Section 3.8, Higher derivatives

Exercise 1. Find the first and second derivative of the functions:

1. $h(x) = \sqrt{x^2 + 5}$

2. $g(x) = x^2 \cos x$

Exercise 2. Find a formula for $f^{(n)}(x)$ for

1. $f(x) = \cos 3x$.

2. $f(x) = \dfrac{1}{x}$.

Exercise 3. Find y'' by implicit differentiation $x^2 + 6xy + y^2 = 8$.

Exercise 4. The equation of motion of a particle is

$$s(t) = t^3 - 3t.$$

1. Find the velocity and the acceleration as function of t.

2. Find the acceleration at the instants when the velocity is 0.

Exercise 5. Given the vector equation

$$\overrightarrow{r}(t) = (1 + t)\mathbf{i} + t^2\mathbf{j},$$

1. Sketch the curve traced by the vector equation

2. Find $\overrightarrow{r}'(t)$ and $\overrightarrow{r}''(t)$.

3. Sketch the position vector $\overrightarrow{r}(t)$, $\overrightarrow{r}'(t)$, $\overrightarrow{r}''(t)$ for $t = 1$.