Test 2: All Unit 2 notes and posted Unit 2 slides

Basic knowledge

- Integration of basic functions ($\sin t$, $\cos t$, e^t, t^n, $\sqrt{t^n}$); u-substitution; Recognize hard integrals; Dot and cross product; Unit vector; Curve and surface parametrization; Partial derivatives.

Math 2204 double and triple integrals

- **5.2-4, 6.2, 6.3** Double integrals in rectangular and polar coordinates; Riemann sum; Changing order of integration; Area and mass of a thin plate.
- **5.5, 6.2, 6.3** Triple integrals in rectangular, cylindrical, and spherical coordinates; Volume and mass of a solid.

Change of variables

- **6.1** Maps of 2D regions; Linear and non-linear maps; Onto maps; One-to-one maps, including proving a map is one-to-one.
- **6.2** Change of variables theorem for double integrals using Jacobian determinant; Change of variables theorem for triple integrals using Jacobian determinant.

Integration over paths and surfaces

- **4.2/7.1** Path integral of scalar functions $\displaystyle\int_{\boldsymbol{c}} f \, \mathrm{d}s = \int_a^b f(\boldsymbol{c}(t)) \, ||\boldsymbol{c}'(t)|| \, \mathrm{d}t$

  Arc length; Area of a fence; Mass of a wire; Integration over piecewise C^1 paths.

- **7.2** Line integral of vector fields $\displaystyle\int_{\boldsymbol{c}} \boldsymbol{F} \cdot \, \mathrm{d}\boldsymbol{s} = \int_a^b \boldsymbol{F}(\boldsymbol{c}(t)) \cdot \boldsymbol{c}'(t) \, \mathrm{d}t$

  Work; Differential form of a line integral; Line integrals over curves with opposite orientation.

- **7.4-5** Surface integral of scalar function $\displaystyle\iint_S f \, \mathrm{d}S = \iint_D f(\boldsymbol{\Phi}(u,v)) \, ||\boldsymbol{T}_u \times \boldsymbol{T}_v|| \, \mathrm{d}u \, \mathrm{d}v$
  Area of a surface; Mass of a surface.

- **7.6** Surface integral of vector field $\displaystyle\iint_S \boldsymbol{F} \cdot \, \mathrm{d}\boldsymbol{S} = \iint_S \boldsymbol{F} \cdot \boldsymbol{n} \, \mathrm{d}S = \iint_D \boldsymbol{F}(\boldsymbol{\Phi}(u,v)) \cdot (\boldsymbol{T}_u \times \boldsymbol{T}_v) \, \mathrm{d}u \, \mathrm{d}v$

  Heat flux; Flow rate; Surface integrals over surfaces with opposite orientation.

What not to know (everything we did **not** discuss in class):

- Integration by parts; Applications involving electric fields; Historical Notes.
- **5.2-4** Properties of the Integral (p.272-276); Fubini's Theorem (p.276-279). Elementary Regions (p.283-284); The Integral over an Elementary Region (p.284-285). Mean-Value Inequality (p.292); Mean-Value Equality (p.292-293).
- **5.5** Elementary Regions (p.297-298); Integrals over Elementary Regions (p.298-300).
- **6.3** Everything except mass.
- **7.1-4** The Total Curvature of a Curve (p.355-356); Line Integrals of Gradient Fields (p.366-368); Line Integrals over Geometric Curves (p.368-halfway 370); The $\mathrm{d}\boldsymbol{r}$ Notation for Line Integrals (p.371-373); Formula (4) on p.387; Formula (6) on p. 388.