HOMEWORK 9 - MATH 151

DUE DATE: Friday, December 15

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Read each problem **very carefully** before starting to solve it. Four out of the ten problems will be chosen at random and graded. Each problem graded is worth 3 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Use the Fundamental Theorem of Calculus to find the derivatives of the functions $f(x) = \int_1^x \ln t dt$ and $g(x) = \int_0^{x^2} \sqrt{1+r^3} dr$.
2. Find the average value of the following functions on the given interval:
   (a) $f(x) = \frac{1}{x}$ on $[1,4]$.
   (b) $g(x) = \sec\theta\tan\theta$ on $[0, \frac{\pi}{4}]$.
3. Find the interval on which the curve $f(x) = \int_0^x \frac{1}{1+t+t^2} dt$ is concave upward.
4. Evaluate the indefinite integrals:
   (a) $\int \sec 2\theta \tan 2\theta d\theta$
   (b) $\int \frac{e^x}{e^x+1} dx$
   (c) $\int \frac{\sin 2x}{1+\cos^2 x} dx$
5. Evaluate the definite integrals:
   (a) $\int_0^1 x^2(1+2x^3)^5 dx$
   (b) $\int_1^4 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$
   (c) $\int_0^4 \frac{x}{\sqrt{1+2x}} dx$
6. Evaluate $\int_0^1 x\sqrt{1-x^4} dx$ by making a substitution and interpreting the resulting integral in terms of an area.
7. Evaluate the indefinite integrals:
   (a) $\int x \cos(7x) dx$
   (b) $\int e^{5\theta} \sin(3\theta) d\theta$
   (c) $\int p^5 \ln p \, dp$
8. Evaluate the definite integrals:
   (a) $\int_1^2 \frac{\ln x}{x^2} dx$
   (b) $\int_0^{1/2} \sin^{-1} x dx$
9. Use integration by parts to prove the reduction formula $\int x^n e^x dx = x^n e^x - n \int x^{n-1} e^x dx$.
10. Suppose that $f(1) = 2, f(4) = 7, f'(1) = 5, f'(4) = 3$ and f'' is continuous. Find the value of $\int_1^4 x f''(x) dx$.