Name: ____________________________ Section: ________________________

Clear your desk of everything except pens, pencils and erasers. **Show all your work.**
If you have a question raise your hand and I will come to you.

1. Calculate and show in detail the volume $V$ of a solid sphere given by rotating curve $x^2 + y^2 = 2^2$ (total 5 points).
   
   Answer: $V = \frac{32}{3} \pi$
   
   (1 point for a correct figure; 3 points for setting correct integral: $V = \int_{-2}^{2} \pi(2^2 - x^2)dx$; and 1 point for the correct integration)

2. How much work $W$ must be done to lift a small satellite of weight 1000-lb vertically from earth’s surface, $r = 4000$ (mi), to an orbit 1000 mi above the surface? (Note: Newton’s law of gravitation is $F(r) = \frac{k}{r^2}$.) (total 5 points)
   
   Answer: $W = 8 \times 10^5$ mi \cdot lb
   
   (2 points for correct $k$ value ($k = F \times r^2 = 16 \times 10^9$ mi$^2 \cdot$ lb); 2 points for correct integral: $W = \int_{4000}^{5000} \frac{k}{r^2}dr$; 1 point for correct integration)