1. Find $\displaystyle\int \frac{3\,x^3 - 12\,x^2 + 17\,x - 3}{x^2 - 4x + 4}\,dx$. Show all your steps.

2. Find $\int \frac{2x+13}{x^2+8x+17}\,dx$. Show all your steps.

3. Find $\int \frac{x^3}{\sqrt{25-x^2}}\,dx$. You may need a trig substitution at the start, and in the middle, it may help to use $\sin^2 u = 1 - \cos^2 u$. Show all your steps.

4A. Let $f(x) = \sqrt{x^3} = x^{3/2}$. Find the second-degree Taylor polynomial $P_2(x)$ for f at $x_0 = 16$. Show all your work, neatly organized.

4B. What does Taylor's theorem give as the maximum possible error committed by P_2 on the interval [9,21]? (Find your "K_3" to four decimal places)

4C. On the interval [9,21], by graphing the difference between $f(x)$ and $P_2(x)$, what does the actual maximimum error appear to be, and at what x does it occur?

5A. Show that for $x \geq 3$, $\sqrt[3]{x^6 - 14x} > (1/2)x^2$.

5B. Use the inequality in 5A and the appropriate p-test comparison to decide if $\displaystyle\int_3^\infty \frac{dx}{\sqrt[3]{x^6 - 14x}}$ converges.

6A. Find $\int \frac{\ln x}{\sqrt{x}}\, dx$. Show your steps.

6B. Explain why a graph of $\frac{\ln x}{\sqrt{x}}$ suggests $\int_0^1 \frac{\ln x}{\sqrt{x}}\, dx$ is an improper integral. (Sketch your graph here).

6C. Decide if the integral in (6B) converges, and if so to what. Make a table which clearly supports your conclusion. Make sure your work shows "$\lim_{x\to\ldots}$" in all the appropriate places.

7A. Solve the initial value problem $\begin{cases} \dfrac{dy}{dt} = \dfrac{e^t}{2y+6} \\ y(0) = -5 \end{cases}$.

Note: to solve for y near the end of the problem, try completing the square. Then remember that $A^2 = B$ means $A = \pm\sqrt{B}$.

7B. Graph your solution on the interval $[-2, 2]$. Pick useful y-coordinates.