Name: ____

- There are 12 points possible on this proficiency, one point per problem. **No partial credit will be given.**
- You have 1 hour to complete this proficiency.
- No aids (book, calculator, etc.) are permitted.
- You do **not** need to simplify your expressions.
- Correct parenthesization is required.
- Do not put a "$+C$" where it does not belong and put a "$+C$" in the correct place at least one time.

1. [12 points] Compute the integrals of the following functions.

a. $\int_0^{\pi} e^x + \sin(x)\,dx = e^x - \cos(x)\Big|_0^{\pi}$

$= \left(e^{\pi} - \cos(0)\right) - \left(e^0 - \cos(0)\right)$

b. $\int_0^2 \frac{4t}{10-t^2}\,dt = 4\left(-\frac{1}{2}\right)\int_{10}^{6} \frac{du}{u} = -2 \cdot \ln|u|\Big]_{10}^{6} = -2\left(\ln(6) - \ln(10)\right)$

$u = 10 - t^2$

$du = -2t\,dt$

$-\frac{1}{2}\,du = t\,dt$

if $t = 0,\ u = 10$

$t = 2,\ u = 6$

c. $\int (5^{2/3} + e^{-x} + e^2x^2)\,dx = 5^{2/3}x - e^{-x} + \frac{e^2}{3}x^3 + C$

d. $\int \frac{3}{\sqrt{1-x^2}}\,dx$ $= 3\arcsin(x) + C$

e. $\int \sec^2(8\theta)\,d\theta$ $= \frac{1}{8}\tan(8\theta) + C$

f. $\int x\sqrt{x+16}\,dx$ $= \int (u-16)\,u^{1/2}\,du = \int \left(u^{3/2} - 16u^{1/2}\right)du$

$u = x+16$

$du = dx$

$u - 16 = x$

$= \frac{2}{5}u^{5/2} - 16\left(\frac{2}{3}u^{3/2}\right) + C$

$= \frac{2}{5}(x+16)^{5/2} - \frac{32}{3}(x+16)^{3/2} + C$

g. $\int 4(\sin(2x))^5 \cos(2x)\, dx$ $= 2\int u^5\, du = \frac{2}{6} u^6 + C$

Let $u = \sin(2x)$

$du = 2\cos(2x)\, dx$

$= \frac{1}{3} (\sin(2x))^6 + C$

h. $\int \frac{4x^3 - 6}{x}\, dx$ $= \int (4x^2 - 6x^{-1})\, dx$

$= \frac{4}{3} x^3 - 6\ln|x| + C$

i. $\int \frac{1}{\sqrt{5x}}\, dx$ $= \int \frac{1}{\sqrt{5} \cdot \sqrt{x}}\, dx = \frac{1}{\sqrt{5}} \int x^{-1/2}\, dx = \frac{1}{\sqrt{5}} \cdot 2 \cdot x^{1/2} + C$

$= \frac{2}{\sqrt{5}} x^{1/2} + C$

j. $\int \sec(x)\tan(x)e^{\sec(x)}\,dx$ $= e^{\sec(x)} + C$

k. $\int x^{-3}(2x+1)\,dx$ $= \int(2x^{-2}+x^{-3})\,dx$

$= -2x^{-1} - \frac{1}{2}x^{-2} + C$

l. $\int \frac{e^{\sqrt{x}}}{5\sqrt{x}}\,dx$ $= \pi^2 x + C$