**Final Exam Information**

You are encouraged to double check this document to make sure that I didn't leave anything off.

- **Section 16.1**

  vector fields

  being able to draw/recognize a vector field

  gradient vector field

  conservative vector field

  potential function for a vector field.

- **Section 16.2**

  line integral of $f$ along C.

  - line integral with respect to arc length
  - how to compute $ds$ in both two dimension and three dimension.
  - is the orientation of C important in this type of line integral?

  parametrize a line segment from start point to end point.

  line integral of a function over a piecewise-smooth path is the sum of the line integrals of the function over each section of the path.

  line integral of $f$ with respect to x and line integral of $f$ with respect to y and line integral of $f$ with respect to z

  - is the orientation of C important in this type of line integral?

  Line integrals in a vector field.

  - is the orientation of C important in this type of line integral?
  - what is the relationship between a line integral of a vector field $F$ along a path C to the line integral of a function $f$ with respect to x, with respect to y, and with respect to z along a path C.

- **Section 16.3**

  Fundamental theorem of line integrals

  - when can this be used? i.e. what types of vectors fields can this theorem be applied in?

  Independent of path

  - any closed path(start and stop at the same point) for a line integral that is independent of path is 0.

  determining if a two dimension vector field is conservative/not conservative

  simple curve

  simply-connect region

  finding a potential function for a conservative vector field.

- **Section 16.4**

  Green's Theorem:

  - positive orientation(counter-clockwise)
  - closed region

  computing the area of region D (a double integral) by using a line integral where $Q_x - P_y = 1$

  common methods

  $P = 0$ and $Q = x$
  $P = -y$ and $Q = 0$
  $P = -0.5y$ and $Q = 0.5x$

  how to fix a path that is not positively orientated.

  how to fix a path that is not closed.

- **Section 16.5**

  curl $F$

  what does it mean if the curl F = $\langle 0, 0, 0\rangle$

  divergence of F

  div curl F = ?

- **Section 16.6**

  parameterize a surface

  tangent plane for a surface that has been parameterized

  short cut for finding a cross product for particular parameterizations.

  compute surface area of a region that is parameterized.

- **Section 16.7**

  not in a vector field

  - surface integral of a function over a surface S.
  - surface integral where S is the boundary of a solid.

in a vector field F

- oriented surface
- picking the cross product that matches the orientation of the surface
- for a closed surface, positive orientation is where the normal vectors point outward.
- surface integral of F over S. also called the flux of F across S.
- surface integral of F over a closed surface.

- **Section 16.8**

  stokes' theorem

- **Section 16.9**

  divergence theorem

Any additional topic/information covered in these sections.