

W.S. 8.6

3. What process would you use to solve the inequality $-15x \leq 90$?
4. Represent on a number line
- the linear equation $6x = 18$
 - the linear inequality $6x \geq 18$
- Compare the solutions. How are they the same? How are they different?

Practise

For help with #5 to #8, refer to Example 1 on pages 352–353.

5. Solve each inequality.

a) $x - 7 \geq 22$ b) $4 < x + 11$
c) $8.6 + x > -5.2$ d) $100 \leq x + 65$

6. Solve each inequality.

a) $6y \geq 54$ b) $29 > -2y$
c) $3.1y \leq -12.4$ d) $-1.6y < -10$

7. Solve each inequality.

a) $\frac{x}{5} > 30$ b) $\frac{x}{-4} \geq -9$
c) $2 \geq \frac{x}{1.2}$ d) $-\frac{1}{6}x < 5$

8. Look at the following operations. For each one, does the inequality symbol need to be reversed when the operation is performed on both sides of an inequality? Why or why not?

- a) Subtract 5.
b) Multiply by 6.
c) Add -15 .
d) Divide by -3 .
e) Multiply by -19.7 .
f) Divide by 0.3 .

For help with #9 to #13, refer to Example 2 on pages 353–354.

9. Verify whether the specific solution is correct for each inequality.

a) $x - 2.5 \leq 10$; $x = 12$
b) $3x \geq 21$; $x = 8$
c) $-4x < 20$; $x = -3$
d) $-\frac{1}{5}x \leq 3$; $x = -20$

10. Verify whether the specific solution satisfies each inequality.

a) $y - 10.2 \geq 18$; $y = 30$
b) $-6y \leq 36$; $y = -7$
c) $\frac{-2}{3}y \geq 10$; $y = 10$
d) $\frac{1}{2}y < 13$; $y = -2$

11. Show whether $x < 4$ is the solution for each inequality.

a) $-3x > -12$
b) $10 + x > 14$
c) $1 > \frac{x}{4}$
d) $-x > -4$

12. Verify that the solution shown on each number line is correct.

a) $x + 10 > 14$



b) $-3.2 < \frac{x}{5}$



13. Verify each solution represented graphically.

a) $-10 \geq x - 1$



b) $-5x \geq -62$



For help with #14 and #15, refer to Example 3 on page 355.

14. The Super Fencing Company builds cedar fences for homes at a cost of \$85 per section of fence, including tax. How many sections of fence could you buy if you could spend no more than \$1400?

- Model the problem using an inequality.
- Solve the inequality.
- Is the boundary point a reasonable solution for the number of fence sections? Explain.

15. Megan is competing in a series of mountain bike races this season. She gets 6 points for each race she wins. If she gets more than 50 points in total, she will move up to the next racing category. How many race wins this season will allow her to move up to the next category?

- Use an inequality to represent the problem.
- Determine the solution and use it to solve the problem.
- Is the boundary point a reasonable solution for the number of race wins? Explain.



Apply

16. For each of the following inequalities, state three values that are specific solutions and three values that are non-solutions.
- $-5 + x < -10$
 - $-3x < 24$

17. Colin's teacher asked him to solve the inequality $-5x \geq -15$. His solution was $x \leq 3$. He explained that he reversed the inequality symbol because of the negative number. Write a more accurate explanation.

18. A local sports complex offers the following options for sharpening skates.

Skate Sharpening Rates

Standard Rate: \$5.75 per pair of skates

Special: \$49 per month for unlimited sharpening



- Estimate at what point the special would be the better option. Show the process you used. Why do you think your method provides a reasonable estimate?
 - Model and solve the problem using an inequality. Compare the answer to your estimate.
19. The owner of a craft store donates 3% of her profits to a local charity every month. If she wants to donate at least \$250 this month, how much profit will the business need to earn?
- Model and solve the problem using an inequality.
 - Verify your solution. Show your work.
20. Andrew's family is driving from Winnipeg to Saskatoon. Before leaving, they fill the gas tank with 57 L of fuel. The car uses fuel at an average rate of 8.4 L/100 km for highway driving. How many kilometres can they drive on this amount of fuel? What assumptions did you make?
21. Natalie is entering the 3200-m event at an upcoming meet. Each lap of the track is 400 m. Her goal is to beat the current record of 9 min 23 s. How fast must she run each lap, on average, to beat the record?
- Explain why the situation can be modelled using the inequality $8x < 563$.
 - Solve the problem and verify your solution. Show your work.

22. Fiona has a rewards card that gives her a reward point for every \$5 she spends. If she earns at least 120 points in a year, she gets a bonus. How much does she need to spend to get at least 120 points?

Extend

23. Chris has a weekend business building doghouses. Each doghouse takes 4 h to build and is sold for \$115. Chris wants to earn at least \$1000 per month. He wants to work no more than 50 h on his business per month.
- Write two inequalities to model the situation.
 - Solve each inequality.
 - What possible numbers of doghouses can he build each month and stay within his guidelines?



24. Solve and check the inequality $-\frac{2}{5}x < \frac{1}{3}$.
Show the solution on a number line.

25. If $-2x > 22$ and $-4x < 60$, determine the possible values of x that satisfy both inequalities. Show your solution on a number line.
26. A food company that is developing a new energy bar has not decided on the size of the bar. The recipe includes 9% protein and 13% fat. The company wants the bar to contain at least 6 g of protein and no more than 10 g of fat. Use two inequalities to determine the possible range of masses for the bar.
27. Consider the inequality $ax \leq 5a$.
- Solve the inequality if $a > 0$.
 - Solve the inequality if $a < 0$.
28. Solve each combination of inequalities.
- $-5 \leq x + 9$ and $x + 9 \leq 8$
 - $-2 < 2x$ and $2x < 12$
 - $-15 \leq -6x$ and $-6x < 9$

Math Link

Some amusement parks offer single-ride tickets, where you pay each time you ride, and all-day passes, where you pay once for unlimited rides. The prices for both types of tickets need to be high enough for the amusement park to earn a profit but low enough that people decide to come.

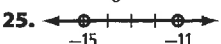
Search various media, such as newspapers, magazines, and the Internet. Look for information about ticket prices at amusement parks.

- Choose a price for single-ride tickets and a price for all-day passes. Explain why your choices are reasonable.
- Use an inequality to determine the number of rides that make one option a better deal than the other.
- Your friends plan on going on seven rides in your amusement park. Which is the better option for them? Show your work.

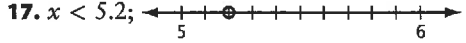


9.2 Solving Single-Step Inequalities, pages 357–359

5. a) $x \geq 29$ b) $-7 < x$ c) $x > -13.8$ d) $35 \leq x$
 6. a) $y \geq 9$ b) $-14.5 < y$ c) $y \leq -4$ d) $y > 6.25$
 7. a) $x > 150$ b) $x \leq 36$ c) $2.4 \geq x$ d) $x > -30$
 8. a)–c) No, the inequality is not changed because there is no multiplication or division by a negative number.
 d) Yes, the direction of the inequality is changed because there is division by a negative number.
 e) Yes, the direction of the inequality is changed because there is multiplication by a negative number.
 f) No, the inequality is not changed because there is no multiplication or division by a negative number.
 9. a) yes b) yes c) yes d) no
 10. a) yes b) no c) no d) yes
 11. a) yes b) no c) yes d) yes
 12. a) yes b) No; the correct answer is $x > -16$, not $x > 16$.
 13. a) No; the correct solution is $-9 \geq x$, not $-11 \geq x$.
 b) yes
 14. a) $85f \leq 1400$ b) $f \leq 16.47$ c) No, the boundary value is not a positive integer, which is required when discussing the number of fence sections.
 15. a) $6w > 50$ b) $w > 8.\bar{3}$. Megan must win 9 or more races to move up to the next racing category. c) No, the number of races won will be a non-negative integer.
 16. a) Example: Three solutions are -6 , -20.2 , and -10 . Three non-solutions are 0 , -4 , and 8.6 .
 b) Example: Three solutions are 0 , -2 , and 5.5 . Three non-solutions are -11 , -8 , and -16 .
 17. Example: The inequality sign is reversed because each side was divided by a negative number, -5 .
 18. a) Example: The single sharpening cost is about \$6. When this is divided by 48, the answer is 8. So, if the skates need to be sharpened more than 8 times, the monthly charge would be a better option.
 b) $5.75s > 49$; $s > 8.52$. It would be better to take advantage of the monthly special if the skates were sharpened more than 8 times. The estimate and solution to the inequality are the same.
 19. a) $0.03p \geq 250$; $p \geq 8333.\bar{3}$. The owner would need to make a profit of at least \$8333.33 in order to donate at least \$250 to the local charity. b) Example: Check the boundary point, 8333. $\bar{3}$, and then check that both sides of the inequality are equal: $0.03(8333.\bar{3}) = 250$. Check a number that is larger than the boundary value (9000) and see that it is a solution: $0.03(9000) = 270$. Since 270 is larger than 250, then 9000 is a solution to the inequality.
 20. $0.084k \leq 57$; $k \leq 678.57$; They can travel no more than 678.57 km, assuming the car consumes the average amount of fuel.
 21. a) Natalie must run 8 laps in order to complete the 3200-m distance: $3200 \div 400 = 8$. The total time of 9 min 23 s is equivalent to 563 s: $9 \times 60 + 23 = 563$. The expression $8x$ represents her total time, where x is her average time per lap. Consequently, her total time must be less than the current record of 563 s: $8x < 563$.
 b) $x < 70.375$

22. $\frac{s}{5} \geq 120$; $s \geq 600$. She will have to spend at least \$600 to get at least 120 points.
 23. a) $115d \geq 1000$; $4d \leq 50$ b) $d \geq 8.70$; $d \leq 12.5$
 c) Chris can build between 9 and 12 doghouses and stay within his guidelines.
 24. $x > -\frac{5}{6}$
 25. 
 26. The mass of the energy bar must be between 66.67 g and 76.92 g.
 27. a) $x \leq 5$ b) $x \geq 5$
 28. a) $-14 \leq x$ and $x \leq -1$ b) $-1 < x$ and $x < 6$
 c) $\frac{5}{2} \geq x$ and $x > -\frac{3}{2}$

9.3 Solving Multi-Step Inequalities, pages 365–367

3. a) $x < 11$ b) $x > -20$ c) $50 \leq x$
 4. a) $y \leq 10.4$ b) $-2.1 > y$ c) $y > -108$ d) $x \leq 3\frac{1}{5}$
 5. a) Check the boundary value: $3(8) + 11 = 35$. Check another number in the solution set, $x = 10$: $3(10) + 11 = 41$. Since 41 is greater than 35, the solution is correct. b) Solve the inequality: $24 - 5x - 24 > 39 - 24$. Finally, simplify $\frac{-5x}{-5} < \frac{15}{-5}$ to get the solution, $x < -3$.
 6. a) $x < 6$ b) $x \geq 11$ c) $x < -\frac{9}{8}$ d) $x > 39$
 7. a) $y < 2$ b) $y \leq 10$ c) $y > \frac{28}{9}$ d) $y \geq 3$
 8. a) Example: Let j represent the number of jerseys; $40j + 80 < 50j$ b) Example: Let n represent the number of text messages sent in one month; $0.12n < 0.05n + 15$
 9. a) $0.05p + 10 > 0.04p + 15$ b) John will have to deliver more than 500 papers to make the *Advance* the better offer.
 10. a) Example: ABC Rentals would be a better deal if you travel less than 200 km per day ($30 \div 0.15$).
 b) $0.14k + 25 < 55$ c) ABC Rentals will be the better option if Kim travels less than 214.3 km per day.
 11. Kevin's weekly sales must be at least \$4000 for Dollar Deal to pay more.
 12. Print Express would be the better option if more than 236 yearbooks are ordered.
 13. The member's plan is a better deal when 22 or more buckets of balls are used per month.
 14. Molly must sell at least 72 candles in order to make a profit.
 15. The first tank will contain less water after $27\frac{3}{11}$ minutes have passed.
 16. a) Example: Estimate: 20 min b) Rob will be closer to the top after 17.14 min have passed.
 17. $x < 5.2$; 
 18. 