Math 173 Exam 4 Review

Sample Problems – These are meant to be representative of the level of difficulty of what might be on an exam – it's a small sample, not meant to be an all-inclusive list of problem types.

1. Evaluate $\int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}}\int_{\sqrt{x^2+y^2}}^{\sqrt{2-x^2-y^2}} \sqrt{x^2+y^2+z^2}\, dz\, dy\, dx$ using spherical coordinates. $\pi(1-\sqrt{2}/2)$

2. Set up the integral for transformation, but do not integrate: $\int_1^3\int_3^9 \frac{4}{9} uv\, dv\, du$

   $\iint_R xy^3 dA$ Jacobian: $\left|-\frac{1}{3u}\right|$

   where R is the region bounded by $xy = 1$, $xy = 3$, $y = 2$ and $y = 6$ using the transformation $x = \frac{v}{6u}$, $y = 2u$

Calculate the following integrals, giving exact answers (no decimal approximations). If a specific method is stated, use it; if not stated, you may use the method of your choice. All curves and surfaces are oriented in the positive direction

3. $\oint_C f\, dS$ where $f(x, y) = y$ and C is the quarter circle $x^2 + y^2 = 9$ from (3, 0) to (0, 3)

   $=9$

4. $\oint_C \boldsymbol{F}\cdot d\boldsymbol{r}$ where $\boldsymbol{F}(x, y, z) = \langle z, y, 0\rangle$ and C is the line segment from (1, 0, 2) to (2, 4, 2)

   $=10$

5. $\int_C \boldsymbol{F}\cdot d\boldsymbol{r}$ where $\boldsymbol{F}(x, y, z) = \frac{\langle x,y,z\rangle}{\sqrt{x^2+y^2+z^2}}$ and C is a bath from (2, 0, 0) to (0, 1, -1).

   $=\sqrt{2}-2$

6. $\oint_C \boldsymbol{F}\cdot d\boldsymbol{r}$ where $\boldsymbol{F}(x, y) = \langle x^3 - y, x + y^3\rangle$, and C is the boundary formed by the intersection of $y = x^2$ and $y = x$, using Green's Theorem. $1/3$

7. Find the surface integral of $\boldsymbol{F}$ over the boundary of E if $\boldsymbol{F}(x, y, z) = \langle x^2, z^2 - x, y^3\rangle$, and E is the solid bounded by $z = \sqrt{x^2 + y^2}$, and $z = \sqrt{2 - x^2 - y^2}$. Spherical coordinates recommended.

   0

This is beyond what we covered – Replace with:

8. Find a parametric representation of surface, including intervals for the part of $z = x+3$ that lies inside $x^2+y^2=1$