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Mathematics II. **(BSc)– Exam Test 1**
May 19, 2017.

1. (7 p.)

$$\underline{\underline{A}} = \begin{pmatrix} 2 & 1 & 2 \\ 3 & 0 & 1 \end{pmatrix}$$

a.) $\underline{\underline{B}} = \underline{\underline{A}} \cdot \underline{\underline{A}}^{T}$
b.) $\underline{\underline{B}}^{-1} =?$
c.) Determine the eigenvalues of $\underline{\underline{B}}$.

2. (6 p.) How depends the solution set from the parameter λ?

$$
\begin{aligned}
x + y + \lambda z &= \lambda^2 \\
x + \lambda y + z &= \lambda \\
\lambda x + y + z &= 1
\end{aligned}
$$

3. (6 p.) Find inverse Laplace transformation function of

$$F(s) = \frac{6s^2 + 10s + 2}{s^3 + 3s^2 + 2s}.$$

4. (6 p.) a.) Let be U the set of all vectors of the form

$$\begin{pmatrix} 2r - s \\ 3r \\ r + s \end{pmatrix}, \quad r, s \in \mathbb{R}.$$

Is U subspace of $\mathbb{R}^3$?
b.) Prove that $V = \{(x, y, z) \in \mathbb{R}^3 \mid z = x + y\}$ is a subspace of $\mathbb{R}^3$.

5. (6 p.) Find the value of the triple integral:

$$\iiint_{1 \le x^2+y^2 \le 4, \ \ 0 \le z \le 9-x^2-y^2} x^2 dx dy dz.$$

6. (2+2+2 p.) Given the function

$$f(x,y) = \begin{cases} \frac{x^4 y}{2x^2+3y^2}, & \text{if } (x,y) \ne (0,0) \\ 2, & \text{if } (x,y) = (0,0) \end{cases}.$$

a.) Continuous whether the function f at the origin?

b.) Determine the partial derivatives of f at the origin and beyond.

7. (2+3+2 p.) Find Taylor series at $x_o = 0$ for the function

$$f(x) = \frac{1}{1+x^2}, \quad g(x) = \frac{1}{(1+x)^2}, \quad h(x) = \sqrt{1+x^2}.$$

Give the radius of the convergence.

8. (6 p.) Solve the following differential equation:

$$y' = \frac{4y}{x} + x^5 \frac{1}{x^2+3}$$

In the tests students can't use a pocket calculator or mobile!