DATE: ______________

Extra Practice for Chapter 5 Test

① $\int f(x)e^x\,dx = f(x)e^x - \int 4x^3 e^x\,dx$

$u = f(x) \qquad dv = e^x dx$

$du = f'(x)dx \qquad v = e^x$

$\int f(x)e^x\,dx = f(x)e^x - \int e^x \cdot f'(x)\,dx$

$f'(x) = 4x^3$

$f(x) = 4(\frac{1}{4}x^4) + C$

$\boxed{f(x) = x^4}$

② $\int_0^1 f(x)g'(x)\,dx \qquad u = f(x) \quad dv = g'(x)dx$

$du = f'(x)dx \quad v = g(x)$

$= f(x)\cdot g(x)\Big|_0^1 - \int_0^1 g(x)\cdot f'(x)\,dx$

$= f(1)g(1) - f(0)g(0) - \int_0^1 f'(x)g(x)\,dx$

$= 3(-1) - 6(1) - 4$

$= \boxed{-13}$

③ $f'(x) = x^2 \ln x \qquad u = \ln x \quad dv = x^2 dx$

$du = \frac{1}{x}dx \quad v = \frac{1}{3}x^3$

$\int f'(x)dx = \int x^2 \ln x\,dx$

$f(x) = \ln x \cdot \frac{1}{3}x^3 - \int \frac{1}{3}x^3 \cdot \frac{1}{x}\,dx$

$= \frac{1}{3}x^3 \ln x - \int \frac{1}{3}x^2\,dx$

$f(x) = \frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + C$

$f(e) = \frac{1}{3}e^3 \ln e - \frac{1}{9}e^3 + C$

$2 = \frac{1}{3}e^3 - \frac{1}{9}e^3 + C$

$2 = \frac{2}{9}e^3 + C \longrightarrow C = 2 - \frac{2}{9}e^3$

$\boxed{\therefore,\ f(x) = \frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + 2 - \frac{2}{9}e^3}$

④ avg # of people in line $= \frac{1}{5-0}\int_0^5 L(t)\,dt$

$= \frac{1}{5}\int_0^5 L(t)\,dt$

$= \boxed{151.667 \text{ people}}$

⑤ $\frac{d}{dx}\int_0^{x^2} (\cos(t^3))\,dt$

$= \cos(x^2)^3 \cdot 2x$

$= 2x\cos x^6$

⑥ $f'(x) = \frac{10x}{x^2+x-6}$

$\int f'(x)dx = \int \frac{10x}{x^2+x-6}\,dx$

$f(x) = \int \left(\frac{6}{x+3} + \frac{4}{x-2}\right)dx$

$= 6\ln|x+3| + 4\ln|x-2| + C$

$= \ln(x+3)^6 + \ln(x-2)^4 + C$

$\boxed{f(x) = \ln\left[(x+3)^6(x-2)^4\right] + C}$

$\frac{10x}{(x+3)(x-2)} = \frac{A}{x+3} + \frac{B}{x-2}$

$10x = A(x-2) + B(x+3)$

$10x = Ax - 2A + Bx + 3B$

$A + B = 10 \qquad -2A + 3B = 0$

$A + 4 = 10 \qquad 2A + 2B = 20$

$A = 6 \qquad 5B = 20$

$B = 4$