

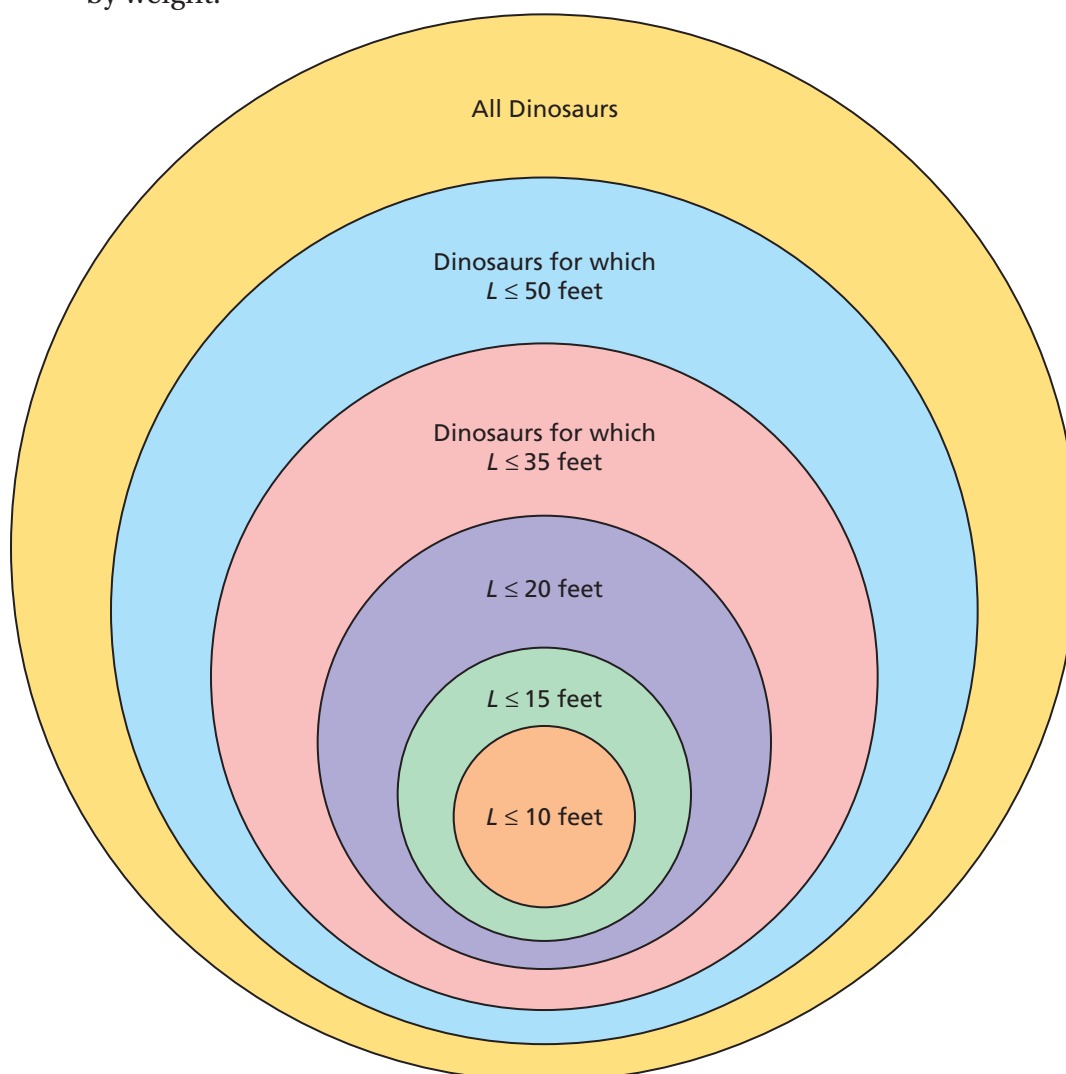
8.4 Solving Two-Step Inequalities

Essential Question How can you use inequalities to classify different species of animals?

1 ACTIVITY: Classifying Dinosaurs

Work with a partner. Let L represent the length of an adult dinosaur.

- Copy the diagram. Put each species of dinosaur shown on the next page into the correct region in the diagram.
- Are all the dinosaur species that are in the “ $L \leq 35$ feet” category also in the “ $L \leq 50$ feet” category? Explain your reasoning.
- Are all the dinosaur species that are in the “ $L \leq 35$ feet” category also in the “ $L \leq 20$ feet” category? Explain your reasoning.
- Draw a different diagram that classifies the six dinosaur species by weight.

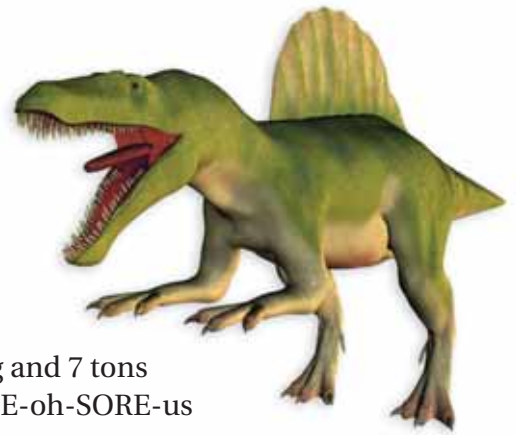




Tyrannosaurus Rex

About 40 feet long and 7 tons

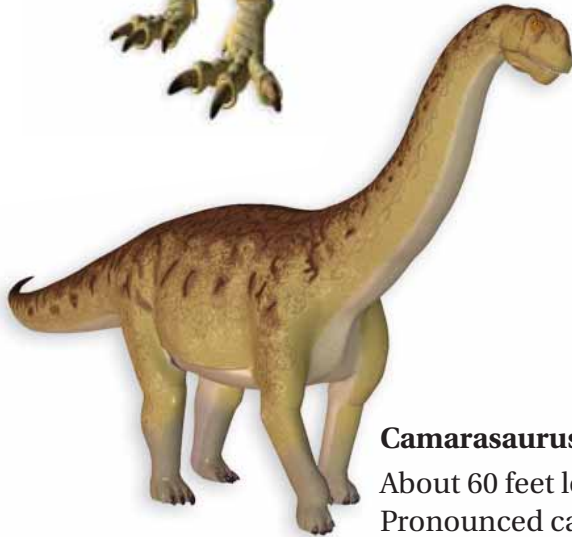
Pronounced tih-RAN-oh-SORE-us REX



Spinosaurus

About 50 feet long and 7 tons

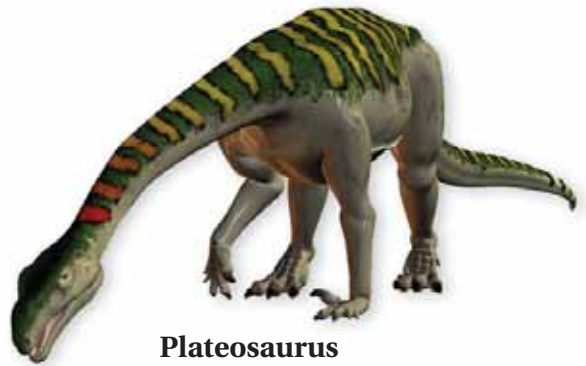
Pronounced SPINE-oh-SORE-us



Camarasaurus

About 60 feet long and 20 tons

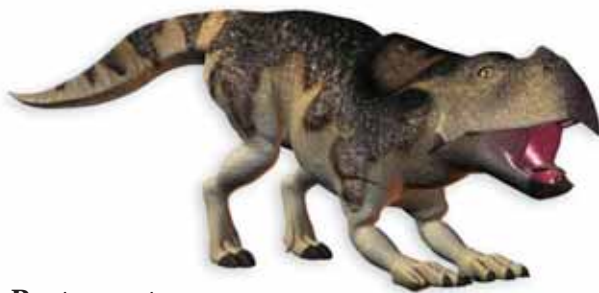
Pronounced cam-AH-rah-SORE-us



Plateosaurus

About 25 feet long and 2 tons

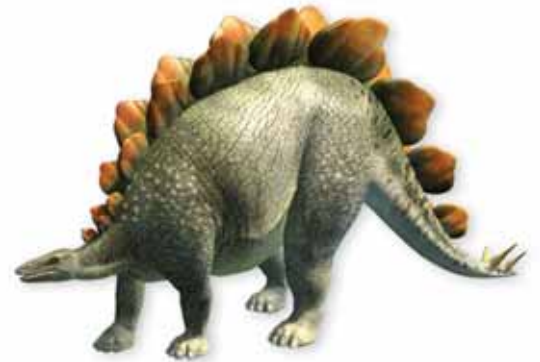
Pronounced PLATT-ee-oh-SORE-us



Protoceratops

About 6 feet long and 400 pounds

Pronounced PRO-toe-SER-ah-tops



Stegosaurus

About 20 feet long and 2 tons

Pronounced STEG-oh-SORE-us

What Is Your Answer?

2. **IN YOUR OWN WORDS** How can you use inequalities to classify different species of animals?
3. **RESEARCH** Find two other species of dinosaur that you can include in the two diagrams.

You can solve two-step inequalities the same way you solve two-step equations.

EXAMPLE 1 Solving Two-Step Inequalities

a. Solve $3x + 2 > 17$. Graph the solution.

Step 1: Undo the addition.

$$3x + 2 > 17$$

Write the inequality.

$$\underline{-2} \quad \underline{-2}$$

Subtract 2 from each side.

$$3x > 15$$

Simplify.

Step 2: Undo the multiplication.

$$\frac{3x}{3} > \frac{15}{3}$$

Divide each side by 3.

$$x > 5$$

Simplify.

••• The solution is $x > 5$.



Check: $x = 4$ is *not* a solution.

Check: $x = 6$ is a solution.

b. Solve $\frac{y}{6} - 9 \leq 1$. Graph the solution.

$$\frac{y}{6} - 9 \leq 1$$

Write the inequality.

$$\underline{+9} \quad \underline{+9}$$

Add 9 to each side.

$$\frac{y}{6} \leq 10$$

Simplify.

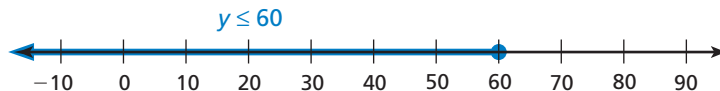
$$\frac{y}{6} \cdot 6 \leq 10 \cdot 6$$

Multiply each side by 6.

$$y \leq 60$$

Simplify.

••• The solution is $y \leq 60$.



On Your Own

Solve the inequality. Graph the solution.

1. $4b - 1 < 7$

2. $8 + 5c \geq 28$

3. $\frac{n}{2} + 11 > 12$

Now You're Ready
Exercises 4–15

EXAMPLE 2 Real-Life Application

Members of a club are selling pizzas for \$8 each.

- Write an inequality to represent the number of additional pizzas the club must sell to reach or exceed its goal.
- How many additional pizzas does the club need to sell to reach or exceed its goal?
 - From the chart, you know that the club has already raised \$1200 of its \$3600 goal. Because the club wants to *reach or exceed* \$3600, use the symbol \geq .

Words Amount already raised plus the cost of each pizza times the number of additional pizzas sold is greater than or equal to the goal.

Variable Let p be the number of additional pizzas sold.

Inequality $1200 + 8p \geq 3600$

• An inequality is $1200 + 8p \geq 3600$.

- Solve the inequality to find the number of additional pizzas the club must sell to reach or exceed its goal.

$$\begin{array}{rcl}
 1200 + 8p & \geq & 3600 \\
 \underline{- 1200} & & \underline{- 1200} \\
 8p & \geq & 2400 \\
 \frac{8p}{8} & \geq & \frac{2400}{8} \\
 p & \geq & 300
 \end{array}$$

Write the inequality.
Subtract 1200 from each side.
Simplify.
Divide each side by 8.
Simplify.

• The club must sell at least 300 additional pizzas.

On Your Own

- A baseball player throws 55 pitches and plans to pitch three more innings. The coach will not allow the player to throw more than 85 pitches in a game. Write and solve an inequality to find the average number of pitches the player can throw in each of the next three innings.



8.4 Exercises



Vocabulary and Concept Check

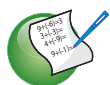
- REASONING** What is the first operation you would undo to solve the inequality $4x - 9 \leq 15$? Explain your reasoning.
- REASONING** Describe the steps you could use to solve the inequality $\frac{t}{7} + 4 > 6$.
- WHICH ONE DOESN'T BELONG?** Which one does *not* belong with the other three? Explain your reasoning.

$$\frac{s}{4} - 7 \leq 3$$

$$\frac{s}{5} \leq 8$$

$$s - 7 \leq 12$$

$$s \leq 40$$



Practice and Problem Solving

Solve the inequality. Graph the solution.

1 4. $\frac{z}{3} + 2 \leq 5$

5. $5t - 3 > 7$

6. $8 \leq 8 + 4x$

7. $5 > \frac{s}{3} - 5$

8. $3n - 14 \geq 1$

9. $20 + 4a < 40$

10. $15 \leq \frac{b}{4} + 9$

11. $2y - 8 \leq 12$

12. $27 < 8w - 5$

13. $0.2 + 2.6c \leq 8$

14. $3.3 > \frac{d}{5} - 1.8$

15. $4k + 10.2 > 22.6$

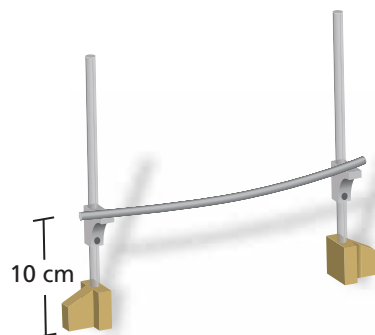
ERROR ANALYSIS Describe and correct the error in solving the inequality.

16.

X $8 > 2x + 6$
 $2 > 2x$
 $x > 1$

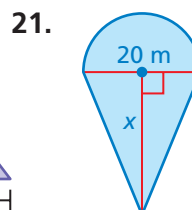
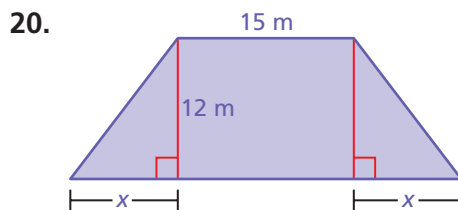
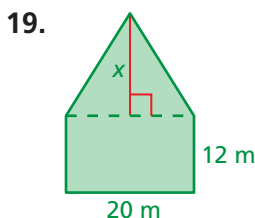
17.

X $1 + \frac{a}{6} > 2$
 $1 + a > 12$
 $a > 11$



18. **UNICYCLE** The first jump in a unicycle high jump contest is shown. The bar is raised 2 centimeters after each jump. Solve the inequality $2n + 10 \geq 26$ to find the number of additional jumps needed to meet or exceed the goal of clearing a height of 26 centimeters.

AREA The area of the figure is at least 400 square meters. Write and solve a two-step inequality to represent the possible values of x . Use 3.14 for π .

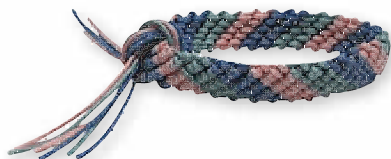


22. **KILLER WHALES** A killer whale has eaten 75 pounds of fish today. It needs to eat at least 140 pounds of fish each day.

- A bucket holds 15 pounds of fish. Write and solve an inequality to represent how many more buckets of fish the whale needs to eat.
- Should the whale be given *four* or *five* more buckets of fish? Explain.



23. **RECYCLING** The sixth grade goal is to collect at least 250 pledges in the Recycling Pledge Card Contest. Your class has 22 students. The other classes have already completed their collections with a total of 180 pledges. Write and solve an inequality to find how many more pledges each student needs for your class to reach its goal.



24. **FRIENDSHIP BRACELET** The bracelet is formed from knots. Each bracelet has two large knots on the ends and six smaller knots per diagonal row. What does the solution of the inequality $6n + 2 \leq 200$ represent?

25. **Reasoning** Write and solve an inequality to help you decide when paying per visit to the zoo is a better deal than an individual membership. When is buying a friend membership a better deal?

Zoo Admission

1. Pay per visit	\$7 per visit
2. Individual membership	\$35 per year
3. Friend membership	\$65 per year
Member and 1 friend free each visit	



Fair Game Review what you learned in previous grades & lessons

Find the radius of a circle with the given diameter. (Section 6.1)

26. 6 inches 27. 4 feet 28. 24 centimeters 29. 13 meters

30. **MULTIPLE CHOICE** Write the ordered pair that represents the point. (Skills Review Handbook)

- (4, 0)
- (3, 3)
- (3, 4)
- (4, 3)

