Section 3 Review

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1. Evaluate the following integrals. Show enough details to explain your solution. (You will not get credit for writing memorized or intuited answers.)

   (a) $\int x \sin x \, dx$

   (b) $\int x^2 \ln x \, dx$

   (c) $\int \sin^2 x \cos^3 x \, dx$

   (d) $\int \tan^2 x \sec^4 x \, dx$

(e) $\displaystyle\int \frac{1}{(1-x^2)^{3/2}}\,dx$

(f) $\displaystyle\int \frac{1}{(x^2-1)^{3/2}}\,dx$

(g) $\displaystyle\int \frac{4-x}{x\,(x-1)\,(x+2)}\,dx$

(h) $\displaystyle\int \frac{3x-1}{x^2\,(x-1)}\,dx$

2. Write the **form** of the partial fractions decomposition using variables A, B, C, etc for constants.

   (a) $\dfrac{x^2}{(x+1)\,(x^2+1)}$

   (b) $\dfrac{x^2+2x+2}{(x+1)^2\,(x^2+1)^2}$

3. Solve using circular integration by parts.

   $\displaystyle\int \sin x \cos x \; dx$

4. Solve by using the double-angle formula: $\sin x \cos x = \frac{1}{2}\sin(2x)$.

   $\displaystyle\int \sin x \cos x \; dx$

5. How can the answers to 3 and 4 both be correct?

6. Give **full details** computing the following integrals.

(a) $\displaystyle\int_0^{\infty} \frac{1}{x^2+1}\,dx$

(b) $\displaystyle\int_1^{2} \frac{2x}{\sqrt{x^2-1}}\,dx$

7. State $\boxed{\text{Convergent}}$ or $\boxed{\text{Divergent}}$ for the integrals below.

(a) $\displaystyle\int_2^{\infty} \frac{x}{(x-1)^2}\,dx$

(b) $\displaystyle\int_0^{1} \frac{x^2+1}{\sqrt{1-x}}\,dx$

(c) $\displaystyle\int_{-\infty}^{0} \frac{\sqrt{2-x}}{(x-1)^2}\,dx$

(d) $\displaystyle\int_1^{2} \frac{x^3+1}{x(x-1)^2}\,dx$