# PROBLEM SET

Practice Problems for Exam #2

Math 1352, Fall 2004

Nov. 5, 2004

- You **must** show enough work to justify your answers. Unless otherwise instructed, give exact answers, not approximations (e.g., $\sqrt{2}$, not 1.414).
- This problem set has 5 problems.

Good luck!

**Problem 1**.

A.

$$\int x\sqrt{2x+1}\,dx.$$

B.

$$\int x\cos(2x)\,dx.$$

C.

$$\int [\ln(x)]^2\,dx.$$

D.

$$\int x^6\ln(x)\,dx$$

E.

$$\int \sin^2(x)\cos^5(x)\,dx.$$

F.

$$\int \tan^3(x)\sec^3(x)\,dx.$$

G.

$$\int \tan^2(x)\sec^3(x)\,dx.$$

H.

$$\int \frac{1}{2x^2+4x+10}\,dx$$

I.

$$\int \frac{1}{x\sqrt{a^2-x^2}}\,dx.$$

J.

$$\int \frac{dx}{(a^2+x^2)^{3/2}}.$$

K.

$$\int \frac{\sqrt{x^2-a^2}}{x}\,dx.$$

L.

$$\int \frac{2x^2+x+1}{x(x+1)^2)}\,dx.$$

M.

$$\int \frac{2x^2+2x+1}{x(x^2+1)}\,dx$$

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**Problem 2**. In each part, give the *form* of the partial fraction decomposition. This is a formula involving undetermined coefficients. **Do not find the coefficients!** (No calculation is required).

A.

$$\frac{x^3+2x+1}{(x-1)(x-2)(x+3)}$$

B.

$$\frac{1}{x(x^2+1)}$$

C.

$$\frac{x^4+1}{x(x^2+1)^2}$$

D.

$$\frac{x^3}{(x-2)^2(x+2)^2(x-1)}$$

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**Problem 3**. In each part, solve the differential equation.

A.

$$\frac{dy}{dx}-\frac{2}{x}y=x^2.$$

B.

$$\frac{dy}{dx}+4y=2e^x.$$

C.

$$\frac{dy}{dx}=y(y-1).$$

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**Problem 4**. A tank contains 200 gallons of water. At the beginning of the problem there are 100 pounds of salt dissolved in the tank. Salt water enters the tank at a rate of 5 gallons per minute. Each gallon of incoming salt water contains 1 pound dissolved salt. The mixture in the tank is kept

prosaically uniform by stirring, and 5 gallons of salt water is drained from the tank per minute. Find the amount (number of pounds) of salt in the tank as a function of time. How long will it be until there are 175 pounds of salt in the tank?

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**Problem 5**. In each part, determine if the improper integral converges or diverges. If it converges, find the value.

A.

$$\int_0^\infty e^{-2x}\,dx$$

B.

$$\int_0^1 \frac{1}{x^2}\,dx$$

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