Exam 2 Review

Note: This is not a complete list of topics – you should study your lecture notes and homework in addition to reviewing the items listed here.

1. hyperbolic functions (§ 5.8)

$$\sinh x = \frac{e^x - e^{-x}}{2} \qquad \cosh x = \frac{e^x + e^{-x}}{2}$$

   - be prepared to verify an identity using the definitions above
   - derivatives and integrals will be given as they were on Exam 1

2. differential equations (§ 6.2)
   - solving differential equations – separation of variables
     separate *dy* and *y* from *dx* and *x*

ex $y' = x(1+y)$

$\frac{y'}{1+y} = x$	separate the variables
$\frac{y'}{1+y}dx = xdx$	multiply both sides by *dx*
$\int \frac{dy}{1+y} = \int xdx$	$dy = y'dx$
$\ln\lvert 1+y\rvert = \frac{1}{2}x^2 + C_1$	integrate
$1+y = e^{\frac{1}{2}x^2 + C_1} = e^{\frac{1}{2}x^2}e^{C_1}$	solve for *y*
$y = Ce^{\frac{1}{2}x^2} - 1$	let $C = e^{C_1}$

   - growth and decay: $y = Ce^{kt}$

3. area (§ 7.1)

$$A = \int_a^b [f(x) - g(x)]dx \quad \text{or} \quad A = \int_c^d [f(y) - g(y)]dy$$

4. volume (§ 7.2 and 7.3)
   - washer/disk: $V = \pi \int_a^b \left(R^2 - r^2\right)(thickness)$
   - shell: $V = 2\pi \int_a^b (radius)(height)(thickness)$

5. arc length (§ 7.4)
   - $s = \int_a^b ds \qquad ds = \sqrt{1 + [f'(x)]^2}\,dx = \sqrt{1 + [g'(y)]^2}\,dy$

6. surface area (§ 7.4)
   - $S = 2\pi \int_a^b (radius)ds$

7. work (§ 7.5)
   - $W = FD$ Work = Force × Distance
   - $F = ma$ Force = mass × acceleration
   - $F = kd$ Hooke's Law for springs
   - $W = \int_a^b F(x)dx$
   - idea: find the work to move one "piece", and add up all the "pieces" (i.e. integrate)
8. center of mass (§ 7.6)

$$\bar{x} = \frac{M_y}{m} \qquad \bar{y} = \frac{M_x}{m}$$

point masses	*planar region*	
$M_y = \sum_{i=1}^{n} m_i x_i$	$M_y = \rho\int_a^b x[f(x) - g(x)]dx$	moment about the *y*-axis
$M_x = \sum_{i=1}^{n} m_i y_i$	$M_x = \rho\int_a^b \left[\frac{f(x)+g(x)}{2}\right][f(x) - g(x)]dx$	moment about the *x*-axis
$m = \sum_{i=1}^{n} m_i$	$m = \rho\int_a^b [f(x) - g(x)]dx$	total mass of the system

9. fluid force (§ 7.7)
   - $P = wh$ Pressure = weight-density × depth
   - $F = PA$ Fluid force = pressure × area

   - idea: same as work – find the force on one "piece", and add up all the "pieces"