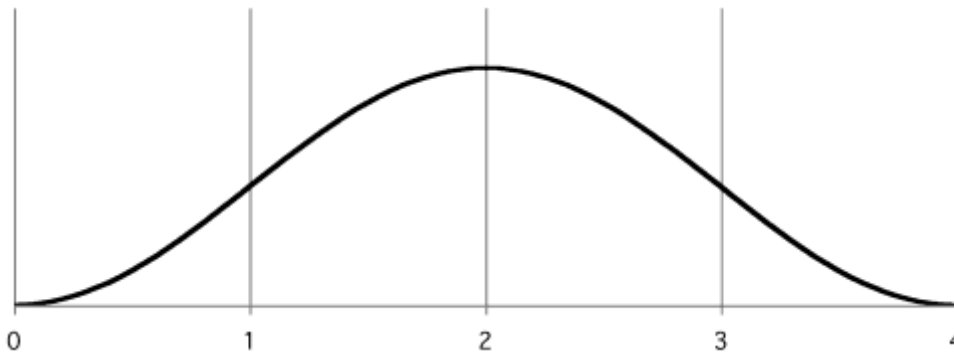**SCI 340 Worksheet #2**
**Unit Conversion and Constant-Acceleration Kinematics**

1. The speed of sound in air is typically around 340 m/s.  What is this speed in mi/h?  Show your work.

2. In the plot below, in what regions is the slope of the curve:



positive? _____    negative? _____    zero? _____

increasing? _____    decreasing? _____

3. In 1954 the English runner Roger Bannister broke the four-minute barrier for a mile with a time of 3:59.4 s.  In 1999 the Moroccan runner Hicham el-Guerroj set a record of 3:43.1 s for the mile.  If these two runners had run against each other, each running at the same average speed of their record races, what distance ahead of Bannister would el-Guerroj have finished?

4.  This graph shows energy production and consumption in the United States from 1850 to 2002.  A "QBtu" is $10^{15}$ British thermal units.

a.  Use a straightedge to draw a single straight line on the graph to *approximate* the data for energy consumption.
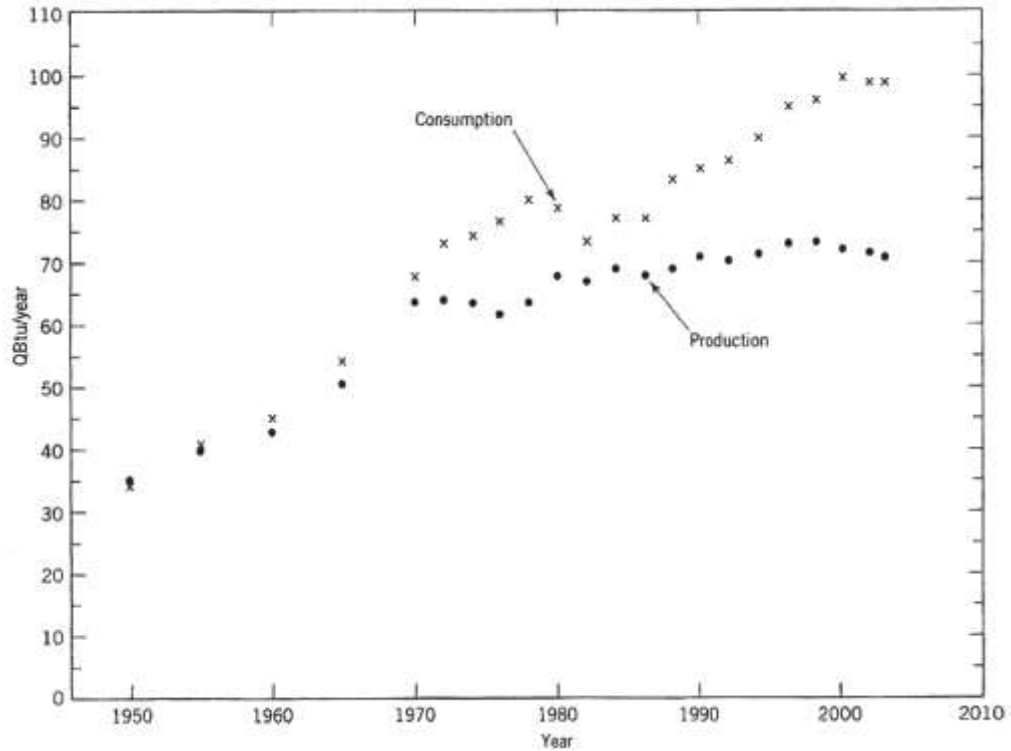


Source: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2003*.

b.  Between 1950 and 2002, what is the area under the line you drew?

c.  What are the units of the area?

d.  What is the physical meaning of the area and of its units?

e.  What is the slope of the line you drew?

f.  What are the units of the slope?

g.  What is the physical meaning of the slope and of its units?

5. A tourist being chased by an angry moose is running in a straight line toward his car at a speed of 4.0 m/s. The car is a distance $d$ away. The moose is 26 m behind the tourist and running at 6.0 m/s. The tourist reaches his car safely. What is the maximum possible value for $d$?

6. The fastest road-tested acceleration for a standard production car occurred in 1993, when a Ford RS200 Evolution went from 0 to 26.8 m/s in 3.275s. Find the magnitude of the car's average acceleration.

7. A ball starts from rest and rolls down an incline at a constant acceleration. In 5 s, it rolls a distance of 50 m down the hill.

   a. What is its acceleration?

   b. If the same ball rolls down the same incline with the same acceleration, but begins with an initial downhill velocity of 2.0 m/s, how far down the hill will it be in 5 s?

   c. If the ball begins with an initial uphill velocity of 2.0 m/s, where will it be at 5 s?