Multiple-choice exam:	**GRA 60352** Mathematics			
Examination date:	07.02.2012	15:00 – 16:00	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	
Extraordinary 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

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

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

$$\mathbf{v}_1 = \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}, \quad \mathbf{v}_2 = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}, \quad \mathbf{v}_3 = \begin{pmatrix} 3 \\ 32 \\ 16 \end{pmatrix}$$

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

$$A = \begin{pmatrix} 1 & 2 & -2 & 1 \\ 2 & 1 & -1 & 2 \\ 7 & 8 & -1 & h \end{pmatrix}$$

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

$$A = \begin{pmatrix} 5 & 1 \\ 3 & 7 \end{pmatrix}$$

Which statement is true?

(a) A has eigenvalues $\lambda = 3$ and $\lambda = 9$
(b) A has eigenvalues $\lambda = 4$ and $\lambda = 8$
(c) A has a single eigenvalue $\lambda = 6$
(d) A has eigenvalues $\lambda = 5$ and $\lambda = 7$
(e) I prefer not to answer.

QUESTION 5.

Consider the matrix

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

Which statement is true?

(a) A is diagonalizable for all h
(b) A is diagonalizable when $h = 4$, and non-diagonalizable for all other values of h
(c) A is diagonalizable when $h = 0$ or $h = 4$, and non-diagonalizable for all other values of h
(d) A is non-diagonalizable for all h
(e) I prefer not to answer.

QUESTION 6.

Consider the quadratic form
$$Q(x_1, x_2) = -4x_1^2 + 24x_1x_2 - 36x_2^2$$
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 negative definite
(e) I prefer not to answer.

QUESTION 7.

Consider the function f defined on $\mathbb{R}^3$, given by
$$f(x, y, z) = -e^{x+y+z}$$
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.

QUESTION 8.

Consider the subset $S = \{(x, y) : 1 \le x^2 + y^2 \le 4\}$ of $\mathbb{R}^2$, which is shown as the shaded region in the figure.
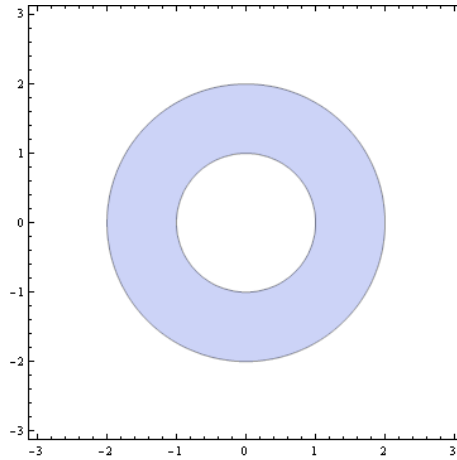
Which statement is true?

    (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.