

Mathematics II

Practice 1 02/25/2022

1. Compute the following indefinite integrals by substitution:

$$\begin{array}{lll} a) \int x\sqrt{x^2+3} dx & b) \int \frac{\cos(x)}{\sin^4(x)} dx & c) \int \frac{1+e^{\sqrt{x}}}{\sqrt{x}} dx \\ d) \int 5x^2 \cos(x^3+5) dx & e) \int \frac{\arctan(x)}{1+x^2} dx & f) \int \frac{1}{(1+x^2)\arctan(x)} dx \end{array}$$

2. Compute the following indefinite integrals by parts:

$$\begin{array}{lll} a) \int x \sin(x) dx & b) \int (x^2+1) \cos(x) dx & c) \int (3x+2)e^x dx \\ d) \int \frac{2x+1}{e^x} dx & e) \int x^8 \log(x) dx & f) \int \log(x) dx \end{array}$$

3. Compute the following indefinite integrals:

$$\begin{array}{lll} a) \int \frac{x}{1+x} dx & b) \int \frac{x^3+x}{\sqrt{2x^2+x^4}} dx & c) \int \frac{1}{1+\sqrt{x}} dx \\ d) \int x^3 e^x dx & e) \int x^3 e^{x^2} dx & f) \int \frac{x e^{\sqrt{1+x^2}}}{\sqrt{1+x^2}} dx \\ g) \int \cos^3(x) dx & h) \int \cos^2(x) dx & i) \int e^x \cos(x) dx \end{array}$$

4. Compute the following definite integrals:

$$a) \int_0^1 \frac{4x}{\sqrt{(x^2+8)^3}} dx \quad b) \int_6^7 x(x-6)^9 dx \quad c) \int_0^{\pi/2} \frac{\cos^3(x)}{1+\sin^2(x)} dx$$

5. Let $F : \mathbb{R} \rightarrow \mathbb{R}$ be the following function:

$$F(x) := \int_0^{x^2-x} \frac{e^{t^2+2t}}{\sqrt{t^2+3}} dt$$

Determine if F is differentiable and, if so, find all its critical points. Determine also the intervals on which the function F is increasing and decreasing.

6. Compute the following limits, if they exist:

$$\lim_{x \rightarrow 0} \frac{\int_0^x e^{t^2} dt}{\sin(x)}, \quad \lim_{x \rightarrow 0} \frac{\int_0^x \sqrt{t+1} \cos(t) dt}{x^2 + x}$$