Integration
9.5 - Rational functions and Partial Fraction Decomposition
9.6 - Trigonometric substitutions
\[ a^2 - u^2 \sin x, \quad u^2 - a^2 \frac{1}{\sin x}, \quad a^2 + u^2 \tan x \]
9.7 - Integrals containing quadratic polynomials (complete the square and use a trigonometric (or hyperbolic) substitution (or use the formula giving some inverse trigonometric function).
9.8 Improper integrals: defined as limits of definite integrals. The limit point is +/- infinity or a discontinuity of the integrand.

Conic Sections
Locus: The set of points P such that PF = e PL (F focus, L directrix, e eccentricity).
10.4 - Parabola; if the vertex at the origin: \[ y^2 = 4px, \quad \text{Focus}(p, 0), \quad \text{Directrix} \ x=-p \]
10.5 - Ellipse; if Center(0,0):
\[ x^2 \frac{a^2}{b^2} + y^2 \frac{b^2}{a^2} = 1 \quad \text{Foci(+/-c, 0),} \quad c^2 = a^2 - b^2 \quad 0 < b < a \ (\text{major semiaxes is a, transverse semiaxes b}) \]
10.6 - Hyperbola (two branches) Center(0,0):
\[ x^2 \frac{a^2}{b^2} - y^2 \frac{b^2}{a^2} = 1 \quad \text{Foci(+/-c, 0),} \quad c^2 = a^2 + b^2 \quad 0 < b < a \ (\text{major semiaxes is a, transverse semiaxes b}) \]

10.7 - Equations for Rotation of Axes and Classification of Conics (discriminant \( B^2 - 4AC \))
10.2 - Polar Coordinates
\[ x = r \cos \theta \ (\text{or } \cos \theta = \frac{\text{adj.}}{\text{hyp.}}), \quad y = r \sin \theta \ (\text{or } \sin \theta = \frac{\text{opp.}}{\text{hyp.}}) \]
Polar curves < – > Cartesian curves, intersecting polar curves.
10.3 - Area computations in polar coordinates.
\[ dA = \frac{1}{2} r^2 d\theta \quad \text{Area between two curves } r_1 \text{ and } r_2: \ dA = dA_1 - dA_2. \]

Infinite Series
11.2 - Infinite Sequences
Limit laws (+/-, ./:), Squize Law, Bounded monotonic Sequence.
Recursive relations and sequences.

Problems
Integrate:
1) \[ \int x^3 + x + 1 \frac{dx}{x(x+1)} \]
2) \[ \int \frac{1}{4x^2 + 4x + 5} \ dx \]
3) \[ \int x \sqrt{1 - x^2} \ dx \]
4) \[ \int \frac{1}{(x^2 + 1)^{3/2}} \ dx \]
5) Find the area under the curve \( y = \frac{1}{x^2} \) from 1 to infinity.
6) Determine if the improper integral for the curve \( y = \frac{1}{\sqrt{x}} \) from -1 to 3 is convergent. Find the volume of the solid obtained by rotating the curve about the x-axis.
7) Find the equation to describe all the points \( P(x,y) \) which are equidistant from (3,2) and (7,4).
8) Draw the graph of the polar equation \( r = 2 + 3 \cos \theta \).
9) Find the area outside of \( r=2 \) and inside \( r = 4 \cos \theta \).
10) Sketch the following conic section (label the foci, vertices, directrices, axes, center):
\[ x^2 - 4y - 4x = 0 \]
11) Sketch the graph of \( \frac{(y-2)^2}{4} - \frac{(x+1)^2}{9} = 1 \)
12) Determine if the following sequences converge: a) \( a_n = \frac{3^n}{n} \), b) \( a_n = \frac{5^2}{n} \), c) \( a_n = (\frac{n}{m})^n \), d) \( a_n = \frac{m}{n} \)
13) Determine if the sequence \( a_{n+1} = \sqrt{a_n} + \frac{2}{a_1} \), \( a_1 = 2 \) converges and if so, compute its limit.