Math 106 Calculus I for Bio & Soc. Sci. Fall 2012

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Homework 11.

7.1.2

(46)

$$\int_0^2 \frac{2x}{\sqrt[3]{4x^2+3}}dx = \int_0^2 \frac{1}{\sqrt[3]{4x^2+3}}dx^2 = \int_0^4 \frac{1}{\sqrt[3]{4u+3}}du = \frac{1}{4}\int_0^4 \frac{1}{\sqrt[3]{4u+3}}d(4u+3)$$
$$= \frac{1}{4}\frac{3}{2}(4\times 4+3)^{\frac{2}{3}} - \frac{1}{4}\frac{3}{2}(4\times 0+3)^{\frac{2}{3}} = \frac{3}{8}\left(19^{\frac{2}{3}} - 3^{\frac{2}{3}}\right)$$

(48)

$$\int_{\ln 4}^{\ln 7} \frac{e^x}{(e^x-3)^2}dx = \int_{\ln 4}^{\ln 7} \frac{1}{(e^x-3)^2}de^x = \int_4^7 \frac{1}{(u-3)^2}du = \int_4^7 \frac{1}{(u-3)^2}d(u-3)$$
$$= (-1)\left(\frac{1}{7-3} - \frac{1}{4-3}\right) = \frac{3}{4}$$

7.2

(18)

$$\int_0^{\frac{\pi}{4}} 2x\cos x\,dx = \int_0^{\frac{\pi}{4}} 2xd\,(\sin x) = 2\frac{\pi}{4}\sin\frac{\pi}{4} - \int_0^{\frac{\pi}{4}} 2\sin x\,dx = \frac{\sqrt{2}\pi}{4} + 2\left(\frac{\sqrt{2}}{2} - 1\right) = \sqrt{2} - 1 + \frac{\sqrt{2}\pi}{4}$$

(20)

$$\int_1^e \ln x^2\,dx = 2\int_1^e \ln x\,dx = 2\left(e\ln e - \int_1^e x\,d\ln x\right) = 2(e-e+1) = 2$$

7.3

(18)

$$\int \frac{4x^2-x-1}{(x-1)^2(x-3)}dx$$

$$\frac{4x^2-x-1}{(x-1)^2(x-3)} = \frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{x-3}$$

After solving this equation we get $A = -4$ $B = -1$ $C = 8$, therefore we have

$$\frac{4x^2-x-1}{(x-1)^2(x-3)} = \frac{-4}{x-1} + \frac{-1}{(x-1)^2} + \frac{8}{x-3}$$

Now we solve the integral separately, we will have the result:

$$\int \frac{4x^2 - x - 1}{(x-1)^2(x-3)} dx = (-4)\ln(x-1) + \frac{1}{x-1} + 8\ln(x-3) + C$$

(24)

$$\int \frac{1}{x^2 + 4x + 5} dx = \int \frac{1}{(x+2)^2 + 1} dx = \int \frac{1}{(x+2)^2 + 1} d(x+2) = \arctan(x+2) + C$$