Problem of the Week
Problem A and Solution
My Beating Heart

Problem

A) My resting heart rate is 21 beats in 15 seconds. Predict my number of heart beats in 1 minute.

B) After skipping rope for 1 minute, my heart rate is now 30 beats in 15 seconds. Now, predict my number of heart beats in 1 minute.

C) If I skip for 10 minutes and my heart rate continues to be 30 beats in 15 seconds, predict how many times my heart will beat in 10 minutes.

Solution

A) One way to solve this problem is by making a table keeping track of how times your heart beats every 15 seconds.

Time Elapsed in seconds	Heart Beats
15	21
30	42
45	63
60	84

Since 60 seconds equals one minute, we can expect that you will have had 84 heart beats over that time.

B) Since $4 \times 15 = 60$ seconds, if we know your heart rate for 15 seconds we can calculate your heart rate for 1 minute by multiplying by 4. So, we can predict that your heart beats $4 \times 30 = 120$ times in 1 minute after skipping.

C) We expect that the number of times your heart beats in 10 minutes will be 10 times the number of beats you have in 1 minute. So after 10 minutes of skipping we expect your heart beats $10 \times 120 = 1200$ times.

Teacher's Notes

To solve this problem, we used a concept from probability theory known as *expected value*. We assumed that the actual measurement of our heart beat over a short period of time would allow us to predict the number of heart beats over a longer period of time. Our predictions in this case are reasonable if the conditions remain stable.

Although expected value is useful for predicting the future, there are other factors that affect predictions. Statisticians would also consider the *variance* of a particular situation. Variance describes the range of possible values that could actually occur. When the variance is low, then our predictions are more likely to be correct or at least close to correct. When the variance is high, then our prediction may be correct, but the actual outcome may be much different than the expected value.