Name: Solutions _____ / **12**

- There are 12 points possible on this proficiency: **One point per problem. No partial credit.**
- A passing score is 10/12.
- You have 60 minutes to complete this proficiency.
- No aids (book, calculator, etc.) are permitted.
- You do **not** need to simplify your expressions.
- Be sure to include constants of integration when appropriate.
- Circle your final answer.

Compute the following integrals.

1. $\int_0^3 x(x+2)\,dx$

$= \int_0^3 x^2 + 2x\,dx$

$= \frac{1}{3}x^3 + x^2 \Big|_0^3$

$= \frac{1}{3}(3)^3 + 3^2 = \boxed{18}$

2. $\int \sin(\pi\theta - 1)\,d\theta$

$= \boxed{-\frac{\cos(\pi\theta - 1)}{\pi} + C}$

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

$u = 1 - x^2$

$du = -2x\,dx$

$= -\frac{1}{2}\int e^u\,du$

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

4. $\int \frac{x^2}{2+x^3}\,dx$

$u = 2 + x^3$

$du = 3x^2\,dx$

$= \frac{1}{3}\int \frac{du}{u}$

$= \frac{1}{3}\ln|u| + C = \boxed{\frac{1}{3}\ln|2+x^3| + C}$

5. $\int_1^3 \frac{2+x^3}{x^2}\,dx$

$= \int_1^3 (2x^{-2}) + x\,dx$

$= -\frac{2}{x} + \frac{1}{2}x^2\Big|_1^3$

$= \left(-\frac{2}{3} + \frac{1}{2}(3)^2\right) - \left(-2 + \frac{1}{2}\right) = \boxed{16/3}$

6. $\int \frac{3}{\sqrt{1-x^2}}\,dx$

$= \boxed{3\arcsin x + C}$

7. $\int \frac{2\sqrt{\ln(t)+2}}{t}\,dt$

$u = \ln t + 2$

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

$= 2\int u^{1/2}\,du$

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

$= \frac{4}{3}(\ln t + 2)^{3/2} + C$

8. $\int_0^1 (e^x + x^e)\,dx$

$= e^x + \frac{1}{e+1}x^{e+1}\Big|_0^1$

$= e^1 + \frac{1}{e+1}(1)^{e+1} - \left(e^0 + \frac{1}{e+1}(0)^{e+1}\right)$

$= e + \frac{1}{e+1} - 1$

9. $\int \frac{w}{\sqrt{w+1}}\,dw$

$u = w+1 \qquad w = u-1$

$du = dw$

$= \int \frac{u-1}{\sqrt{u}}\,du$

$= \int (u^{1/2} - u^{-1/2})\,du$

$= \frac{2}{3}u^{3/2} - 2u^{1/2} + C$

$= \frac{2}{3}(w+1)^{3/2} - 2(w+1)^{1/2} + C$

10. $\int \frac{\sec^2 x}{\tan^3 x}\,dx$

$u = \tan x$

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

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

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

11. $\int \left(\ln(2) - \frac{1}{z}\right) dz$

$= \ln(2)\cdot z - \ln|z| + C$

12. $\int \frac{\sin t}{\cos t}\,dt$

$u = \cos t$

$du = -\sin t\,dt$

$= -\int \frac{du}{u}$

$= -\ln|u| + C$

$= -\ln|\cos t| + C$