Essential Question How can you use inequalities to classify different species of animals?
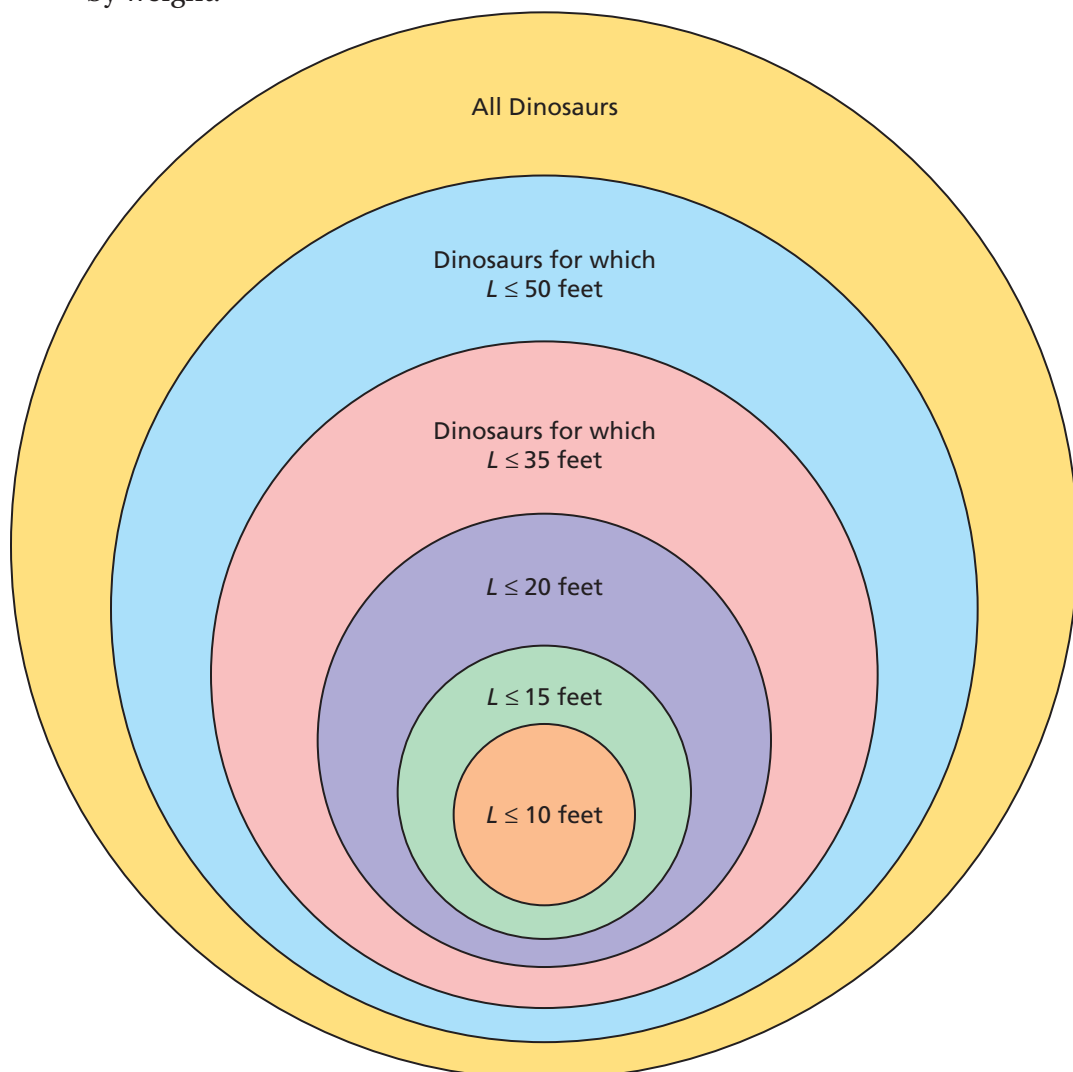
1 ACTIVITY: Classifying Dinosaurs

Work with a partner. Let _L_ represent the length of an adult dinosaur.
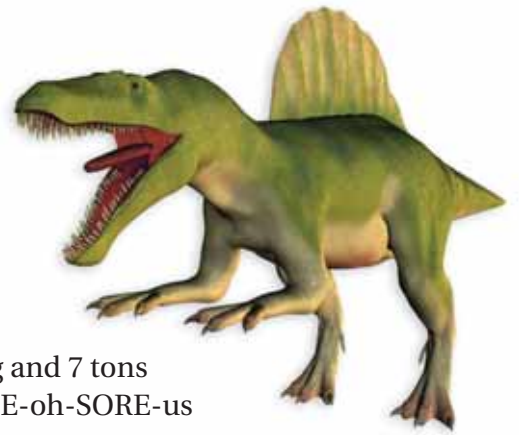
a. Copy the diagram. Put each species of dinosaur shown on the next page into the correct region in the diagram.

b. 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.

c. 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.

d. Draw a different diagram that classifies the six dinosaur species by weight.

All Dinosaurs

Dinosaurs for which
$L \leq 50$ feet

Dinosaurs for which
$L \leq 35$ feet

$L \leq 20$ feet
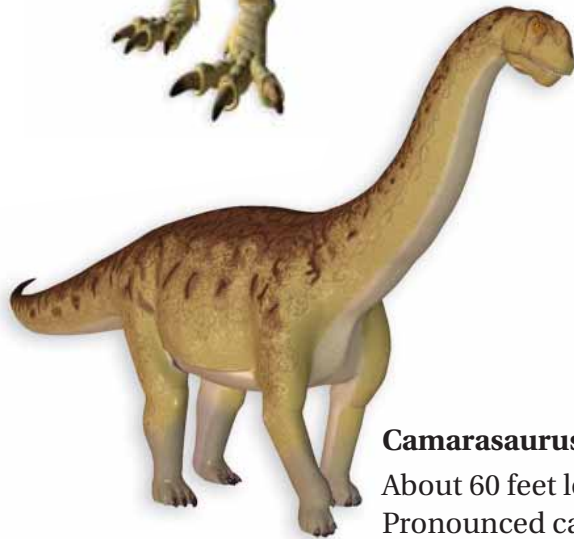
$L \leq 15$ feet

$L \leq 10$ feet

Tyrannosaurus Rex
About 40 feet long and 7 tons
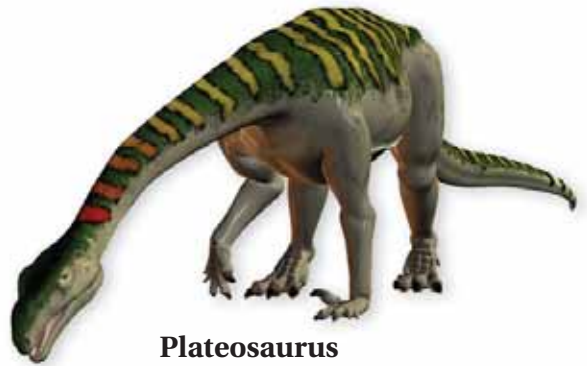Pronounced tih-RAN-oh-SORE-us REX

Spinosaurus
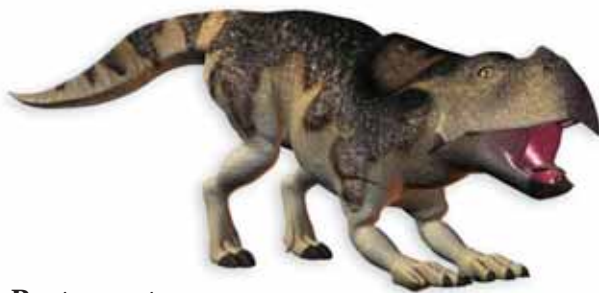About 50 feet long and 7 tons
Pronounced SPINE-oh-SORE-us

Camarasaurus
About 60 feet long and 20 tons
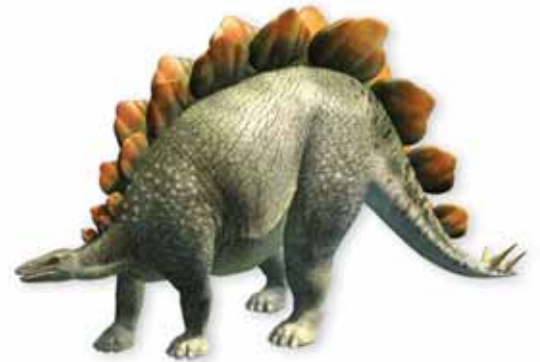Pronounced cam-AH-rah-SORE-us

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.

8.4 Lesson

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.

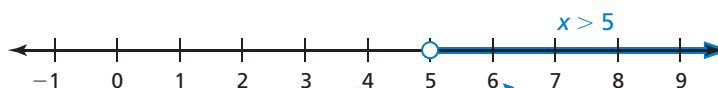|		
	$3x + 2 > 17$	Write the inequality.
Step 1: Undo the addition. →	$\underline{-2 \qquad -2}$	Subtract 2 from each side.
	$3x > 15$	Simplify.
Step 2: Undo the multiplication. →	$\dfrac{3x}{3} > \dfrac{15}{3}$	Divide each side by 3.
	$x > 5$	Simplify.

∴ The solution is $x > 5$.

$x > 5$

Check: $x = 4$ is *not* a solution.   Check: $x = 6$ is a solution.

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

	$\dfrac{y}{6} - 9 \leq 1$	Write the inequality.
	$\underline{+9 \qquad +9}$	Add 9 to each side.
	$\dfrac{y}{6} \leq 10$	Simplify.
	$\dfrac{y}{6} \cdot 6 \leq 10 \cdot 6$	Multiply each side by 6.
	$y \leq 60$	Simplify.

∴ The solution is $y \leq 60$.

$y \leq 60$

On Your Own

Now You're Ready
Exercises 4–15

Solve the inequality. Graph the solution.

1. $4b - 1 < 7$ **2.** $8 + 5c \geq 28$ **3.** $\dfrac{n}{2} + 11 > 12$

EXAMPLE **2** **Real-Life Application**

Our Goal
$3600

$3200
$2800
$2400
$2000
$1600
$1200
$80
$4

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

a. Write an inequality to represent the number of additional pizzas the club must sell to reach or exceed its goal.

b. How many additional pizzas does the club need to sell to reach or exceed its goal?

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

Variable   Let p be the number of additional pizzas sold.

Inequality   1200   +   8   • p $\geq$ 3600

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

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

$$1200 + 8p \geq 3600 \qquad \text{Write the inequality.}$$
$$\underline{-\ 1200} \qquad\qquad \underline{-\ 1200} \qquad \text{Subtract 1200 from each side.}$$
$$8p \geq 2400 \qquad \text{Simplify.}$$
$$\frac{8p}{8} \geq \frac{2400}{8} \qquad \text{Divide each side by 8.}$$
$$p \geq 300 \qquad \text{Simplify.}$$

The club must sell at least 300 additional pizzas.

🔴 **On Your Own**

4. 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.

✔ Vocabulary and Concept Check

1. **REASONING** What is the first operation you would undo to solve the inequality $4x - 9 \le 15$? Explain your reasoning.

2. **REASONING** Describe the steps you could use to solve the inequality $\frac{t}{7} + 4 > 6$.

3. **WHICH ONE DOESN'T BELONG?** Which one does *not* belong with the other three? Explain your reasoning.

$$\frac{s}{4} - 7 \le 3 \qquad \frac{s}{5} \le 8 \qquad s - 7 \le 12 \qquad s \le 40$$

Practice and Problem Solving

Solve the inequality. Graph the solution.

4. $\dfrac{z}{3} + 2 \le 5$

5. $5t - 3 > 7$

6. $8 \le 8 + 4x$

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

8. $3n - 14 \ge 1$

9. $20 + 4a < 40$

10. $15 \le \dfrac{b}{4} + 9$

11. $2y - 8 \le 12$

12. $27 < 8w - 5$
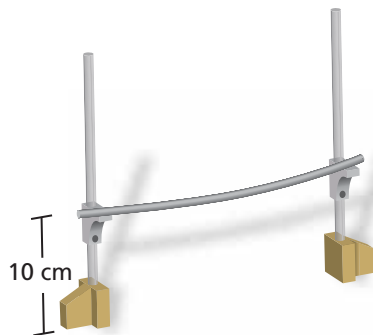
13. $0.2 + 2.6c \le 8$

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

15. $4k + 10.2 > 22.6$

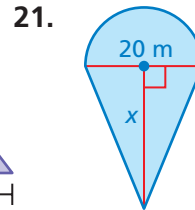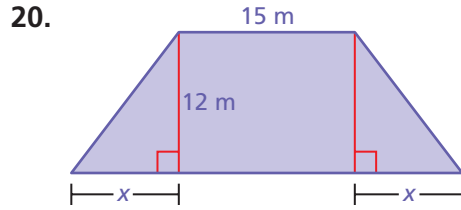**ERROR ANALYSIS** Describe and correct the error in solving the inequality.

16.
✗
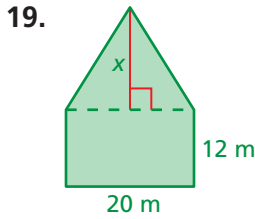$8 > 2x + 6$
$2 > 2x$
$x > 1$

17.
✗
$1 + \dfrac{a}{6} > 2$
$1 + a > 12$
$a > 11$

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 $2n + 10 \ge 26$ to find the number of additional jumps needed to meet or exceed the goal of clearing a height of 26 centimeters.
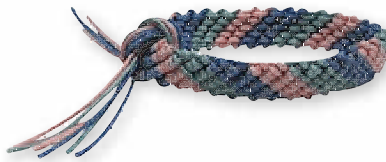
10 cm

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.

19.

x

12 m

20 m

20.

15 m

12 m

x x

21.

20 m

x

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. 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.

  b. 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 $6n + 2 \le 200$ 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)*

  A (4, 0)   **B** (3, 3)

  C (3, 4)   **D** (4, 3)