Question 1. (a) \(10\) pts) Use method of partial fractions to write the integral
\[
\int \frac{2x + 1}{(x - 1)^2(x^2 + x)^2} \, dx
\]
in simpler form. DO NOT EVALUATE THE CONSTANTS!

(b) \(10\) pts) \(
\int \frac{e^x \, dx}{e^{2x} + 3e^x + 2} = ?
\)

Question 2. (30 pts) Evaluate the following integrals:

(a) \(\int \arcsin x \, dx\). Hint: Integration by parts.

(b) \(\int \sin^5 x \cdot \cos^2 x \, dx = ?\)

(c) \(\int \frac{xdx}{1 + x^4} = ?\). Hint: Use a proper substitution and then a trigonometric substitution.

Question 3. (a) (10 pts) Determine whether the improper integral \(\int_{2}^{\infty} \frac{2dx}{x^{3/2} - 1}\) converges or diverges?

(b) (10 pts) \(
\lim_{n \to \infty} \left( \frac{3}{n} \right)^{1/n} = ?
\)

(c) (10 pts) Does the series \(\sum_{n=0}^{\infty} \frac{e^n}{e^n + n}\) converge or diverge?

Question 4. (25 pts) Determine whether the following series converge or diverge.

(a) \(\sum_{n=1}^{\infty} \frac{n(n+1)}{(n^2 + 1)(n - 1)}\)

(b) \(\sum_{n=1}^{\infty} \frac{1}{n(1 + \ln^2 n)}\)

GOOD LUCK!