

## Differentiation

1. Differentiate at least five of the following functions.

a)  $f(x) = 2x - 5$

b)  $f(x) = -2x^2 + 3x + 6$

c)  $f(x) = 2x \cdot (-3x^3)$

d)  $f(x) = \frac{3}{-x^2}$

e)  $f(x) = (3x^2 - x)(x + 1)$

f)  $f(x) = \frac{5}{6x^5 + 3}$

g)  $f(x) = \frac{1}{4}(x - 3)^2$

h)  $f(x) = \frac{1}{5} \cdot 3x^3 \cdot \sqrt{x}$

i)  $f(x) = (x^4 - x^3) \cdot \sqrt[3]{x}$

j)  $f(x) = \frac{5x-2}{3x}$

k)  $f(x) = (5x + 3)^3$

l)  $f(x) = \frac{-4x^3 + x^2 - 1}{x^2 + 3x - 1}$

m)  $f(x) = \sqrt{6x - \frac{1}{2}}$

n)  $f(x) = \frac{(x+1)(x-3)}{x^2 - 3x + 2}$

o)  $f(x) = \sqrt[3]{\left(\frac{1}{3} + 2x\right)^2}$

p)  $f(x) = -3 \cos(2x^2 + x)$

q)  $f(x) = e^{4x-5}$

r)  $f(x) = \ln(3x^2 - 2x)$

2. Calculate the second derivative in each case.

a)  $f(x) = \frac{3}{-x^2}$

b)  $f(x) = e^{4x-5}$

c)  $f(x) = \cos(\sin(x) - 1)$

3. Perform a curve discussion of the function  $f(x) = \frac{1}{4}x^4 - 2x^2 + 1$ , i.e. determine

- maximum domain as well as range,
- Intersections with the coordinate axes,
- Extrema,
- Inflection points,
- Saddle points

and then make a sketch of the function graph.