(10) 1. Integrate

\[ \int \frac{x^4 + 3x^2 + 1}{x^3 + x} \, dx \]
(10) 2. Integrate

\[ \int \frac{\sqrt{9 - x^2}}{x^2} \, dx \]
3. Integrate

a. \[ \int_{-8}^{1} \frac{1}{\sqrt[3]{x}} \, dx \]

b. \[ \int_{1}^{\infty} \frac{1}{x^4} \, dx \]
(10) 4. Sketch the graph of the polar equation \( r = 1 - 2 \cos \theta \).

(10) 5. Find the area of the region that is inside the circle \( r = 1 \) and outside \( r = 2 + 2 \cos \theta \).
(10) 6. Write the equation of the indicated conic section in standard form. Identify the vertex, focus, and directrix. Sketch the graph of the equation, showing these features on your graph.

\[ y^2 - 4y - 4x + 4 = 0 \]
(10) 7. Sketch the graph of \( \frac{(x - 3)^2}{4} - \frac{y^2}{9} = 1 \), showing the center, asymptotes and vertices. (Label the center and the vertices.)
8. Determine whether or not the sequence \( \{a_n\} \) converges, and find its limit if it does.

\[
a_n = \frac{n^e + 1}{e^n}
\]

9. Find the limit of the recursive sequence

\[
\sqrt[6]{6 + \sqrt[6]{6 + \sqrt[6]{6 + \ldots}}}
\]