

This exam consists of 20 multiple choice questions, each worth 5 points.

1. If $g(x) = \int_1^{2x} \arctan t dt$, find $\frac{dg}{dx}$.

a) $\frac{1}{1+x^2}$

b) $\frac{1}{1+4x^2}$

c) $\frac{2}{1+x^2}$

d) $\frac{2}{1+4x^2}$

e) $\frac{2x}{1+4x^2}$

f) $\arctan x$

g) $\arctan 2x$

h) $2 \arctan 2x$

i) $2 \arctan x$

j) $\int_1^{2x} \frac{1}{1+t^2} dt$

$$\frac{dg}{dx} = \arctan(2x) \cdot (2x)' = 2 \cdot \arctan(2x)$$

2. Evaluate the indefinite integral $\int \frac{x}{x^2+1} dx$.

a) $\frac{x^2}{x^2+1} + C$

f) $\frac{-x}{(x^2+1)^2} + C$

b) $\frac{x^2}{2(x^2+1)} + C$

g) $\frac{x}{2(x^2+1)^2} + C$

c) $x \ln(x^2+1) + C$

h) $\frac{-x}{2(x^2+1)^2} + C$

d) $\frac{x^2}{2} \ln(x^2+1) + C$

i) $\ln(x^2+1) + C$

e) $\frac{x}{(x^2+1)^2} + C$

j) $\frac{1}{2} \ln(x^2+1) + C$

$$\int \frac{x}{x^2+1} dx \quad \begin{array}{l} u = x^2+1 \\ du = 2x dx \end{array} \quad \int \frac{1}{2} \frac{du}{u} = \frac{1}{2} \ln|u| + C$$
$$= \frac{1}{2} \ln(x^2+1) + C$$

3. Evaluate the indefinite integral $\int x \ln x dx$.

a) C

b) $x + C$

c) $x^2 + c$

d) $\frac{x^2}{2} \ln x + C$

e) $x \ln x - x + C$

f) $x \ln x + c$

g) $\frac{x^2}{2} \ln x - \frac{x}{2} + C$

h) $\frac{x^2}{2} \ln x - \frac{x^2}{4} + C$

i) $x^2 \ln x - x + C$

j) $x^2 \ln x - \frac{x^2}{2} + C$

$$u = \ln x$$

$$du = \frac{1}{x} dx$$

$$dv = x dx$$

$$v = \frac{x^2}{2}$$

$$\int x \ln x dx = \frac{x^2}{2} \ln x - \int \frac{x^2}{2} \cdot \frac{1}{x} dx$$

$$= \frac{x^2}{2} \ln x - \int \frac{x}{2} dx$$

$$= \frac{x^2}{2} \ln x - \frac{x^2}{4} + C$$