

# 4.3 Exponential Decay

- ▶ Make a table and graph showing exponential decay.
- ▶ Calculate and use half-life.
- ▶ Find an exponential decay rate.

### Calculating Exponential Decay

A quantity has **exponential decay** when the quantity *decreases* by the same percent from one time period to the next.

**Study Tip**

As with exponential growth, be sure you see that the rate of decay is written in decimal form.

### Formula for Exponential Decay

A quantity  $A$  that has exponential decay can be modeled by

$$A = P(1 - r)^n$$

$A$  measures the quantity at any time.

$P$  is the initial value of  $A$ , when  $n = 0$ .

$r$  is the rate (%) of decay, in decimal form.

$n$  is the elapsed time.

### EXAMPLE 1 Making a Table

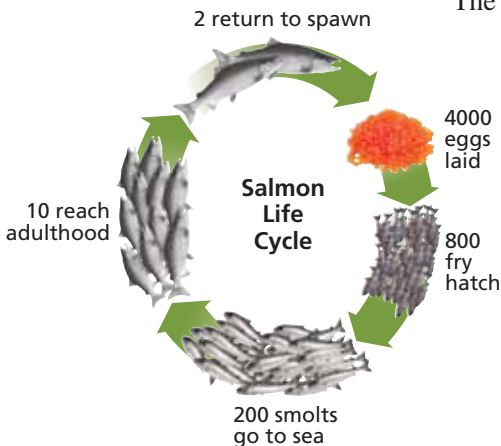
As young salmon pass through a turbine on a hydroelectric dam (on their way to the ocean), about 15% are killed. Make a table showing how many of 100,000 young salmon survive after passing through 6 turbines.



#### SOLUTION

The formula for this exponential decay is

$$A = P(1 - r)^n = 100,000(1 - 0.15)^n \quad P = 100,000, r = 15\% = 0.15$$



Turbines, $n$	Formula	Survivors
0	$A = 100,000(0.85)^0$	$A = 100,000$
1	$A = 100,000(0.85)^1$	$A = 85,000$
2	$A = 100,000(0.85)^2$	$A = 72,250$
3	$A = 100,000(0.85)^3$	$A = 61,412$
4	$A = 100,000(0.85)^4$	$A = 52,200$
5	$A = 100,000(0.85)^5$	$A = 44,370$
6	$A = 100,000(0.85)^6$	$A = 37,714$

Remember that a nonzero number raised to an exponent of 0 is defined to be 1.

### ✓ Checkpoint

Help at [Math.andYOU.com](http://Math.andYOU.com)

In the Columbia and Snake River system, some young salmon pass through 12 turbines. Of 100,000 young salmon, how many will survive?