

**Study Tip**

Suppose the value of a new automobile decreases from \$32,000 to \$26,000 after 1 year. The ratio of the second year's value to the first year's value is

$$\frac{A_1}{A_0} = \frac{26,000}{32,000} = 0.8125 = 1 - r.$$

This implies that  $r = 0.1875$ . So, the rate of decay is 18.75%.



As you get older and your BMR decreases, you may need to exercise more or eat less to keep from gaining weight.

**Finding an Exponential Decay Rate**

**Exponential Decay Rate**

If  $A_0$  and  $A_1$  are the quantities for any two times, then the decay rate between those times,  $r$ , is given by

$$\frac{A_1}{A_0} = 1 - r.$$

**EXAMPLE 5 Finding an Exponential Decay Rate**

Your *basal metabolic rate* (BMR) is the number of calories you expend per day while in a state of rest. Informally, it is the amount of calories your body uses to stay alive. Studies show that your BMR decreases in adulthood.

A man's BMR was 1800 calories when he was 20 years old. It decreased to 1710 calories when he was 30 years old. Assuming his BMR decays exponentially, estimate the man's age when his BMR will be about 1390 calories.

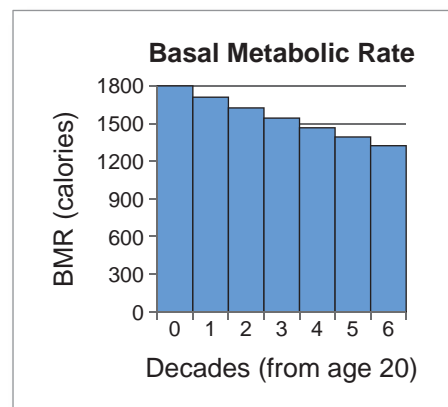
**SOLUTION**

Begin by dividing the BMR at age 30 by the BMR at age 20.

$$\frac{A_1}{A_0} = \frac{1710}{1800} = 0.95 = 1 - r$$

This implies that  $r = 0.05$  and the rate of exponential decay is 5% every decade. Use a spreadsheet to calculate a 5% per decade decrease from the age of 20 for several decades.

DATA		A	B
1	Decades	BMR (calories)	
2	0	1800.0	
3	1	1710.0	
4	2	1624.5	
5	3	1543.3	
6	4	1466.1	
7	5	1392.8	
8	6	1323.2	



From the spreadsheet, you can see that his BMR will be about 1390 calories after 5 decades. So, he will be 70 years old.

**✓ Checkpoint**

In the above example, suppose the man's BMR decreased to 1764 calories when he was 30 years old. Estimate the man's age when his BMR will be about 1660 calories assuming it decreases exponentially. Explain the results.

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