**FACULTY OF INFORMATION TECHNOLOGY**
**DEPARTMENT OF MATHEMATICS**
**December 27, 2017**

**FINAL EXAM**
Course name: **Calculus 1**
Duration **75 minutes**
Exam type: **Written**

**Code 1**

**Exercise 1.** Realize the following matrix operations

a) 1.0 pt $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} - 2 \begin{bmatrix} 2 & 0 \\ -1 & 1 \end{bmatrix}.$

b) 1.0 pt $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -3 & 1 \end{bmatrix} \times \begin{bmatrix} 2 & -1 \\ -1 & 3 \\ 2 & 0 \end{bmatrix}.$

**Exercise 2.** 1.0 pt Use the determinant to determine whether the matrix

$$A = \begin{bmatrix} 3 & -2 \\ 2 & 2 \end{bmatrix}$$

is invertible. If it is invertible, compute its inverse.

**Exercise 3.**

a) 1.0 pt Find the image of the vector $\begin{bmatrix} -3 \\ 1 \end{bmatrix}$ by the map associated with the matrix $A = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}.$

b) 1.5 pts Use a rotation matrix to rotate the vector $\begin{bmatrix} 2 \\ -1 \end{bmatrix}$ counterclockwise by the angle $\dfrac{\pi}{6}$ .

**Exercise 4.** 1.5 pts Find the dot product of two vectors $x = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $y = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$, and then the angle between them.

**Exercise 5.** 1.0 pt Prove that the limit

$$\lim_{(x,y) \to (0,0)} \frac{2x - y}{x + y}$$

doesn't exist.

**Exercise 6.** 2.0 pts Let the function

$$f(x, y) = x^2 e^y - 2xy + 1.$$

a) Find the partial derivatives of $f$.

b) Find the standard linear approximation of the function at the point $(2, 0)$.

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**FINAL EXAM**
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**Code 2**

**Exercise 1.** Realize the following matrix operations

a) ⬚1.0 pt $2\begin{bmatrix} 2 & 0 \\ 1 & -3 \end{bmatrix} - \begin{bmatrix} 3 & 1 \\ -2 & 3 \end{bmatrix}$.

b) ⬚1.0 pt $\begin{bmatrix} 2 & 1 & 0 \\ -1 & 2 & 3 \end{bmatrix} \times \begin{bmatrix} 1 & 3 \\ 3 & -1 \\ -2 & 1 \end{bmatrix}$.

**Exercise 2.** ⬚1.0 pt Use the determinant to determine whether the matrix

$$A = \begin{bmatrix} 2 & -2 \\ 3 & 2 \end{bmatrix}$$

is invertible. If it is invertible, compute its inverse.

**Exercise 3.**

a) ⬚1.0 pt Find the image of the vector $\begin{bmatrix} 2 \\ -3 \end{bmatrix}$ by the map associated with the matrix $A = \begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix}$.

b) ⬚1.5 pts Use a rotation matrix to rotate the vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ counterclockwise by the angle $\dfrac{\pi}{3}$ .

**Exercise 4.** ⬚1.5 pts Find the dot product of two vectors $x = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$ and $y = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$, and then the angle between them.

**Exercise 5.** ⬚1.0 pt Prove that the limit

$$\lim_{(x,y)\to(0,0)} \frac{x-y}{x+2y}$$

doesn't exist.

**Exercise 6.** ⬚2.0 pts Let the function

$$f(x,y) = e^x y^2 - 3xy + 1.$$

a) Find the partial derivatives of $f$.

b) Find the standard linear approximation of the function at the point $(0,2)$.