TAKS

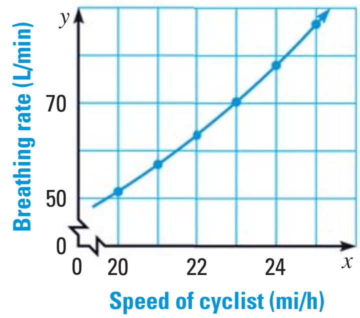
EXAMPLE 4 TAKS REASONING: Multi-Step Problem

CYCLING The table shows the breathing rates *y* (in liters of air per minute) of a cyclist traveling at different speeds *x* (in miles per hour). Tell whether the data can be modeled by a *linear function*, an *exponential function*, or a *quadratic function*. Then write an equation for the function.

Speed of cyclist, *x* (mi/h)	20	21	22	23	24	25
Breathing rate, *y* (L/min)	51.4	57.1	63.3	70.3	78.0	86.6

Solution

STEP 1 **Graph** the data. The graph has a slight curve. So, a linear function does not appear to model the data.



STEP 2 **Decide** which function models the data.

In the table below, notice that $\frac{57.1}{51.4} \approx 1.11$, $\frac{63.3}{57.1} \approx 1.11$, $\frac{70.3}{63.3} \approx 1.11$, $\frac{78.0}{70.3} \approx 1.11$, and $\frac{86.6}{78.0} \approx 1.11$. So, the ratios are all approximately equal. An exponential function models the data.

Speed of cyclist, *x* (mi/h)	20	21	22	23	24	25
Breathing rate, *y* (L/min)	51.4	57.1	63.3	70.3	78.0	86.6

Ratios: 1.11 1.11 1.11 1.11 1.11

STEP 3 **Write** an equation for the exponential function. The breathing rate increases by a factor of 1.11 liters per minute, so $b = 1.11$. Find the value of a by using one of the data pairs, such as (20, 51.4).

REVIEW EXPONENTIAL FUNCTIONS
For help with writing an equation for an exponential function, see p. 520.

$y = ab^x$ **Write equation for exponential function.**

$51.4 = a(1.11)^{20}$ **Substitute 1.11 for *b*, 20 for *x*, and 51.4 for *y*.**

$\frac{51.4}{(1.11)^{20}} = a$ **Solve for *a*.**

$6.38 \approx a$ **Use a calculator.**

▶ The equation is $y = 6.38(1.11)^x$.

GUIDED PRACTICE for Example 4

5. In Example 4, suppose the cyclist is traveling at 15 miles per hour. Find the breathing rate of the cyclist at this speed.