

**Exercises 13****Task 1**

Given is the following function of two variables:

$$f(x, y) = 18x^2 - 36xy - 6y^3 - 36x + 20y .$$

- (a) Calculate the first and second partial derivatives of  $f$  (i.e., the functions  $f_x, f_y, f_{xx}, f_{xy}, f_{yy}$ ).
- (b) Determine all critical points of  $f$  and make decisions about possible extrema (if maximum or minimum).

**Task 2**

Determine the following indefinite integrals (if necessary, use a table of integrals):

(a)  $\int (5x^4 - 3 + \frac{2}{\sqrt{x}}) dx$

(b)  $\int \frac{4x^3 - \frac{1}{x}}{x^4 - \ln x} dx$

(c)  $\int \frac{7}{\sqrt{4-t^2}} dt$

(d)  $\int 2^{(x-1)} dx$

(e)  $\int \frac{2}{\cos^2(2x)} dx$

**Task 3**

Calculate the following definite integrals (trigonometric functions should be evaluated with angle specifications in radians):

(a)  $\int_0^1 (e^x + \frac{3}{2}x^2) dx$

(b)  $\int_{-\pi/4}^{\pi/4} \sin x dx$

(c)  $\int_{41}^{42} x dx$

(d)  $\int_{-1}^1 \frac{1}{9-x^2} dx$

**Task 4**

Calculate the area which is enclosed from above by the graph of the function  $f(x) = 4x - x^2 - 3$ , below by the graph of the function  $g(x) = x - 3$ , from the left by  $x = 1$  and from the right by  $x = 3$ .