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1. Expand the following quotient by partial fractions

$$\frac{x^4}{x(x^4+x)(x^2-x+3)^2} \quad (\text{DO NOT EVALUATE THE COEFFICIENTS})$$

2. Evaluate $\int \frac{x}{(x+1)(x^2+1)} dx$

3. Solve the initial value problem $\frac{dy}{dt} = \frac{\sqrt{t^2-4}}{t}$, $t \geq 2$, $y(2) = 0$.

4. Determine whether each integral converges or diverges.

$$(a) \int_1^{\infty} \frac{e^{-x}}{\sqrt{x}} dx$$

$$(b) \int_{\pi/2}^{3\pi/2} \csc x dx$$

5. Which of the sequences $\{a_n\}$ converge, and which diverge? Find the limit of each convergent sequence.

$$(a) a_n = \frac{n!}{5^{2n}}$$

$$(b) a_n = \frac{1}{n} \int_1^n \frac{1}{t} dt$$

6. (Bonus) Evaluate $\int \frac{1}{y - \sqrt{1-y^2}} dy$