

HOMEWORK 12 - MATH 160

DUE DATE: Tuesday, December 8

INSTRUCTOR: George Voutsadakis

Read each problem **very carefully** before starting to solve it. Two out of the ten problems will be chosen at random and graded for a total of 20 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Compute the following indefinite integrals:

(a) $\int (e^{-x} + x)^2 dx$

(b) $\int x(x + 4)^{-2} dx$

2. Compute the following indefinite integrals:

(a) $\int \frac{\ln x}{\sqrt{x}} dx$

(b) $\int \frac{\ln x}{x^3} dx$

3. Compute the following indefinite integrals:

(a) $\int x^2 e^{-x} dx$ (Need to integrate twice)

(b) $\int x \ln(x + 1) dx$ (First substitution; then by-parts)

4. Compute the definite integrals:

(a) $\int_0^2 x e^{-x} dx$

(b) $\int_0^3 \ln(x + 1) dx$

5. Find the function f given that the slope of the tangent line to the graph of f at any point $(x, f(x))$ is $x\sqrt{x+1}$ and that the graph passes through the point $(3, 6)$.

6. Find the area of the region under the curve $y = f(x)$ over the indicated interval:

(a) $f(x) = \frac{2}{(x+1)^3}; \quad x \geq 0;$

(b) $f(x) = x e^{-x^2}; \quad x \geq 0.$

7. Find the area of the region bounded by the x -axis and the graph of the function $f(x) = \frac{e^x}{(1+e^x)^2}$.

8. Consider the improper integral $\int_1^\infty x^{-2/3} dx$.

(a) Evaluate $I(b) = \int_1^b x^{-2/3} dx$.

(b) Show that $\lim_{b \rightarrow \infty} I(b) = \infty$ thus proving that the given improper integral is divergent.

9. Evaluate each improper integral whenever it is convergent:

(a) $\int_1^\infty \frac{1}{x^3} dx$

(b) $\int_{-\infty}^0 \frac{1}{(4-x)^{3/2}} dx$

(c) $\int_1^\infty \frac{e^{-\sqrt{x}}}{\sqrt{x}} dx$

(d) $\int_{e^2}^\infty \frac{1}{x \ln x} dx$

10. **No tenth problem this week! Start studying for the Final!**