Examination in MA0002 Mathematical methods A—Appendix
Tuesday 24 May 2005

Permitted aids: Any written and printed material. One calculator.

Mark one answer for each problem on the form overleaf. You will score one point for each right answer and zero points for each wrong answer. Multiple answers will score zero.

Note: There is text on both sides of the sheet. All problems have five alternative answers.

Problem 1. The yield x (in milligrams) of a chemical reaction satisfies the differential equation $(t+1)dx/dt + x = 3t+2$, where t is time (in seconds). At $t = 0$ the yield x is 0. What is the yield when one second has passed?

(a) 2.75 mg **(b)** 2.25 mg **(c)** 1.75 mg **(d)** 1.61 mg **(e)** 2.61 mg

Problem 2. The temperature (in °C) at the point (x, y) (where the coordinates are measured in meters) is $20 - 0{,}1x^2 - 0{,}1y^2$, where $-5 \leq x \leq 5$, $-5 \leq y \leq 5$. A bumblebee is flying along the curve $y = x^2 - 1$. What is the highest temperature the bumblebee will experience?

(a) 20 °C **(b)** 19.925 °C **(c)** 19.9 °C **(d)** 19.95 °C **(e)** 19.975 °C

Problem 3. Let $z = y^2 e^{xy^2}$. What is $\partial z/\partial y$ equal to?

(a) $4xy^2e^{xy^2}$ **(b)** $y^4e^{xy^2}$ **(c)** $2ye^{2xy}$ **(d)** $2ye^{xy^2}$ **(e)** $2y(1+xy^2)e^{xy^2}$

Problem 4. Assume that x, y and z satisfy the system $x+y+z = 0$, $x-y+z = -4$, $x+y-z = 8$. Which of the following is true?

(a) $y = 2$ **(b)** $y = 0$ **(c)** $y = -1$ **(d)** $y = 1$ **(e)** $y = -2$

Problem 5. What is the linear approximation of $f(x, y) = (y+1)e^x$ at $(0, 0)$?

(a) $1 + x + y$ **(b)** $1 + x + y + xy$ **(c)** $1 + \frac{1}{2}x + \frac{3}{2}y$ **(d)** $1 + y$ **(e)** $1 + x$

Problem 6. In an animal population with x juveniles and y adults the number of juveniles and the number of adults next year are the first and the second entry of $\left[\begin{smallmatrix} 0{,}7 & 0{,}9 \\ 1{,}6 & 0 \end{smallmatrix}\right]\left[\begin{smallmatrix} x \\ y \end{smallmatrix}\right]$, respectively. What is the population's long term relative growth rate?

(a) 1.5 **(b)** 1.0 **(c)** 1.4 **(d)** 1.6 **(e)** 1.2

Problem 7. Which types of equilibrium points does the differential equation $dy/dt = (y^2 - y)(y - 2)$ have?

(a) One stable and one unstable **(b)** One stable and two unstable **(c)** Two stable **(d)** Two unstable **(e)** Two stable and one unstable

Problem 8. Which type of critical point is $(3, 4)$ for the function f defined by $f(x, y) = -x^2 - y^2 + 6x + 8y - 21$ for all (x, y)?

(a) Local minimum **(b)** Local maximum **(c)** Saddle point **(d)** Stirrup point **(e)** $(3, 4)$ is not a critical point

Problem 9. What is the top left entry of the inverse matrix of $\left[\begin{smallmatrix} -2 & 1 \\ 4 & -2 \end{smallmatrix}\right]$?

(a) -0.5 **(b)** -2 **(c)** 0.5 **(d)** 2 **(e)** The matrix is not invertible

Problem 10. A solution x of the differential equation $dx/dt = 2xt$ is equal to 1 when $t = 0$. What is x equal to when $t = 2$?

(a) e^4 **(b)** e **(c)** e^3 **(d)** e^2 **(e)** 1

Problem	a	b	c	d	e
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Studentnummer Student number

Studieprogram Study program

Inspektør Inspector