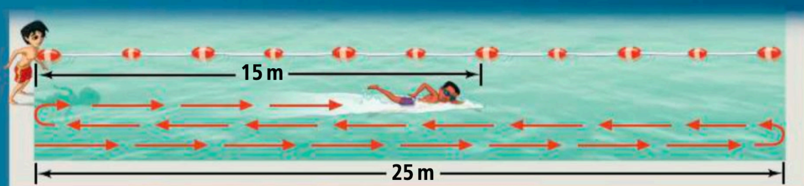
# 4-5 Writing a Function Rule

Start with a simple case—how far has your friend swum when you finish your first lap?

MATHEMATICAL PRACTICES

**SOLVE IT! Getting Ready!**

You and a friend are swimming 20 laps at the local pool. One lap is the distance across the pool and back. You both swim at the same rate. Your friend started first. The trail of arrows shows how far he has already swum. What equation gives the distance you have swum as a function of the number of laps your friend has swum? How far have you swum when your friend finishes? Explain your reasoning.




In the Solve It, you can see how the value of one variable depends on another. Once you see a pattern in a relationship, you can write a rule.

Many real-world functional relationships can be represented by equations. You can use an equation to find the solution of a given real-world problem.

LINEAR FUNCTIONS

$\boxed{\text{Dep. Variable}} = \boxed{\text{Initial Amount}} + \boxed{\text{Rate of Change}} \cdot \boxed{\text{Ind. Variable}}$

**PROBLEM 1: WRITING A FUNCTION RULE**

a) You can estimate the temperature by counting the number of chirps of the snowy tree cricket. The outdoor temperature is about 40ºF more than one fourth the number of chirps the cricket makes in one minute. What is a function rule that represents this situation?

Let $t$ = temperature

$c$ = chirps in one minute

$$\boxed{t = 40 + \tfrac{1}{4}c}$$

i) Use your equation to predict the temperature if you count 48 chirps in one minute.

$t = 40 + \frac{1}{4}(48)$

$t = 40 + 12$

$t = 52$

52°F

ii) Use your equation to predict the number of chirps you should hear if the temperature is 68ºF.

$68 = 40 + \frac{1}{4}c$

$-40 \quad -40$

$4(28) = (\frac{1}{\cancel{4}}c)\cancel{4}$

$112 = c$

112 chirps in one minute

initial amount

rate of change

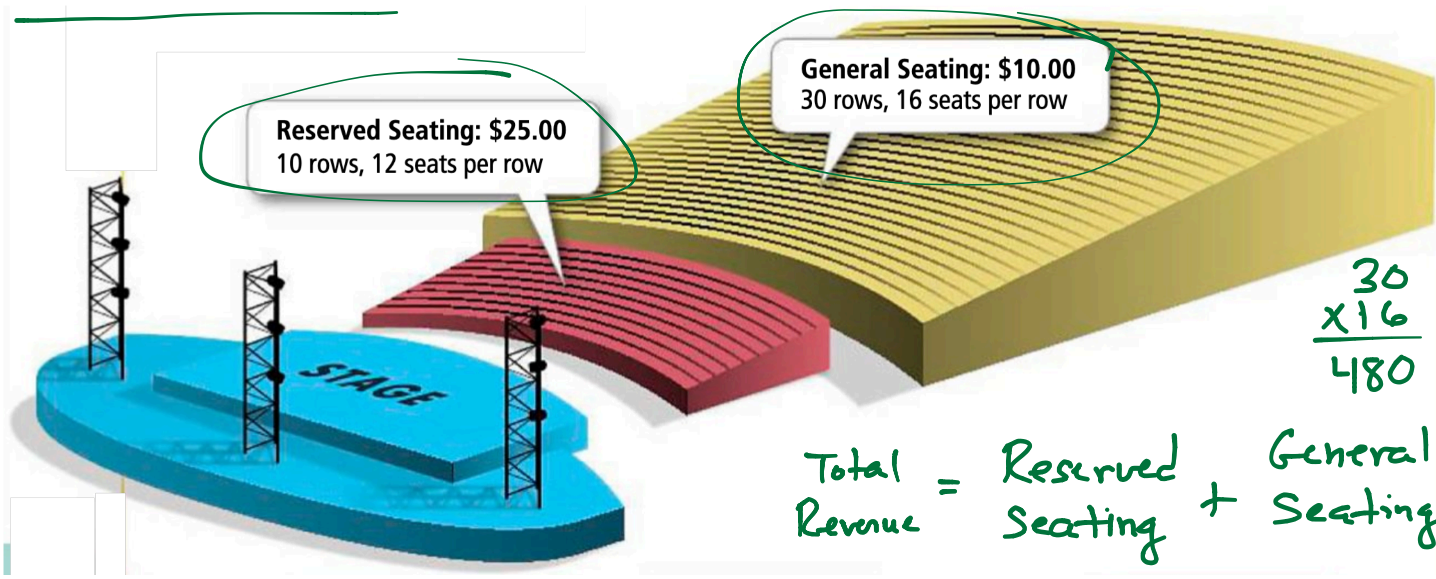
b) A landfill has 50,000 tons of waste in it. Each month it accumulates an average of 420 more tons of waste. What is a function rule that represents the total amount of waste after *m* months?

Let w = total waste ✓

$\boxed{w = 50000 + 420m}$ ✓

**PROBLEM 2: WRITING AN EVALUATING A FUNCTION RULE**

a) A concert seating plan is shown below. Reserved seating is sold out. Total revenue from ticket sales will depend on the number of general-seating tickets sold. Write a function rule to represent this situation. What is the maximum total revenue?




$$\begin{array}{r} 30 \\ \times 16 \\ \hline 480 \end{array}$$

Total Revenue = Reserved Seating + General Seating

Let r = total revenue

g = general-seating tickets

$r = (10)(12)(25) + 10g$

$\boxed{r = 3000 + 10g}$

$r = 3000 + 10(480)$
$= 3000 + 4800$
$= 7800$

Max revenue is $7800.

rate

initial

b) A kennel charges $15 per day to board dogs. Upon arrival, each dog must have a flea bath that costs $12. Write a function rule for the total cost for *n* days of boarding plus a bath. How much does a 10-day stay cost?

Let c = total cost

$\boxed{c = 12 + 15n}$

$c = 12 + 15(10)$
$= 12 + 150$
$= 162$

$162 for 10-day stay

**PROBLEM 3: MORE PRACTICE**

*Write a function rule that represents each situation.*

initial rate

a) The price $p$ of a pizza is \$6.95 plus \$0.95 for each topping $t$ on the pizza.

$$\boxed{p = 6.95 + 0.95t}$$

initial rate

b) A helicopter hovers 40 ft above the ground. Then the helicopter climbs at a rate of 21 ft/s. Write a rule that represents the helicopter's height $h$ above the ground as a function of time $t$. What is the helicopter's height after 45 s?

$$\boxed{h = 40 + 21t}$$

$h = 40 + 21(45)$
$= 40 + 945$
$= 985$

985 ft after 45 sec.

c) A new book is being planned. It will have 24 pages of introduction. Then it will have $c$ 12-page chapters and 48 more pages at the end. Write a rule that represents the total number of pages $p$ in the book as a function of the number of chapters. Suppose the book has 25 chapters. How many pages will it have?

$$\boxed{p = 72 + 12c}$$

$p = 72 + 12(25)$
$= 72 + 300$
$= 372$

372 pages

d) You go to dinner and decide to leave a 15% tip for the server. You had \$55 when you entered the restaurant.

i) Make a table showing how much money you would have left after buying a meal that costs \$15, \$21, \$24, and \$30.

| Cost | | Left |
|---|---|---|
| 15 | $55-(15+.15(15))$ | 37.75 |
| 21 | $55-(21+.15(21))$ | 30.85 |
| 24 | $55-(24+.15(24))$ | 27.40 |
| 30 | $55-(30+.15(30))$ | 20.50 |
| c | $55-(1c+.15c)$ | |

$55 - 1.15c$

+6, +3, +6

$\frac{\Delta \text{dep}}{\Delta \text{ind}}$

$\frac{-6.90}{+6} = -1.15$

$\frac{-3.45}{+3} = -1.15$

$\frac{-6.90}{+6} = -1.15$

42

| | |
|---|---|
| 10% | 4.2 |
| + 5% | 2.1 |
| 15% | 6.30 |

ii) Write a function rule for the amount of money $m$ you would have left if the meal costs $c$ dollars before the tip.

$$\boxed{m = 55 - 1.15c}$$

rate/day

e) A car rental agency charges \$29 per day to rent a car and \$13.95 per day for a a GPS device. Customers are charged for their full tank of gas at \$3.00 per gallon.

i) A car has a 12-gal tank and a GPS. Write a rule for the total bill *b* as a function of the number of days *d* the car is rented. $\times 3$

36 ← initial

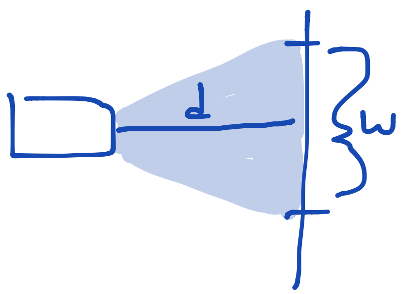
$$\boxed{b = 36 + 42.95d}$$

ii) What is the bill for a 9-day rental?

$$b = 36 + 42.95(9)$$
$$= 36 + 386.55$$
$$= 422.55$$

\$422.55

f) You consult your new projector's instruction manual before mounting it on the wall. The manual says to multiply the desired image width by 1.8 to find the correct distance of the projector lens from the wall.




i) Write a rule to describe the distance of the lens from the wall as a function of desired image width.

Let $d$ = distance from wall

$w$ = width of image

$$\boxed{d = 1.8w}$$

ii) The farthest you could possible fit a projector away from the screen in a certain room is 12 ft. Would you be able to project an image 7 ft wide?

$w$

$$d = 1.8(7)$$
$$= 12.6$$

NO. You would need to be 12.6 ft away

iii) What is the maximum image width you can project in that room?

$$12 = 1.8w$$
$$\frac{12}{1.8} = \frac{1.8w}{1.8}$$
$$6.7 = w$$

$6\frac{2}{3}$ ft is the max image width.