Midterm 1May 30, 2018Duration: 50 minutesThis test has 4 questions on 7 pages, for a total of 40 points.

- Read all the questions carefully before starting to work.
- Give complete arguments and explanations for all your calculations. Answers without justifications will not be marked, unless otherwise indicated.
- Continue on the closest blank page if you run out of space, and **indicate this clearly on the original page.**
- Attempt to answer all questions for partial credit.
- This is a closed-book examination. No aids of any kind are allowed, including: documents, cheat sheets, electronic devices of any kind (including calculators, phones, etc.)

First Name: _____ Last Name: _____

Student-No: _

_____ Section: _

Signature: _

dates, unless otherwise authorized;

Question:	1	2	3	4	Total
Points:	10	10	10	10	40
Score:					

Student Conduct during Examinations 1. Each examination candidate must be prepared to produce, upon (ii) purposely exposing written papers to the view of other examination candidates or imaging devices; the request of the invigilator or examiner, his or her UBCcard for identification. (iii) purposely viewing the written papers of other examination candidates: Examination candidates are not permitted to ask questions of the examiners or invigilators, except in cases of supposed errors or am-(iv) using or having visible at the place of writing any books, pabiguities in examination questions, illegible or missing material, or pers or other memory aid devices other than those authorized the like. by the examiner(s); and, (v) using or operating electronic devices including but not lim-3. No examination candidate shall be permitted to enter the examinaited to telephones, calculators, computers, or similar devices tion room after the expiration of one-half hour from the scheduled other than those authorized by the examiner(s)—(electronic devices other than those authorized by the examiner(s) must starting time, or to leave during the first half hour of the examination. Should the examination run forty-five (45) minutes or less, no examination candidate shall be permitted to enter the examination be completely powered down if present at the place of writroom once the examination has begun. ing). 4. Examination candidates must conduct themselves honestly and in 6. Examination candidates must not destroy or damage any examinaaccordance with established rules for a given examination, which tion material, must hand in all examination papers, and must not will be articulated by the examiner or invigilator prior to the examtake any examination material from the examination room without ination commencing. Should dishonest behaviour be observed by the examiner(s) or invigilator(s), pleas of accident or forgetfulness permission of the examiner or invigilator. shall not be received. Notwithstanding the above, for any mode of examination that does not fall into the traditional, paper-based method, examination can-Examination candidates suspected of any of the following, or any didates shall adhere to any special rules for conduct as established other similar practices, may be immediately dismissed from the examination by the examiner/invigilator, and may be subject to and articulated by the examiner. disciplinary action: Examination candidates must follow any additional examination (i) speaking or communicating with other examination candirules or directions communicated by the examiner(s) or invigila-

tor(s).

4 marks 1. (a) Compute the equation of the plane which contains the points A = (2, 1, 1), B = (2, 2, 3) and C = (1, -1, -2) and write it in the form ax + by + cz = d.

Answer:

2 marks

(b) Consider the point D = (0, 1, t) where t is a value such that D is in the plane which contains A, B and C. Determine the value of t.

Answer:

4 marks (c) What angle does the plane from (a) form with the plane given by the equation x - y = 0?

10 marks 2. In the box below each plot, place a function from the list below which could generate that plot. There are two functions which are not associated to any plot. You do not need to justify your answers.



6 marks 3. (a) Let $u(x,y) = \sin(x+3y) + (x-3y)^3$. Compute the partial derivatives u_x, u_y, u_{xx} and u_{yy} .

Answer:

Answer:

Answer:

Answer:

4 marks

(b) Determine for which values $a \in \mathbb{R}$ is u(x, y) a solution of the equation

$$\frac{\partial^2 u}{\partial y^2} + a^3 \left(\frac{\partial^2 u}{\partial x \partial y} - \frac{\partial^2 u}{\partial y \partial x} \right) = a^2 \frac{\partial^2 u}{\partial x^2}.$$

2 marks 4. (a) Consider the function $f(x, y) = \ln(xy)$. Draw a sketch of largest possible domain $D \subset \mathbb{R}^2$ where f is well defined. Does it contain the lines defined by y = 0 and x = 0?

Answer:		

4 marks

(b) What is the equation of the tangent plane to $f(x, y) = \ln(xy)$ passing through $(x_0, y_0) = (1, 1)$?

3 marks

(c) The volume of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ is given by the expression $V = \frac{4\pi}{3}abc$. Suppose that the values of a, b, c are known up to an error $\Delta a = \Delta b = \Delta c = \frac{3}{400\pi}$. Give an estimation of the error ΔV on the volume of the ellipsoid using total differentials. Leave your answer in expressed in terms of a, b, c.

Answer:

1 mark

(d) Find the estimation on the error ΔV above when a = 50, b = 40 and c = 30.

 $This \ page \ has \ been \ left \ blank \ for \ your \ rough \ work \ and \ calculations.$