Name: ______________________________ ________ / 12

Instructor: **Bueler** | **Jurkowski** | **Maxwell**

- There are 12 points possible on this proficiency: one point per problem with no partial credit.
- You have 30 minutes to complete this proficiency.
- No aids (book, calculator, etc.) are permitted.
- You do **not** need to simplify your expressions.
- For at least one problem you must indicate correct use of a constant of integration.
- Circle your final answer.

1. [12 points] Compute the following definite/indefinite integrals.

a. $\int \sin(\pi x) - x^3 \, dx$

$$\int \sin(\pi x) - x^3 dx = \boxed{\frac{-1}{\pi}\cos(\pi x) - \frac{x^4}{4} + C}$$

b. $\int \sqrt{2}x + \sec(x)\tan(x) + e^{-x} \, dx$

$$\boxed{\sqrt{2}\frac{x^2}{2} + \sec(x) - e^{-x} + C}$$

c. $\int_0^3 \cos(t) + e^t \, dt$

$$\sin(t) + e^t \Big|_0^3 = \sin(3) + e^3 - (\sin(0) + e^0)$$

$$= \boxed{\sin(3) + e^3 - 1}$$

d. $\displaystyle\int \frac{x^3-5}{x^2}\,dx$

$$\int x - \frac{5}{x^2}\,dx = \boxed{\frac{x^2}{2} + \frac{5}{x} + C}$$

e. $\displaystyle\int \frac{1}{(2v-5)^3}\,dv$

$u = 2v - 5$

$du = 2dv$

$$\int \frac{1}{2}\,\frac{1}{u^3}\,du = \frac{1}{2}\,\frac{u^{-2}}{(-2)} + C$$

$$= \boxed{\frac{-1}{4}(2v-5)^{-2} + C}$$

f. $\displaystyle\int \sin(6+x^3)x^2\,dx$

$u = 6 + x^3$

$du = 3x^2 dx$

$$\int \sin(u)\,\frac{1}{3}\,du = -\frac{1}{3}\cos(u) + C$$

$$= \boxed{-\frac{1}{3}\cos\left(6+x^3\right) + C}$$

g. $\int \cos(t)e^{\sin(t)}\,dt$

$u = \sin(t)$

$du = \cos(t)\,dt$

$\int e^u\,du = e^u + C = \boxed{e^{\sin(t)} + C}$

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

$\boxed{\sqrt{2}\arctan(x) + C}$

i. $\int \frac{\sec^2(x)}{7+\tan(x)}\,dx$

$u = 7 + \tan(x)$

$du = \sec^2(x)\,dx$

$\int \frac{1}{u}\,du = \ln(|u|) + C$

$= \ln(|7 + \tan(x)|) + C$

j. $\int w^3(\sqrt{w}-1)\,dw$

$$\int w^{\frac{7}{2}} - w^3\,dw = \boxed{\frac{2}{9}w^{9/2} - \frac{w^4}{4} + C}$$

k. $\int x\sqrt{x-3}\,dx$

$u = x-3$

$du = dx$

$$\int (u+3)\sqrt{u}\,du = \int u^{3/2} + 3u^{1/2}\,du$$

$$= \frac{2}{5}u^{5/2} + 3\,\frac{2}{3}u^{3/2} + C$$

$$= \boxed{\frac{2}{5}(x-3)^{5/2} + 2(x-3)^{3/2} + C}$$

l. $\int \frac{1}{x\ln(x)}\,dx$

$u = \ln(x)$

$du = \frac{1}{x}\,dx$

$$\int \frac{1}{u}\,du = \ln(|u|) + C$$

$$= \boxed{\ln(|\ln(x)|) + C}$$