

1. (a) (10%) Evaluate $\lim_{n \rightarrow \infty} \frac{2}{n} \sum_{k=1}^n (2 + \frac{2k}{n})^2$ by interpreting it as the limit of a Riemann sum of a function on the interval $[2, 4]$.
(b) (5%) Evaluate the above limit by transforming it into a definite integral.
2. Find the derivative of the function
 - (a) (5%) $F(x) = \int_{-1}^x \frac{1}{1+t^2} dt$.
 - (b) (5%) $G(x) = \int_x^3 \sqrt{1+t^2} dt$.
 - (c) (5%) $H(x) = \int_0^{x^3} \cos t^2 dt$.
3. Find the integral
 - (a) (5%) $\int (x+1)\sqrt{2x-1} dx$.
 - (b) (5%) $\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx$.
 - (c) (5%) $\int \sin^3 x \cos x dx$.
4. (15%) Suppose that g is the inverse of a differentiable function f and $H = g \circ g$. If $f(4) = 3$, $g(4) = 5$, $f'(4) = \frac{1}{2}$, and $f'(5) = 2$, find $H'(3)$.
5. A solid is generated by revolving the region bounded by $y = x$, and $y = x^2$ about the line $x = 0$.
 - (a) (5%) Use the disk method to find the volume.
 - (b) (5%) Use the method of cylindrical shells to find the volume.
6. (10%) Find the length of the graph $f(x) = \frac{1}{3}x^3 + \frac{1}{4x}$ on the interval $[1, 3]$.
7. (10%) Find the derivative of $f(x) = x^2 \log(e^{2x} + 1)$.
8. (a) (5%) Find $\int \frac{1}{2x+1} dx$.
(b) (5%) Find $\int \frac{e^x}{e^{2x}+1} dx$.