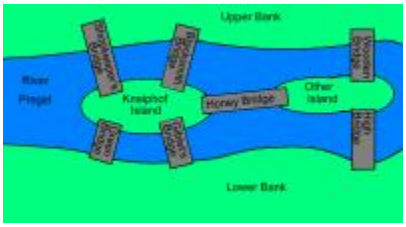
Pre-Calculus
Applications 4 ’05-‘06

1) Biorhythms are mathematically based predictors of your physical, emotional, and intellectual capabilities (in terms of percentage) for a given day. The physical cycle is 23 days in length, the emotional cycle is 28 days in length, and the intellectual cycle is 33 days in length. On the day of your birth, each cycle (which follows a sine/cosine curve is at 50% and decreasing.
    a) Leonhard Euler was born on April 15, 1707. He died on September 7, 1783. How was Euler doing emotionally on the day he married (January 7, 1734)? How was his physical biorhythm on the day he died?
    b) Construct a chart of your overall biorhythm (combine all three) for the month of February 2006.



2) Tuning musical instruments uses the sum of sine waves. When two sounds with different wavelengths are added together, you hear beats in the tone. A tuner has come to tune your piano. The tuner plays his tuning fork at an amplitude of A with a frequency of 440 Hertz. The piano plays the “same note” but has a frequency of 441 Hertz. Find the number of beats per second the tuner will hear. Find the number of beats heard if the frequency of the piano is 442, 443, 444, 445, 446, etc. Provide a graphical analysis of the situation.

3) A typical CD's data ranges from an inner radius of 2.25 cm to an outer radius of 5.5 cm. If a CD player is to read the data at a constant rate (which they used to do), the drive's motor must adjust as you read from the different parts of the CD. The motor's maximum speed is 10000 revolutions per minute.
    a) Find the angular (in radians/minute) and linear (in meters/second) velocity at the outermost point of the CD.
    b) Find the angular (in radians/minute) and linear (in meters/second) velocity at the innermost point of the CD.
    c) Define the motor's speed (in revolutions/second) as a function of the radius of the CD. Clearly identify units, discuss domain and range, and include an appropriate graph.

4) Tall players seem to advantage when serving in tennis. In matches shown on TV, it seems that short players must use spin serves and are less able to hit hard, flat serves. Why? Here are questions to consider: At what heights are serves usually hit? How high is the net? How long is the service box? How far is the ball from the net when it is hit? Is there a minimum height from which a flat, driving serve can be hit? Is there an advantage in serving from far behind the service line? Is there an advantage in serving from the corner of the service area? Should the server jump when serving?