Calculus I
Homework Substitution Rule
Lecture 22

1. Evaluate the indefinite integral. The answer key has not been proofread, use with caution.

(a) $\int (1+3x)^9 \mathrm{d}x$.

(b) $\int \left(\sqrt{2x+1}\right) \mathrm{d}x$.

(c) $\int (3x+2)^{2.4} \mathrm{d}x$.

(d) $\int (x-1)\sqrt{2x-x^2} \mathrm{d}x$.

(e) $\int x\sqrt{1-x^2} \mathrm{d}x$.

(f) $\int \frac{1+x^2}{\sqrt{3x+x^3}} \mathrm{d}x$.

(g) $\int (x^2+1)(x^3+3x)^5 \mathrm{d}x$.

(h) $\int \frac{x^2}{\sqrt[3]{1+x^3}} \mathrm{d}x$.

(i) $\int x^2 \left(\sqrt{1+x}\right) \mathrm{d}x$.

(j) $\int x(2x+5)^{2014} \mathrm{d}x$.

(k) $\int x^3 \left(\sqrt{x^2+1}\right) \mathrm{d}x$.

(l) $\int \sqrt{x} \sin\left(2+x^{\frac{3}{2}}\right) \mathrm{d}x$.

(m) $\int \frac{\cos\left(\frac{\pi}{x}\right)}{x^2} \mathrm{d}x$.

(n) $\int \csc^2(2t) \mathrm{d}t$.

(o) $\int \sec(5t)\tan(5t) \mathrm{d}t$.

(p) $\int \frac{\cos t}{\sin t} \mathrm{d}t$.

(q) $\int \tan t \mathrm{d}t$.

(r) $\int \cot(2t) \mathrm{d}t$.

(s) $\int \frac{\sin\sqrt{t}}{\sqrt{t}} \mathrm{d}t$.

(t) $\int \sec^2 t \tan^3 t \mathrm{d}t$.

(u) $\int \cos^4 t \sin t \mathrm{d}t$.

(v) $\int \frac{\mathrm{d}t}{\cos^2 t\sqrt{1+\tan t}}$.

(w) $\int \sqrt{\cot t} \csc^2 t \mathrm{d}t$.

(x) $\int \sin t \sec^2(\cos t) \mathrm{d}t$.

(y) $\int \sec^3 t \tan t \mathrm{d}t$.

(z) $\int t\sin\left(t^2\right) \mathrm{d}t$.

2. **Since we haven't studied** $\arctan$ **yet, please ignore problem 2.u. You can solve the problem using the formula** $\int \frac{1}{1+x^2}\mathrm{d}x = \arctan x + C$**. The function** $\arctan x$ **is the arctangent function (the inverse function to the tangent function).** Evaluate the integral. The answer key has not been proofread, use with caution.

(a) $\int \frac{\mathrm{d}x}{3x+5}$.

(b) $\int \frac{\mathrm{d}x}{2-3x}$.

(c) $\int e^x \cos(e^x) \mathrm{d}x$.

(d) $\int \frac{(\ln x)^3}{x} \mathrm{d}x$.

(e) $\int e^x \left(\sqrt{e^x+1}\right) \mathrm{d}x$

(f) $\int e^x\sqrt{1-e^x} \mathrm{d}x$.

(g) $\int e^{\sin t} \cos t \mathrm{d}t$.

(h) $\int e^{\cot x} \csc^2 x \mathrm{d}x$.

(i) $\int \frac{x}{1+x^2} \mathrm{d}x$.

(j) $\int \frac{x}{2+3x^2} \mathrm{d}x$.

(k) $\int \frac{x}{\sqrt{1-x^2}} \mathrm{d}x$.

(l) $\int \frac{\cos(\ln x)}{x} \mathrm{d}x$.

(m) $\int \frac{\sin(\ln x)}{x} \mathrm{d}x$.

(n) $\int \frac{\sin(2x)}{2+\cos^2 x} \mathrm{d}x$.

(o) $\int \frac{\cos x}{\sin x} \mathrm{d}x$

(p) $\int \cot x \mathrm{d}x$.

(q) $\int \cot\left(\frac{x}{2}\right) \mathrm{d}x$

(r) $\int \tan(2x) \mathrm{d}x$.

(s) $\int \frac{x^4+3x}{x^2} \mathrm{d}x$

(t) $\int x^2 e^{x^3} \mathrm{d}x$

(u) $\int \frac{\arctan x}{1+x^2} \mathrm{d}x$.

3. Evaluate the definite integral. The answer key has not been proofread, use with caution.

(a) $\int_e^{e^3} \frac{\mathrm{d}x}{x\sqrt[3]{\ln x}}$.

(b) $\displaystyle\int_0^1 xe^{-x^2}\mathrm{d}x.$

(c) $\displaystyle\int_0^1 \frac{e^x+1}{e^x+x}\mathrm{d}x.$

(d) $\displaystyle\int_1^2 \frac{x}{2x^2+1}\mathrm{d}x.$

(e) $\displaystyle\int_{-3}^{-2} \frac{x}{1-x^2}\mathrm{d}x.$

(f) $\displaystyle\int_{-3}^{-2} \frac{3x}{2-x^2}\mathrm{d}x.$

(g) $\displaystyle\int_0^{\frac{1}{4}} \frac{x}{\sqrt{1-3x^2}}\mathrm{d}x.$