

LECTURE: Few examples on the mechanics of substitution: $\int (3x - 5)^{100} dx$, $\int x^2 \cos(x^3) dx$, $\int \frac{\sec^2(\sqrt{x})}{\sqrt{x}} dx$.
Justification of substitution method.

1) Compute the following integrals using integration by substitution and the given substitution:

(a) $\int \frac{2x+1}{x^2+x} dx$ using $u = x^2 + x$

(b) $\int \frac{1}{x(\ln x)^2} dx$ using $u = \ln x$

(c) $\int \sin^4(3x) \cos(3x) dx$ using $w = \sin(3x)$

2) Compute the following integrals using integration by substitution:

(a) $\int e^{5x} dx$

(b) $\int \cos^5 x \sin x dx$

(c) $\int \sqrt{3x+7} dx$

(d) $\int (x^2 + 4x + 7)^9 (x + 2) dx$

(e) $\int x \sec(x^2) \tan(x^2) dx$

3) Compute the following integrals using integration by substitution.

(a) $\int \frac{e^{2x}}{1+e^{2x}} dx$

(b) $\int \frac{e^x}{1+e^{2x}} dx$

(c) $\int \frac{1}{x^2+a^2} dx$ where a is a constant.

(d) $\int \frac{t}{\sqrt{1-t^4}} dt$

(e) $\int \frac{\sin \theta}{1+\cos^2 \theta} d\theta$

(f) $\int \tan(x) dx$

(g) $\int x\sqrt{2x+1} dx$

(h) $\int \frac{\cos(1/x)}{3x^2} dx$