SF1685 (SF1625) Calculus in one variable
Tentamen
Monday 7, January 2019

Time: 08:00-11:00
Available aid: None
Examinator: Roy Skjelnes

The exam consists of three parts; A, B and C, each worth 12 points. To the score on part A your bonus points are added, up to a maximum of 12. The score on part A is at most 12, bonus points included. The bonus points are added automatically.

The grading will be performed according to the table

Grade	A	B	C	D	E	Fx
Total score	27	24	21	18	16	15
score on part C	6	3	–	–	–	–

A necessity for full score on a problem is that your solution is well presented and easy to follow. Notation must be explained, the logical structure of the solution must be clearly described in words or in symbols and the reasoning leading up to the conclusion must be well motivated and clearly explained. Solutions that are clearly inadequate in these respects will be awarded no more than 2 points.

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PART A

1. Determine all primitive functions to
   (a) $f(x) = x^2 e^{1-x^3}$, **(3 p)**
   (b) $g(x) = \arctan(x)$. **(3 p)**

2. Determine the points on the curve $y = x^2$ being closest to the point $(0, 3)$. **(4 p)**

PART B

3. The function f is defined as **(4 p)**

$$f(x) = 2x^3 - 3x^2 - 12x + 14.$$

   For which real values y does the equation $f(x) = y$ have exactly two different solutions?

4. Determine whether the series

$$\sum_{n=1}^{\infty} \frac{2 + \sin(n)}{n^2 + \sqrt{n}}$$

   is divergent or convergent. **(3 p)**

5. Determine whether $|\ \ln(3/2) - \frac{3}{8}\ |$ is smaller or bigger than 0.05. **(5 p)**

PART C

6. We have the function

$$F(x) = \begin{cases} x^2 \cos(1/x) & \text{when} \quad x \neq 0, \\ 0 & \text{when} \quad x = 0. \end{cases}$$

   Show that $F''(0)$ does not exist. **(5 p)**

7. The curve C is parametrized as

$$r(t) = \left(\frac{\cos t}{t^2}, \frac{\sin t}{t^2} \right) \qquad \frac{\pi}{2} \leq t < \infty.$$

   Show that the curve C has finite arc length. **(7 p)**