Math 1172 HW #5

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6.8 #47

$$\lim_{x\to\infty} x^3 e^{-x^2} = \lim_{x\to\infty} \frac{x^3}{e^{x^2}} \qquad \frac{\infty}{\infty}$$

$$\overset{H}{=} \lim_{x\to\infty} \frac{3x^2}{e^{x^2}\cdot 2x} = \lim_{x\to\infty} \frac{3x}{2e^{x^2}} \qquad \frac{\infty}{\infty}$$

$$\overset{H}{=} \lim_{x\to\infty} \frac{3}{2e^{x^2}\cdot 2x} = \frac{3}{\infty} = 0$$

6.8 #53

$$\lim_{x\to 0}\left(\frac{1}{x} - \frac{1}{e^x - 1}\right) \qquad \infty - \infty$$

$$= \lim_{x\to 0} \frac{e^x - 1 - x}{x(e^x - 1)} \to \frac{e^0 - 1 - 0}{0(e^0 - 1)} = \frac{0}{0}$$

$$\overset{H}{=} \lim_{x\to 0} \frac{e^x - 1}{x(e^x) + (e^x - 1)} = \lim_{x\to 0} \frac{e^x - 1}{xe^x + e^x - 1} \qquad \frac{0}{0}$$

$$\overset{H}{=} \lim_{x\to 0} \frac{e^x}{xe^x + e^x + e^x} = \lim_{x\to 0} \frac{e^x}{e^x(x+1+1)} = \lim_{x\to 0} \frac{1}{x+2} = \frac{1}{2}$$

7.1 #15

$$\int t^4 \ln t \, dt$$

$u = \ln t \qquad du = \frac{1}{t} dt$

$dv = t^4 dt \qquad v = \frac{1}{5} t^5$

$$\ln t \cdot \frac{1}{5} t^5 - \int \frac{1}{5} t^5 \cdot \frac{1}{t} \, dt$$

$$\frac{1}{5} t^5 \ln t - \frac{1}{5} \int t^4 \, dt = \frac{1}{5} t^5 \ln t - \frac{1}{5} \cdot \frac{1}{5} t^5 + C$$

7.1 #57

$$\int (\ln x)^n \, dx$$

$u = (\ln x)^n \qquad du = n(\ln x)^{n-1} \cdot \frac{1}{x}$

$dv = dx \qquad v = x$

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

$$= x(\ln x)^n - n \int (\ln x)^{n-1} \, dx$$