

1. (15%) Find the absolute maximum and absolute minimum values, if any, of the function $f(x) = -2t^3 + 3t^2 + 12t + 3$ on $[-2, 3]$.
2. (15%) Find the relative extrema of $f(x) = x^4 - 4x^3 + 12$.
3. (15%) Evaluate the integral $\int_1^2 8t(t^2 - 1)^7 dt$.
4. (a) (10%) Evaluate $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \left(\frac{k}{n}\right)^{1/3}$ by interpreting it as the limit of a Riemann sum of a function on the interval $[0, 1]$.
(b) (5%) Evaluate the above limit by transforming it into a definite integral.
5. (10%) Determine where the graph of the function $h(x) = x^2 + \frac{1}{x^2}$ is concave upward and where it is concave downward. Also, find all inflection points of the function.
6. (10%) Find the relative extrema of $f(x) = x^3 - 3x^2 - 24x + 32$ using the second derivative test.
7. (10%) Evaluate $\lim_{n \rightarrow 0} \frac{1}{h} \int_2^{2+h} \sqrt{5 + t^2} dt$.
8. Find the integral
 - (a) (5%) $\int (3 \sin x - 4 \cos x) dx$.
 - (b) (5%) $\int \frac{\sin x}{(1 + \cos x)^3} dx$.