

Tag : Toetsen/18-19/Calc1A.18-19[01].Test.EN  
 Course : **Calculus 1A**  
 Date : Friday October 26<sup>th</sup>, 2018  
 Time : 13:45 – 15:45

**Motivate all your answers.**  
**The use of electronic devices is not allowed.**

1. The points  $P$ ,  $Q$ ,  $R$  and  $S$  are the vertices of a parallelogram. Three of the four vertices are given:  $P(-1, -3, 0)$ ,  $Q(0, -2, 4)$ , and  $R(-2, -1, 2)$ .

- (a) [1 pt] Calculate  $\vec{PQ} \times \vec{PR}$ .
- (b) [1 pt] Calculate the area of the parallelogram  $PQRS$ .
- (c) [2 pt] In the parallelogram, calculate the angle at vertex  $P$ .
- (d) [1 pt] Find an equation for the plane that contains  $P$ ,  $Q$  and  $R$ .

2. [2 pt] Calculate

$$\lim_{x \rightarrow 0} \frac{x \sin x}{1 - \cos x}.$$

3. Define

$$f(x) = \begin{cases} e^{\frac{1}{x}} - 1 & \text{if } x \neq 0, \\ 0 & \text{if } x = 0. \end{cases}$$

- (a) [1 pt] Show with a calculation that  $\lim_{x \rightarrow 0^-} f(x) = -1$ .
- (b) [2 pt] Calculate  $\lim_{x \rightarrow 0^+} f(x)$ .
- (c) [1 pt] Is  $f$  continuous at 0? Motivate your answer.

4. (a) [1 pt] Using the definition of the derivative, show that the function  $y = \sqrt[3]{x}$  is not differentiable at 0.

Define the function  $f: \mathbb{R} \rightarrow \mathbb{R}$  as follows:

$$f(x) = 3\sqrt[3]{x} - 4x.$$

- (b) [2 pt] Find all critical points of  $f$ .
- (c) [2 pt] Find the absolute extreme values of  $f$  on the interval  $[-1, 8]$ .

~~5. [3 pt] Calculate~~

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x + y^2}{\sqrt{x^2 + y^2}},$$

or show that this limit does not exist.

6. (a) [2 pt] Find an equation for the tangent plane to the graph of the function

$$f(x, y) = x^4 - x + y^3 + 4$$

at the point  $(1, -1, f(1, -1))$ . Simplify the equation as much as possible.

- (b) [1 pt] Calculate the linearization of  $f$  at  $(1, -1)$ . With this linearization, calculate an approximation of  $f\left(\frac{4}{3}, -\frac{2}{3}\right)$ .

**Total: 22 points**