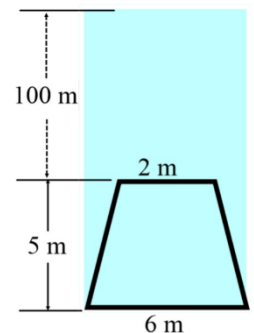


Do all your work and put all your answers WITH your work, CIRCLED, on the white paper provided. All I want on this sheet is your NAME! Work up to 4 **Bonus** problems.

- (15 pts) Write the integral for the arc length of the graph of the function $y = \sqrt{4 - x^2}$ from $x = -1$ to $x = 2$.
- (5 pts **Bonus**) Find the exact arc length from #1.
- Write the integral for the surface area obtained by revolving the graph of $x = y^2 + 2$ for $2 \leq x \leq 11$ about the ...
 - (10 pts) ... y -axis.
 - (10 pts) ... x -axis.

- (5 pts **Bonus**) Give an exact answer for #3b. Hint: I found this one to be easier if I inverted the $x = g(y)$ to get $y = g^{-1}(x)$ and used that formulation for the integral.

- (10 pts) A gate at the bottom of a hydro-electric dam is as shown in the picture. Recall that the density of water is $1000 \frac{kg}{m^3}$ and the acceleration due to gravity is $9.8 \frac{m}{s^2}$. Write the integral giving the hydrostatic force on the submerged plate.



- (5 pts) Find the force on the plate, to the nearest Newton.
- (10 pts) The growth rate of a trout population in a beaver pond is proportional to the population, itself. If they stock the pond with 20 trout, in 5 years, there are 500 trout. How many trout will be in the pond in 100 years, if nothing happens to slow the rate of population growth?
- (5 pts) What are the problems with the population model in #7, if any?
- (10 pts) Solve the differential equation $\frac{dp}{dt} = t^2 p + t^2 - p - 1$. Hint: This equation is separable. To see this, factor the right-hand-side, by grouping.

10. (10 pts) Solve the differential equation $2xy' + y = 2\sqrt{x}$

11. (15 pts) $y'' - 3y' - 10y = 0$

12. (5 pts **Bonus**) Evaluate $\int_e^\infty \frac{dx}{x(\ln(x))^4}$

13. (5 pts **Bonus**) Evaluate $\int x^2 \ln(\sqrt[5]{x^4}) dx$

14. (5 pts **Bonus**) If $y = (1 + x)^{\frac{3}{x}}$, what is $\frac{dy}{dx}$?