Exam 1 Review **February, 2026**
Calculus II **Prof. Nollet**

Look over all of your home work and quizzes, try to overcome problems you might have had there. Practice similar problems with book closed.

5.5 Method of u-substitution for integrals. This can be useful, as you have seen on quizzes and homework.

5.6 Area of the region $R : g(x) \leq y \leq f(x)$ for $a \leq x \leq b$ is given by $A = \int_a^b f(x) - g(x)\, dx$. Similarly if x is a function of y.

6.1 If a solid has cross-sectional area $A(x)$ for $a \leq x \leq b$, then the volume is $V = \int_a^b A(x)\, dx$. Washers: if region R above is revolved about x-axis, then cross sections are circles of smaller radius $g(x)$ and larger radius $f(x)$, so $V = \int_a^b \pi(f(x)^2 - g(x)^2)\, dx$. Be able to adjust this for different axes of revolution, including vertical axes, when your variable is y.

6.2 Shells: If the shells of the solid have radius $r(x)$ and height $h(x)$, then volume is $V = \int_a^b 2\pi r(x)h(x)\, dx$ for revolution about vertical line. To revolve about a horizontal line, can switch x and y.

6.3 & 6.4 For a curve $y = f(x)$ for $a \leq x \leq b$, set $ds = \sqrt{1 + (dy/dx)^2}$. Then the arc length is $L = \int_a^b ds$ and the surface area of revolution about a line is $\int_a^b 2\pi r(x)\, ds$, where $r(x)$ is the radius of a strip.

6.5 Formula for work under variable force $F(x)$ is $\int_a^b F(x)\, dx$. Be able to apply to spring problems with Hooke's law and chain problems. Most likely exam question would be the tank pumping problems, where you have to take into account both variable force and distance.

6.6 A *thin wire* of density $\delta(x)$ for $a \leq x \leq b$ weighs $M = \int_a^b \delta(x)\, dx$. If the *plate* $g(x) \leq y \leq f(x)$ for $a \leq x \leq b$ has constant density δ, the mass is $M = \int_a^b \delta(f(x) - g(x))\, dx$, the y-moment is $M_y = \int_a^b \delta x(f(x) - g(x))\, dx$ and x-moment $M_x = \int_a^b \delta((f(x))^2 - (g(x))^2)/2\, dx$. The center of mass is $(\overline{x}, \overline{y}) = (M_y/M, M_x/M)$. Pappus theorem: To find the volume of revolution about any line L, let r be the distance from $(\overline{x}, \overline{y})$ to L, then $V = 2\pi r A$, where A is the area.