

**Problem 1.** Determine limits.

$$(1) \quad \lim_{x \rightarrow 0^+} (\sin x)^x$$

$$(2) \quad \lim_{x \rightarrow \infty} x^{\frac{1}{\ln(\ln x)}}$$

$$(3) \quad \lim_{x \rightarrow 1} x^{\frac{1}{1-x}}$$

**Problem 2.** Calculate indefinite integrals.

$$(1) \quad \int (x^3 - x)^2 dx$$

$$(2) \quad \int \left( 2 \cos x + 3e^x - \frac{2}{1+x^2} \right) dx$$

$$(3) \quad \int \frac{x^3 + x^2 \sin x - x + 4}{x^2} dx$$

$$(4) \quad \int e^{2x} dx$$

$$(5) \quad \int (1 + e^x)(2 - e^{2x}) dx$$

**Problem 3.** Consider  $f(x) = 2x - x^2$  on  $[0, 2]$ .

(1) Write the right endpoint approximation with  $n = 4$  for the area bounded by  $f(x)$  on  $[0, 2]$ . Calculate it.

(2) Write the right endpoint approximation with  $n = 100$  for the area bounded by  $f(x)$  on  $[0, 2]$ . Calculate it. (Given  $\sum_{i=1}^n i = \frac{1}{2}n(n+1)$ ,  $\sum_{i=1}^n i^2 = \frac{1}{6}n(n+1)(2n+1)$ )

(3) For the right endpoint approximation as above, what is the limit as  $n \rightarrow \infty$ ?

(4) Repeat (1)(2)(3) with left endpoint approximation.