No notes, books or calculators.
You must show your reasoning, not just the answer. Answers without justification will get only partial credit.

Please cross out anything that is not part of your solution — e.g., some preliminary computations that you didn’t need.

All answers should be simplified if possible — e.g., \( \sin(0) \) should be replaced by 0. However, unless instructed, do not replace exact answers by approximate ones — e.g. do not replace \( \sqrt{2} \) by 1.41

Each problem is worth 10 pts.
1. Find the derivative of the following function:

\[ s(x) = \int_{\frac{1}{2} \sin(x)}^{\frac{1}{2}} \frac{dt}{\sqrt{1-t^2}} \]
2. Evaluate the following indefinite integrals:

(a) \[ \int x^5 \ln(x) \, dx \]

(b) \[ \int \frac{\cos^3(x)}{\sin(x)} \, dx \]
3. Evaluate the following definite integrals:

(a) \[ \int_{1/\pi}^{2/\pi} \frac{\sin(1/x)}{x^3} \, dx \]

(b) \[ \int_{0}^{2} x^2 \sqrt{4 - x^2} \, dx \]

(c) \[ \int_{1}^{e^\pi} \frac{\cos(\ln x) \sin^2(\ln x)}{x} \, dx \]

(d) \[ \int_{1/\pi}^{2/\pi} \frac{\sin(1/x)}{x^2} \, dx \]
4. Evaluate the integrals

(a) \[ \int_{0}^{1} \frac{9}{x^2 + 3} \, dx \]

(b) \[ \int_{0}^{1} \frac{x + 1}{x^2 - 9} \, dx \]
5. (a) Decompose the rational function into partial fractions
\[ \frac{x^3 - 2x^2 - 7x + 10}{x^2 - 5x + 6} \]

(b) Compute the integral
\[ \int \frac{x^3 - 2x^2 - 7x + 10}{x^2 - 5x + 6} \, dx \]