The class before the exam there will be a chance to earn extra credit. Groups of three to four can present a solution to one of the problems below. Up to 4% can be earned:

- [1] Mastery of the problem: Do you understand the problem and all of the steps used to solve it? Would you be able to solve the problem if given a slightly different question?
- [1] Presentation of the problem: You are presenting material to your classmates that will be on their exam next week! Take care to explain your steps and why you take them but your group also needs to complete your presentation in under 10 minutes!
- [1] Presentation: Do you interact with your audience? Do you make eye contact?
- [1] Fielding questions: Can you understand the questions and give a cohesive answer?

Word Problem Practice take 2

1. A rocket accelerates by burning its onboard fuel, so the mass of the rocket decreases with time. Suppose the initial mass of the rocket at lift off (including its fuel) is m, the fuel is consumed at a rate r, and the exhaust gases are ejected with constant velocity v_c (relative to the rocket). A model for the velocity of the rocket at time t is given by the equation
$$v(t) = -gt - v_c \ln\left(\frac{m - rt}{m}\right)$$
where g is the acceleration due to gravity and t is not too large. If the rocket is on earth, $m = 30,000\text{kg}$, $r = 160\frac{\text{kg}}{\text{s}}$, and $v_c = 3000\frac{\text{m}}{\text{s}}$, find the height of the rocket one minute after liftoff. What is the velocity one minute after liftoff? Acceleration one minute after liftoff?

2. A charged rod of length L produces an electric field at point $P(a, b)$ given by
$$E(P) = \int_{-a}^{L-a} \frac{\lambda b}{4\pi\epsilon_0(x^2 + b^2)^{\frac{3}{2}}} dx$$
where λ is the charge density per unit length on the rod and ϵ_0 is the free space permittivity. Evaluate the integral to determine an expression for the electric field $E(P)$.

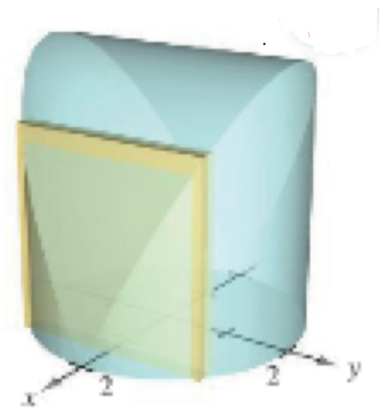
3. The download rate from the internet company is variable starting low, increasing, and then decreasing again. This data download rate (megabytes/second) can be modeled by $500t^2e^{-3t} + 10$ where t is seconds since the start of download. How long does it take for a computer to download a movies that is 3 gigabytes.

4. A manufacturer begins with a metal sphere with a radius of 5 inches and drills a 2 inch hole directly through the center of it. What is the volume of the resulting metal ring?

5. Find the volume of the solid generated by revolving the region bounded by the graphs of $y = \sqrt{x}$, $y = 0$, and $x = 3$ that is revolved around the line $x = 3$.

6. A torus that is 4 units 'thick' with a 'hole 2 units across' is generated by rotating the circle $x^2 + (y - 3)^2 = 2^2$. Find the volume enclosed by the torus.

7. Find the volume of the solid whose base is bounded by the circle $x^2 + y^2 = 4$ with square cross sections that are perpendicular to the x axis. The figure is shown to the right.



8. Find the volume of the solid whose bases is bounded by the circle $x^2 + y^2 = 4$ with rectangle cross sections that are perpendicular to the x axis of fixed height 2.

9. A red-throated loon has an egg that is well modeled by rotating the region below the graph of $f(x) = (-0.06x^3 + 0.04x^2 + 0.1x + 0.54)\sqrt{1 - x^2}$ around the x-axis. Use the description to find the volume of the egg. Explain how you might find the volume of the egg in real life.

10. A water storage tank has the shape of a cylinder with diameter 10ft. It is mounted so that the circular cross-sections are vertical. If the depth of the water is 7ft, what percentage of the total capacity is being used?

11. Create your own problem. You must have this approved by the instructor.