NORWEGIAN BUSINESS SCHOOL

Multiple-choice exam:	**GRA 60352** Mathematics		
Examination date:	19.04.2012 09:00 – 10:00	Total no. of pages:	5 incl. attachments
		No. of attachments:	1 (1 page)
Permitted examination	A bilingual dictionary and BI-approved calculator TEXAS		
support material:	INSTRUMENTS BA II Plus		
Answer sheets:	Answer sheet for multiple-choice examinations		
	Counts 20% of GRA 6035	The questions are weighted equally	
Re-sit exam		Responsible department: Economics	

PLEASE READ THE FOLLOWING BEFORE YOU BEGIN!

- Students must themselves assure that the examination papers are complete.

- Students must provide the following information on the answer sheet:
  - Examination code
  - Personal initials
  - ID-nr

  The ID-nr must be recorded with both the appropriate numbers and by putting an "X" by the corresponding number in the columns below.

- Do not use pencils or pens with green ink when filling in answer sheets. Answer sheets must not be used for rough drafts.

- **All answers must be recorded with an "X" under the letter you believe corresponds with the correct answer.**

- **Cancel an "X" by filling in the box completely (boxes that are completely filled in will not be registered). "X" in two boxes for one question will be registered as a wrong answer.**

- The attached example shows you how the answer sheet would be filled in if A were the correct answer for question 1, B correct for question 2, C correct for question 3 and D correct for question 4. An "X" under E indicates that you choose not to answer question 5.

- **Your answers are to be recorded on the answer sheet. Answers written on the examination papers and not on the answer sheets will not be graded.**

- There is only <u>one</u> right answer for each question. Because the questions are weighted equally, it can be to your advantage to answer the easiest questions first.

- Wrong answers are given -1 point, unanswered questions get 0 points (indicated by an "X" next to E") and correct answers are given 3 points.

- You can keep the examination papers.

This exam has 8 questions

QUESTION 1.

Consider the linear system with augmented matrix

$$\left(\begin{array}{cccc|c} 1 & 2 & 3 & 4 & 0 \\ 0 & 1 & 1 & 1 & 3 \\ 0 & 1 & 2 & 4 & -4 \\ 0 & 1 & 3 & 9 & 2 \end{array}\right)$$

Which statement is true?

    (a) The linear system is inconsistent.
    (b) The linear system has a unique solution.
    (c) The linear system has one degree of freedom
    (d) The linear system has two degrees of freedom
    (e) I prefer not to answer.

QUESTION 2.

Consider the vectors $\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3$, given by

$$\mathbf{v}_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \quad \mathbf{v}_2 = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \quad \mathbf{v}_3 = \begin{pmatrix} 1 \\ 4 \\ 9 \end{pmatrix}$$

Which statement is true?

    (a) The vectors $\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3$ are linearly independent
    (b) The vectors $\mathbf{v}_1, \mathbf{v}_2$ are linearly independent, and $\mathbf{v}_3$ is a linear combination of $\mathbf{v}_1, \mathbf{v}_2$
    (c) The vectors $\mathbf{v}_1, \mathbf{v}_3$ are linearly independent, and $\mathbf{v}_2$ is a linear combination of $\mathbf{v}_1, \mathbf{v}_3$
    (d) The vectors $\mathbf{v}_2, \mathbf{v}_3$ are linearly independent, and $\mathbf{v}_1$ is a linear combination of $\mathbf{v}_2, \mathbf{v}_3$
    (e) I prefer not to answer.

QUESTION 3.

Compute the rank of the matrix

$$A = \begin{pmatrix} 1 & 2 & -2 & 1 \\ 2 & 1 & -1 & 2 \\ 6 & 6 & 1 & h-1 \end{pmatrix}$$

Which statement is true?

    (a) $\operatorname{rk} A = 2$ for all h
    (b) $\operatorname{rk} A = 2$ for $h \neq 7$ and $\operatorname{rk} A = 3$ for $h = 7$
    (c) $\operatorname{rk} A = 3$ for $h \neq 7$ and $\operatorname{rk} A = 2$ for $h = 7$
    (d) $\operatorname{rk} A = 3$ for all h
    (e) I prefer not to answer.

Consider the matrix

$$A = \begin{pmatrix} 5 & 8 \\ 0 & 5 \end{pmatrix}$$

Which statement is true?

    (a) A has eigenvalues $\lambda = 3$ and $\lambda = 7$
    (b) A has eigenvalues $\lambda = 4$ and $\lambda = 6$
    (c) A has a single eigenvalue $\lambda = 5$
    (d) A has eigenvalues $\lambda = 5$ and $\lambda = 8$
    (e) I prefer not to answer.

Consider the matrix

$$A = \begin{pmatrix} 1 & h & -2h \\ 0 & -1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$$

Which statement is true?

    (a) A is diagonalizable for all h
    (b) A is diagonalizable when $h = 2$, and non-diagonalizable for all other values of h
    (c) A is diagonalizable when $h = 0$, and non-diagonalizable for all other values of h
    (d) A is non-diagonalizable for all h
    (e) I prefer not to answer.

Consider the quadratic form

$$Q(x_1, x_2) = 4x_1^2 - 15x_1x_2 + 36x_2^2$$

Which statement is true?

    (a) Q is positive semidefinite but not positive definite
    (b) Q is negative semidefinite but not negative definite
    (c) Q is indefinite
    (d) Q is positive definite
    (e) I prefer not to answer.

Consider the function f defined on the set of points in $\mathbb{R}^3$ such that $x + y + z > 0$, given by
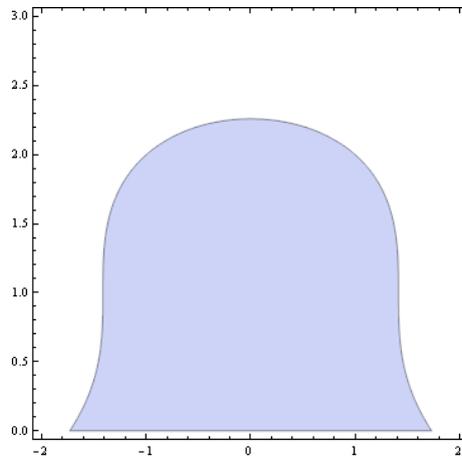
$$f(x, y, z) = \ln(x + y + z)$$

Which statement is true?

    (a) f is a convex function but not a concave function
    (b) f is a convex function and a concave function
    (c) f is not a convex function but a concave function
    (d) f is neither a convex nor a concave function
    (e) I prefer not to answer.

Consider the subset $S = \{(x, y) : x^2 + (y - 1)^3 \leq 2 \text{ and } y \geq 0\}$ of $\mathbb{R}^2$, which is shown as the shaded region in the figure.

Which statement is true?

(a) S is a convex set that is closed and bounded
(b) S is not a convex set, but it is closed and bounded
(c) S is a convex set that is closed but not bounded
(d) S is not a convex and not a closed set, but it is bounded
(e) I prefer not to answer.