

# EXAMINATION WORK

Discipline: **Single Variable Calculus** Course: **1** Semester: **2** 2020–2021

Student's name \_\_\_\_\_ Group \_\_\_\_\_

Total Score		Grade	
Checked by		Examiner	

1. ⑦ Investigate the function

$$y = \frac{(x+2)^2}{(x-6)^3}$$

and sketch its graph.

2. ⑤ Evaluate the integral

$$\int \frac{2x^3 - 7x^2 + 12x - 27}{(x-2)(x^2 - x + 3)} dx.$$

3. ⑤ Determine for which  $\alpha$  the improper integral  $\int_0^{+\infty} \frac{(x^3 + \sqrt[3]{x})^\alpha}{\arctan \sqrt{x}} dx$  converges or diverges.

4. ⑤ Determine whether the series

$$\sum_{n=1}^{\infty} 2^n \left( \frac{n^2}{n^2 + 1} \right)^{n^3+n}$$

converges or diverges.

5. ⑦ Determine whether the sequence

$$f_n(x) = \frac{\log^2 x}{x(nx+1)}$$

converges pointwise or uniformly on  $(0, 1)$  and on  $(1, \infty)$ .

6. ⑦ Determine whether the series

$$\sum_{n=1}^{\infty} \frac{x}{x+n} \sin \frac{x}{n}$$

converges pointwise or uniformly on  $(0, 1)$  and on  $(1, \infty)$ .

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Total Score		Grade	
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1. ⑦ Investigate the function

$$y = \frac{(x - 6)^3}{(x + 2)^2}$$

and sketch its graph.

2. ⑤ Evaluate the integral

$$\int \frac{3x^3 + 13x^2 + 27x + 18}{(x + 3)(x^2 + x + 2)} dx.$$

3. ⑤ Determine for which  $\alpha$  the improper integral  $\int_0^{+\infty} \frac{(x^2 + \sqrt{x})^\alpha}{\log(1 + x)(1 + x^{3/2})} dx$  converges or diverges.

4. ⑤ Determine whether the series

$$\sum_{n=1}^{\infty} \left( \cos \frac{1}{\sqrt{n}} \right)^{n^2}$$

converges or diverges.

5. ⑦ Determine whether the sequence

$$f_n(x) = \sin \left( \frac{\pi}{nx + 2} \right)$$

converges pointwise or uniformly on  $(0, 1)$  and on  $(1, \infty)$ .

6. ⑦ Determine whether the series

$$\sum_{n=1}^{\infty} \sqrt{\frac{n}{x+1}} \left( e^{x^2/n^2} - 1 \right)$$

converges pointwise or uniformly on  $(0, 1)$  and on  $(1, \infty)$ .