NORWEGIAN SCHOOL OF MANAGEMENT

Department of Economics

Mock exam in:	**GRA 60353 Mathematics**
Examination date:	22.11.2010, 09:00 – 12:00
Permitted examination aids:	Bilingual dictionary BI-approved exam calculator: TEXAS INSTRUMENTS BA II Plus™
Answer sheets:	Squares
Total number of pages:	1

Question 1.

We consider the matrix A given by

$$A = \begin{pmatrix} 1 & 1 & -4 \\ 0 & t+2 & t-8 \\ 0 & -5 & 5 \end{pmatrix}$$

(a) Compute the determinant and the rank of A.
(b) Find all eigenvalues of A.
(c) Determine the values of t such that A is diagonalizable.

Question 2.

(a) Find all stationary points of $f(x, y, z) = e^{xy+yz-xz}$.
(b) Determine the values of the parameters a, b, c such that the function $g(x, y, z) = e^{ax+by+cz}$ is convex. Is it concave for any values of a, b, c?

Question 3.

(a) Find the solution of the differential equation $y' = y(1 - y)$ that satisfies $y(0) = 1/2$.
(b) Find the general solution of the differential equation

$$\big(\ln(t^2 + 1) - 2\big)\, y' = 2t - \frac{2ty}{t^2 + 1}$$

(c) Solve the difference equation

$$p_{t+2} = \frac{2}{3} p_{t+1} + \frac{1}{3} p_t, \quad p_0 = 100, \quad p_1 = 102$$

Question 4.

We consider the following optimization problem: Maximize $f(x, y, z) = xy + yz - xz$ subject to the constraint $x^2 + y^2 + z^2 \leq 1$.

(a) Write down the first order conditions for this problem, and solve the first order conditions for x, y, z using matrix methods.
(b) Solve the optimization problem. Make sure that you check the non-degenerate constraint qualification, and also make sure that you show that the problem has a solution.