BI NORWEGIAN BUSINESS SCHOOL

Written examination:	**GRA 60353 Mathematics**		
Examination date:	06.06.2012	09:00 – 12:00	Total no. of pages: 1
Permitted examination support material:	A bilingual dictionary and BI-approved calculator TEXAS INSTRUMENTS BA II Plus		
Answer sheets:	Squares		
	Counts 80% of GRA 6035		The subquestions are weighted equally
Re-sit exam			Responsible department: Economics

Question 1.

We consider the function f given by $f(x, y, z) = 7xy + 5y^2 - (z - x)^4$.

(a) Find all the stationary points of f.
(b) Is f convex? Is it concave?

Question 2.

Find the general solution $y = y(t)$ of the following differential equations:

(a) $y'' - 7y' + 12y = t - 3$
(b) $1 - 3y^2y' = te^t$
(c) $(t/y) \cdot y' + \ln y = 1$

Question 3.

We consider the matrix A and the vector $\mathbf{b}$ given by

$$A = \begin{pmatrix} 5 & -5 & 15t - 35 \\ 2 & t - 4 & 7t - 16 \end{pmatrix}, \quad \mathbf{b} = \begin{pmatrix} 2t \\ t \end{pmatrix}$$

(a) What is the rank of A? Are the column vectors of A linearly independent for any values of t?
(b) For which values of t does the linear system $A\mathbf{x} = \mathbf{b}$ have one solution, infinitely many solutions and no solutions?
(c) How many degrees of freedom does the linear system $(A^TA)\mathbf{x} = \mathbf{0}$ have? (It is not necessary to compute A^TA to answer this question.)

Question 4.

We consider the optimization problem

$$\max x^2yz \text{ subject to } x^2 + 2y^2 - 2z^2 \leq 32$$

(a) Write down the first order conditions and the complementary slackness conditions for the maximum problem, and find all admissible points that satisfy these conditions.
(b) Does the maximum problem have a solution?