1. (10%) Suppose the function $f(x) = 3x^3 - ax^2 + bx + c$ has extreme values at $x = 1, \frac{1}{3}$ and $f(2) = 0$. Find a, b, c.

2. (20%) Evaluate the following limit.

   A. $\lim_{x \to 0} \left(\frac{1}{x^2}\right)^x$

   B. $\lim_{y \to \pi/2} \left(\frac{\pi}{2} - y\right) \tan y$

   C. $\lim_{t \to 1} \frac{t-1}{\ln t - \sin \pi t}$

   D. $\lim_{x \to 2} \frac{x-2}{x^2-4}$

3. (20%) Evaluate the following integrals.

   A. $\int_0^2 x\sqrt{16 - 3x^2}\, dx$

   B. $\int x \cos 2x\, dx$

   C. $\int \frac{e^x + e^{-x}}{e^x - e^{-x}}\, dx$

   D. $\int \frac{2x+1}{3x^2 + x - 2}\, dx$

4. (10%) Find the local extrema of $f(x) = \frac{12}{5}x^5 + \frac{5}{4}x^4 - \frac{14}{3}x^3 - \frac{5}{2}x^2 + 2x + 3$, where $-1 \le x \le 1$.

5. (10%) Find the tangent line of $x^4 - x^2 y + 2xy^4 = 4$ passing through $(1,1)$.

6. (10%) Find $\iint_R x + y\, dA$, where $R = \{(x,y) | 0 \le 2y \le x + 4, x \le y \le x - 2\}$.

7. (20%) Find the radius of convergence of the power series.

   A. $\sum_{n=0}^{\infty} x^n$

   B. $\sum_{n=0}^{\infty} \frac{x^{2n+1}}{n!}$

   C. $\sum_{n=0}^{\infty} \frac{(4x-5)^{2n+1}}{n^{3/2}}$

   D. $\sum_{n=0}^{\infty} (-2)^n (n+1)(x-1)^n$