Calculators and open books are not allowed. All work must be self-contained and shown in your blue book(s)! Note that some of the problems are similar but not identical to some of the Home Work problems.

1. (30 pts.) Find a rationalizing substitution for the integral:

\[ \int \frac{\sqrt{x}}{x^2 - 4} \, dx. \]

Important: there is no need to evaluate the resulting integral.

2. (30 pts.)

(a) (15 pts.) Let \( L \) denote the arclength of the curve \( y = f(x), a \leq x \leq b \). Find a formula for \( L \).

(b) (15 pts.) Set up, but do not evaluate, an integral for the length of the curve

\[ \frac{x^2}{2^2} + \frac{y^2}{3^2} = 1. \]

3. (30 pts.) Set up, but do not evaluate, an integral for the area of the surface obtained by rotating the curve,

\[ y(x) = e^x, 2 \leq y \leq 3, \]

around the \( y - \text{axis} \).

4. (30 pts.)

(a) (15 pts.) Find a solution to the differential equation:

\[ y'(x) = 3y(x). \]

(b) (15 pts.) Find two solutions to the differential equation:

\[ y''(x) - 2y'(x) - 4y(x) = 0. \]

Hint: Assume that \( y(x) = e^{rx} \) and find an equation for \( r \).

5. (30 pts.) Find an equation to the tangent to the curve,

\[ x(t) = 10 \cos t, \quad y(t) = 10 \sin t, \]

at the point \((6, 8)\).