represented by points with whole-number coordinates in the solution region, which includes the stippled boundary, but not the intersection of the two boundaries.

PRACTISING

Lesson 6.1

1. For a school fundraiser, the drama students are selling white and dark chocolates. The goal is to sell at least 70 kg of chocolates, in total, and they need to determine how many kilograms of each to buy.
   a) Define the variables and write an inequality to model this situation.
   b) Graph the inequality. Use the graph to choose three possible combinations of kilograms of white and dark chocolates. Explain your choices.

2. a) What can you deduce from this graph of a linear inequality?



   b) Is each point a possible solution?

   i) (2, 2)
   ii) (3.5, −1)
   iii) (−2, −2)
   iv) (−2, 2)

3. Horst and Lev volunteer at a seniors' centre. Together they volunteer, at most, 30 h each week and work only a whole number of hours.
   a) Define the variables and write an inequality to model this situation.
   b) Graph the inequality and use it to find several possible combinations of hours that the two boys could volunteer.

Lesson 6.2

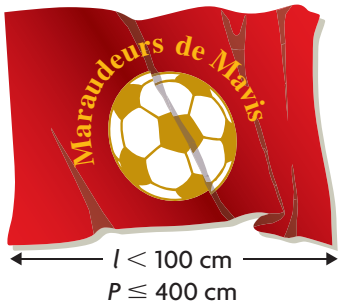
4. Nick is preparing a tomato and red pepper soup as the daily special for his restaurant.
   - To allow the red pepper taste to dominate, he will include at least twice as many peppers as tomatoes, by mass.
   - However, he wants no more than 25 kg of tomatoes and red peppers altogether.
   a) Define the variables and write a system of inequalities to model this situation.
   b) Graph the system. Use your graph to suggest three possible combinations of tomatoes and peppers.

Lesson 6.3

5. a) Graph this system of linear inequalities:
   $\{(x, y) \mid x \leq 3y, x \in \mathrm{W}, y \in \mathrm{W}\}$
   $\{(x, y) \mid x + y \leq 60, x \in \mathrm{W}, y \in \mathrm{W}\}$
   b) Suggest a possible context for the system, and explain why you chose this context.

6. A flag is being created for a soccer team.
   - The length must be less than 100 cm.
   - The perimeter must be 400 cm or less.

   Use a graph to choose three possible combinations of length and width. Explain your choices.



7. A service station owner, Uma, has two part-time employees: Pali and Meg.
   - Pali is skilled at repairs but has limited experience with customers. Uma pays him $18 an hour.
   - Meg has experience with customers but can do only simple repairs. Uma pays her $10 an hour.
   - Uma has a budget of $470 for their wages.
   - Uma can hire both of these employees for no more than 30 h a week, in total. Both employees are scheduled in whole numbers of hours.
   a) Use a graph to choose two possible combinations of hours for Pali and Meg. Explain your choices.
   b) For each change in the situation below, predict how the graph would change. Explain your prediction, and then graph to check it.
   i) Uma's budget is $400 a week.
   ii) Uma wants Pali to work at least twice as many hours as Meg.