MATH 206
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QUIZ 2
ANSWER KEY

Summer 2001

1. Find each indefinite integral.

(a) $\int 2x(x^2+3)^4 dx$ (Use substitution: $u = x^2+3;\ du = 2xdx$)

$= \int u^4 du = \frac{u^5}{5} + C = \frac{(x^2+3)^5}{5} + C$

(b) $\int \cos(2\theta)\, d\theta$ (Use substitution: $u = 2\theta;\ du = 2d\theta;\ \frac{1}{2}du = d\theta$)

$= \frac{1}{2}\int \cos u\, du = \frac{1}{2}\sin u + C = \frac{1}{2}\sin 2\theta + C$

(c) $\int \frac{(\ln x)^3}{x} dx$ (Use substitution: $u = \ln x;\ du = \frac{1}{x}dx$)

$= \int u^3 du = \frac{u^4}{4} + C = \frac{(\ln x)^4}{4} + C$

(d) $\int e^{\csc x}\csc x \cot x dx$ (Use substitution: $u = \csc x;\ du = -\csc x \cot x\, dx$)

$= -\int e^u du = -e^u + C = -e^{\csc x} + C$

2. Find each definite integral. (Simplify your answer.)

(a) $\int_0^1 \frac{-x^2}{x^3+1} dx$ (Use substitution: $u = x^3+1;\ du = 3x^2dx;\ -\frac{1}{3}du = -x^2dx$

Change the limits of integration: $x = 0 \Rightarrow u = 1$
$x = 1 \Rightarrow u = 2$)

$= -\frac{1}{3}\int_1^2 \frac{1}{u} du = -\frac{1}{3}[\ln|u|]_1^2 = -\frac{1}{3}(\ln 2 - \ln 1) = \frac{-\ln 2}{3}$

(b) $\int_e^{e^4} \frac{dx}{x\sqrt{\ln x}}$ (Use substitution: $u = \ln x;\ du = \frac{1}{x}dx$

Change the limits of integration: $x = e \Rightarrow u = \ln e = 1$
$x = e^4 \Rightarrow u = \ln e^4 = 4$)

$= \int_1^4 u^{-1/2} du = [2u^{1/2}]_1^4 = \left(2\sqrt{4} - 2\sqrt{1}\right) = 4 - 2 = 2$