Alternative Assessment

1. Work in cooperative groups to analyze a game of chess in terms of displacement vectors. Make a model chessboard, and draw arrows showing all the possible moves for each piece as vectors made of horizontal and vertical components. Then have two members of your group play the game while the others keep track of each piece's moves. Be prepared to demonstrate how vector addition can be used to explain where a piece would be after several moves.

2. Use a garden hose to investigate the laws of projectile motion. Design experiments to investigate how the angle of the hose affects the range of the water stream. (Assume that the initial speed of water is constant and is determined by the pressure indicated by the faucet's setting.) What quantities will you measure, and how will you measure them? What variables do you need to control? What is the shape of the water stream? How can you reach the maximum range? How can you reach the highest point? Present your results to the rest of the class and discuss the conclusions.

3. You are helping NASA engineers design a basketball court for a colony on the moon. How do you anticipate the ball's motion compared with its motion on Earth? What changes will there be for the players—how they move and how they throw the ball? What changes would you recommend for the size of the court, the basket height, and other regulations in order to adapt the sport to the moon's low gravity? Create a presentation or a report presenting your suggestions, and include the physics concepts behind your recommendations.

4. There is conflicting testimony in a court case. A police officer claims that his radar monitor indicated that a car was traveling at 176 km/h (110 mi/h). The driver argues that the radar must have recorded the relative velocity because he was only going 88 km/h (55 mi/h). Is it possible that both are telling the truth? Could one be lying? Prepare scripts for expert witnesses, for both the prosecution and the defense, that use physics to justify their positions before the jury. Create visual aids to be used as evidence to support the different arguments.

Graphing Calculator *Practice*

Two Dimensional Motion

Recall the following equation from your studies of projectiles launched at an angle.

$$\Delta y = (v_i \sin \theta)\Delta t + \tfrac{1}{2}a_y(\Delta t)^2$$

Consider a baseball that is thrown straight up in the air. The equation for projectile motion can be entered as Y_1 on a graphing calculator.

$$Y_1 = VX - 4.9X^2$$

Given the initial velocity (V), your graphing calculator can calculate the height (Y1) of the baseball versus the time interval (X) that the ball remains in the air. Why is the factor $\sin \theta$ missing from the equation for Y_1?

In this activity, you will determine the maximum height and flight time of a baseball thrown vertically at various initial velocities.

Visit go.hrw.com and type in the keyword **HF6TDMX** to find this graphing calculator activity. Refer to **Appendix B** for instructions on downloading the program for this activity.