

Due at the start of lecture (not lab) on Tues May 5, 2009.

Answer the following questions in groups of two, but turn in one solution sheet per student. Write neatly and orderly as points will be deducted for messy work. No work shown \Rightarrow partial/full credit not possible, so show as much work as possible.

1. (a) Find $\int \frac{(x-1)^2(2x+1)}{\sqrt{x^3}} dx$.
 - (b) Let a, b, c, d, p denote constants; find $\int \frac{ax^3}{b^2} (2cx - \sqrt[d]{x^p}) dx$.
 - (c) Find $\int \frac{2x^2+1}{x^2+1} dx$.
 - (d) Using a trigonometric substitution, find $\int \tan^2 x dx$.
2. Given that $\frac{df}{dx} = e^x + \frac{4}{3}x^{-2/3}$ and $f(1) = e$, find $f(x)$.
 3. Let $f(x) = 5 + 4x - x^2$ and let A denote the area between the graph $y = f(x)$ and the x -axis on the interval $[3, 5]$.
 - (a) Approximate the area A by using a lower sum based on four equal subintervals.
 - (b) Compute the EXACT value of A by expressing A as the limit of a Riemann sum and using appropriate summation formulae.
 4. (a) For the function $f(x) = e^x$ find the lower sum S_n on the interval $[1, 2]$ using the partition obtained by dividing the interval into n equal parts.
 - (b) Use (a) and the fundamental theorem of calculus to compute $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n e^{\left(1 + \frac{k}{n}\right)}$.
 5. Find $f(x)$ if $f''(x) = 1/x^3$, $x > 0$, $f(1) = 0$ and $f'(2) = 0$.
 6. Find a function f such that $f'(x) = x^3$ and the line $x + y = 0$ is tangent to the graph $y = f(x)$.
 7. A stone is dropped from the top of a tower, 450 meters above the ground. Assuming the acceleration due to gravity is 9.8 m/s^2 , find:
 - (a) the height of the stone above the ground at time t ;
 - (b) the time it takes for the stone to reach the ground;
 - (c) the velocity with which the stone strikes the ground.