University of Ottawa

Department of Mathematics and Statistics

MAT 1341: Introduction to Linear Algebra

Instructor: Erhard Neher

Diagnostic Test May 12, 2008

Family Name: _____

First Name: _____

Student number: _____

Please read these instructions carefully:

- Enter your name on this page and the next, but your student number only on this page. You will get back the exam without this first page.
- You have 60 minutes to complete this exam.
- This is a closed book exam, and no notes of any kind are allowed. The use of calculators, cell phones, pagers or any text storage or communication device is not permitted.
- Read each question carefully - you will save yourself time and unnecessary grief later on.
- All 9 questions are multiple choice, are worth 1 point each and no part marks will be given. Please record your answers in the space provided.
- Where it is possible to check your work, do so.

Good luck! Bonne chance!

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1. The volume of the parallelepiped determined by $\overrightarrow{u} = [1 \quad 1 \quad 2]^T$, $\overrightarrow{v} = [1 \quad -1 \quad -1]^T$ and $\overrightarrow{w} = [0 \quad 2 \quad 4]^T$ is

A. 7

B. $\frac{5}{2}$

C. -4

D. $\frac{3}{2}$

E. 5

F. 2

My answer:_____

2. The point on the line through $P_0(2, 0, -1)$ with direction vector $\overrightarrow{d} = [1 \quad 1 \quad 0]^T$ which is closest to $P(1, 3, -2)$ is

A. $[3 \quad 1 \quad -1]^T$

B. $[2 \quad 0 \quad -1]^T$

C. $[1 \quad -1 \quad 1]^T$

D. $[4 \quad 2 \quad -1]^T$

E. $[5 \quad 3 \quad -1]^T$

F. $[5 \quad 3 \quad -1]^T$

My answer:_____

3. The direction vector of the line through $P(1,1,2)$, intersecting the line $[\,x \quad y \quad z\,]^T = [\,2 \quad 1 \quad 0\,]^T + t\,[\,1 \quad 1 \quad 1\,]^T$ and perpendicular to it, is

A. $[\,0 \quad 1 \quad -1\,]^T$

B. $[\,2 \quad 1 \quad -3\,]^T$

C. $[\,1 \quad -2 \quad 1\,]^T$

D. $[\,4 \quad 1 \quad -5\,]^T$

E. $[\,3 \quad -1 \quad 2\,]^T$

F. such a line does not exist.

My answer:_____

4. The equation of the plane containing the point $A(0,-2,1)$ and the line $[\,x \quad y \quad z\,]^T = [\,1 \quad -5 \quad 2\,]^T + t\,[\,-1 \quad 1 \quad 5\,]^T$ is

A. $7x - 2y + z = 5$

B. $8x + 3y + z = -5$

C. $2x + y + z = -1$

D. $-x + z = 1$

E. $5x + 2y + z = -3$

F. $-4x - y + z = 3$

My answer:_____

5. The vector equation of the line through $[3 \quad 1 \quad 5]^T$ and $[4 \quad 2 \quad 1]^T$ is

A. $[3 \quad 1 \quad 5]^T + t[1 \quad -5 \quad 2]^T$

B. $[4 \quad 2 \quad 1]^T + t[1 \quad 1 \quad -3]^T$

C. $[3 \quad 1 \quad 5]^T + t[-1 \quad -1 \quad 4]^T$

D. $[4 \quad 2 \quad 1]^T + t[1 \quad -1 \quad 3]^T$

E. $[3 \quad 1 \quad 5]^T + t[-2 \quad 3 \quad -1]^T$

F. $[4 \quad 2 \quad 1]^T + t[1 \quad -5 \quad 3]^T$

My answer:_____

6. The equation of the plane, each point of which has the same distance from the points $A(2, 4, -2)$ and $B(3, 2, -1)$, is

A. $2x + 4y - 2z = 16$

B. $7x - 4y + 3z = 9$

C. $x - 2y + z = -5$

D. $x + 3y - 4z = 0$

E. $3x + 2y - z = 14$

F. $3x - 4y - z = 9$

My answer:_____

7. Find the correct combination of true/false for the following three statements.

- If $\overrightarrow{u}$ and $\overrightarrow{v}$ are orthogonal, then $-3\overrightarrow{u}$ and $2\overrightarrow{v}$ are also orthogonal.
- If the projection vector $\text{proj}_{\overrightarrow{d}}(\overrightarrow{v}) = 0$, then $\overrightarrow{v} = 0$.
- If $\overrightarrow{v} \cdot \overrightarrow{w} = 0$, then $\overrightarrow{v} = 0$ or $\overrightarrow{w} = 0$.

A. true, true, true

B. true, true, false

C. false, true, false

D. false, false, true

E. false, false, false

F. true, false, false

My answer:_____

8. Find the correct combination of true/false for the following three statements.

- The equation $3z^3 - 4z^2 + 7z - 9 = 0$ does not have a solution in the complex numbers $\mathbb{C}$.
- The complex conjugate $\bar{z}$ of a complex number z is always different from z.
- For any complex number z we have $z\,\bar{z} > 0$.

A. true, true, true

B. true, true, false

C. false, true, false

D. false, false, true

E. false, false, false

F. true, false, false

My answer:_____

9. The complex number z satisfying $3z + 1 + 2i = 4iz + 3 + i$ is

A. $\frac{1}{10}(1 + 7i)$

B. $\frac{1}{5}(2 + i)$

C. $\frac{1}{5}(2 + 3i)$

D. $\frac{1}{10}(1 - i)$

E. $\frac{1}{5}(1 + 2i)$

F. $\frac{1}{10}(2 - 3i)$

My answer:_____