MA-UY 2114
Final Exam Formulas
Calculus III, Fall 2021

Here are some potentially useful formulas for the exam. Note that you may not need to use them, they are here so you do not need to memorize them. You must know the context in which each is applied.

- $\mathbf{r}(t) = (1-t)\,\mathbf{r}_0 + t\mathbf{r}_1, \qquad 0 \le t \le 1$
- $\mathbf{T} = \dfrac{\mathbf{r}'}{\|\mathbf{r}'\|}$
- $\mathbf{N} = \dfrac{\mathbf{T}'}{\|\mathbf{T}'\|}$
- $A(S) = \iint_D \sqrt{1 + z_x^2 + z_y^2}\,dA$
- $A(S) = \iint_D \|\mathbf{r}_u \times \mathbf{r}_v\| dA$
- $\int_C f(x,y)ds = \int_a^b f(x(t),y(t))\sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}dt$
- $\iint_S \mathbf{F} \cdot d\mathbf{S} = \iint_D \mathbf{F} \cdot (\mathbf{r}_u \times \mathbf{r}_v) dA$
- $\iint_S \mathbf{F} \cdot d\mathbf{S} = \iint_S \mathbf{F} \cdot \mathbf{n}\ dS$
- $\iint_S \mathbf{F} \cdot d\mathbf{S} = \iint_D (-Pg_x - Qg_y + R)\,dA$
- $\int_C \mathbf{F} \cdot d\mathbf{r} = \int_a^b \mathbf{F}(\mathbf{r}(t)) \cdot \mathbf{r}'(t)dt = \int_C \mathbf{F} \cdot \mathbf{T} ds = \int_C P dx + Q dy + R dz$
- $\int_C \nabla f \cdot d\mathbf{r} = f(\mathbf{r}(b)) - f(\mathbf{r}(a))$
- $\iint_S f(x,y,z)dS = \iint_D f(\mathbf{r}(u,v))\|\mathbf{r}_u \times \mathbf{r}_v\| dA$
- curl $\mathbf{F} = (R_y - Q_z)\mathbf{i} + (P_z - R_x)\mathbf{j} + (Q_x - P_y)\mathbf{k}$ rotaion divF = Px+Qy+Rz source
- Green's Theorem Integral: $\int_C \mathbf{F} \cdot d\mathbf{r} = \iint_D \text{curl } \mathbf{F} \cdot \mathbf{k} dA$ |Pdx+Qdy = ||(Qx-Py)dA
  C: positive-counterclockwise
- Stokes' Theorem Integral: $\int_C \mathbf{F} \cdot d\mathbf{r} = \iint_S \text{curl } \mathbf{F} \cdot d\mathbf{S}$
- Divergence Theorem Integral: $\iint_S \mathbf{F} \cdot d\mathbf{S} = \iiint_E \text{div } \mathbf{F} dV$ S: positive-outward

Curl Test: curlF = 0, F is path independent and thus a gradient field, has scaler potential.

Divergence Test: divF = 0, F is a curl field, has vector potential.