# Component Area Option (a): Mathematics/Reasoning - MATH - 1451

### Restricted Use - AR -UGRD Course - REVISE existing Core Course <or> Revise existing non-core course to ADD to Core

## General Information

**Please use this form to:**

- **REVISE** a course that is already on the Core course list.
- **ADD** to the Core course list an existing permanent course that is not already on the Core course list

### Course Ownership

**Department*** **Department of Mathematics**

**Will the course be cross-listed with another area?***
- Yes
- No (selected)

**If "Yes", please enter the cross-listed course information (Prefix Code Title)**

### Implementation

**Academic Year to begin offering course:***
- 2015 (selected)
- 2016
- 2017

**Term(s) Course will be TYPICALLY Offered:***
- Fall (including all sessions within term)
- Spring (including Winter Mini all sessions within term (checked)
- Summer (including Summer Mini and all sessions within term)

### Justification for changing course

**Justification(s) for Adding Course*** **1. REVISE EXISTING non-CORE COURSE ADD TO CORE**

**Justification "Other" if selected above:**

## Importing course information for revising existing Core course

**Instructional Area/Course Prefix*** MATH

**Course Number*** 1451

**Long Course Title*** Accelerated Calculus

**Short Course Title**

## Instruction Type and Student Contact Hours

**Instruction Type*** **Lecture / Laboratory**

### Contact Hours

**Student Contact Hours are determined by a number of factors, including instruction type, and are used to determine the accuracy of credit hours earned by accrediting agencies and THECB. Please contact your college resource for assistance with this information.**

**Student Contact Hours must match the instruction type.**
**Eg: If Lecture ONLY, then Student Contact Hours for Lab must be zero.**
**Eg: If Lab ONLY, then Student Contact Hours for Lecture must be zero.**

**Lecture*** 3

**Lab*** 2

## Grade Options

**Grade Option*** **Letter (A, B, C.....)**

**CIP Code**

**The CIP Code is used by the university and the THECB to determine funding allocated to the course, which means that selecting the most helpful valid code may have an effect on your course.**

**If assistance is needed with code selection, please contact your college resource.**

**CIP Code Directory:** http://www.txhighereddata.org/Interactive/CIP/

CIP Code must use this format:
##.####.## ##

## Course Repeatability

**Can this course be repeated for credit?*** Yes No

**If Yes, how often and/or under what conditions may the course be repeated?**

**CIP Code*** 27.0101.00 01

## Catalog Descriptions

**Prerequisite(s):*** Math 1450

**Corequisite(s)**

**Course Description***

Credit may not be received for both MATH 1450 and MATH 1431. Students with credit in MATH 1451 may not enroll in or receive credit for either MATH 1432 or MATH 2433. An accelerated calculus sequence. MATH 1450 will include topics normally covered in MATH 1431. MATH 1451 will include topics normally covered in MATH 1432 and MATH 2433.

**Course Notes**

## Authorized Degree Program(s)

**Impact Report ***

# Impact Report for Math 1451

| | |
|---|---|
| **Note:** | MATH 1450 - Accelerated Calculus |
| **Description** | MATH 1451 - Accelerated Calculus |
| | MATH 1450 - Accelerated Calculus |

## Core Curriculum Information

**For additional guidance when developing course curriculum that will also meet the Core Curriculum requirements, please refer to the Undergraduate Committee website for Core Curriculum:**

http://www.uh.edu/undergraduate-committee/doc_2014-core-review.html

**Therein you will find a chart for the required and optional competencies based on the Core Component Area (Core Category) selected.**

**Component Area for which the course is being proposed (select one)***

**Component Area Option (a): Mathematics/Reasoning**

**List the student learning outcomes for the course***

The student will demonstrate mastery of the following course objective at the level indicated on the syllabus.

**Functions of several variables, limits and continuity.**

**Partial differentiation and the chain rule. Matrices and linearization.**

**Directional derivatives and the gradient.**

**Maximum and minimum values, Lagrange multipliers.**

**Multiple integrals: double and triple integrals.**

**Line integrals, curl and divergence, Green's theorem.**

**Surface integrals, Stoke's theorem and the divergence theorem.**

**Applications to physics and chemistry.**

**Competency areas addressed by the course***

**Communication Skills**

**Critical Thinking**

**Empirical & Quantitative Skills**

**Because we will be assessing student learning outcomes across multiple core courses, assessments assigned in your course must include assessments of the core competencies. For each competency selected above, indicated the specific course assignment(s) which, when completed by students, will provide evidence of the competency.**

**Provide (upload as attachment) detailed information, such as copies of the paper or project assignment, copies of individual test items, etc. A single assignment may be used to provide data for multiple competencies.**

**Critical Thinking,**

**if applicable**

See attached final for examples. Questions 1b through 5 all require mathmatical critical thinking.

**Communication Skills, if applicable**

See attached final for examples. Questions 1a, 3a, 4a and 5a all require mathmatical communication skills.

**Empirical & Quantitative Skills, if applicable**

See attached final for examples. Questions 2b, 3b, 4d, and 5b all requires quantitative skills.

**Teamwork, if applicable**

**Social Responsibility, if**

**applicable**

**Personal Responsibility, if applicable**

## Syllabus

**Syllabus*** Syllabus Attached

**Will the syllabus vary across multiple section of the course?*** Yes No

**If yes, list the assignments that will be constant across sections**

### Important information regarding Core course effectiveness evaluation:

**Inclusion in the core is contingent upon the course being offered and taught at least once every other academic year. Courses will be reviewed for renewal every 5 years.**

**The department understands that instructors will be expected to provide student work**

**and to participate in university-wide assessments of student work. This could include, but may not be limited to, designing instruments such as rubrics, and scoring work by students in this or other courses. In addition, instructors of core courses may be asked to include brief assessment activities in their course.**

## Additional Information Regarding This Proposal

**Comments:**

Math 1451, Accelerated Calculus- Semester 2

**Course times:** Lecture times are Tuesday and Thursday 2:30pm-4:00pm, L 212S.

**Office hours:** My office hours are 10.00am -11.00am, 1.00-2.00pm Wednesday or by appointment.

**Recitation Class.** The recitation classes are held by Mauricio Rivas in 212S on MWF from 9am- 10 noon and on MWF 11-12. Attendance is compulsory on Mondays and Wednesdays.

**Contact Details:** Dr Matthew Nicol , Office PGH Room 665, Extn: 6181

**Course Description:** Here is a brief outline of the course syllabus. The lectures will be based partly on Stewart's calculus and also other texts, notably the book by Colley listed below.

- Functions of several variables, limits and continuity.
- Partial differentiation and the chain rule. Matrices and linearization.
- Directional derivatives and the gradient.
- Maximum and minimum values, Lagrange multipliers.
- Multiple integrals: double and triple integrals.
- Line integrals, curl and divergence, Green's theorem.
- Surface integrals, Stoke's theorem and the divergence theorem.
- Applications to physics and chemistry.

**Recommended Texts:** The textbook of most use is "Calculus-early transcendentals" by James Stewart 6th edition.

Another good reference is "Vector calculus" by Susan Colley (3rd edition).

**Please see reverse side**

**Assessment:** Your final grade will be based on:

(75) 25 points from each of three in-class exams.
(25) 25 points for homeworks and quizzes (quizzes are announced a week ahead of time).

There will be no final exam.

# Honors Calculus, Final Exam

Dr Matthew Nicol, PGH 665

**ATTEMPT 5 OUT OF 5 QUESTIONS. NO CALCULATORS ARE TO BE USED.**

*Please write your answers clearly and in a logical and well-organized way. Points will be deducted for sloppy work. All questions have equal worth.*

**Good Luck.**

(1) [8] (a) Explain the terms **grad**, **div** and **curl** and illustrate your discussion with examples.

(b) [7] If $F(x,y,z) = P(x,y,z)\hat{\imath} + Q(x,y,z)\hat{\jmath} + R(x,y,z)\hat{k}$ is a vector field with continuous first order partial derivatives show that show

$$\mathbf{div}(\mathbf{curl}F) = 0$$

(2) (a) [10] If $C(t) = (x(t), y(t), z(t))$ is a parametrized curve in $\mathbb{R}^3$ and $F : \mathbb{R}^3 \to \mathbb{R}^3$ is a vector field, while $f : \mathbb{R}^3 \to \mathbb{R}$ is a scalar function define the line integral of $F$ along $C$

$$\int_C F \cdot dr$$

and the integral of $f$ along $C$ with respect to arc-length

$$\int_C f ds$$

Which of these integrals depend on the orientation of $C$? on the parametrization of $C$?

(b)[5] Compute the line integral of $F = (x^2 - xy, y^2 - xy)$ along the parabola $y = x^2$ from $(-1, 1)$ to $(1, 1)$.

(3) (a) [5] What is a conservative vector field? What can be said about the line integral of a conservative vector field over a closed curve?

(b) [10] Let $F(x, y, z) = (2x + yz, 2y + xz, 2z + xy)$. Find the integral of $F$ along the curve $C(t) = (t, t^2, t^3)$, $0 \leq t \leq 1$ from $(0, 0, 0)$ to $(1, 1, 1)$.

(4) (a) Consider the vector field $F(x, y, z) = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and the surface $S$ with boundary given by that part of $z = 4 - (x^2 + y^2)$ lying above the $(x, y)$-plane and the disk $(x, y, 0) : 0 \leq x^2 + y^2 \leq 4$ lying in the $(x, y)$ plane.

(a) [4] Sketch the surface $S$.

(b) [6] Parametrize that part of $S$ where $z > 0$ by writing $r(x, y) = (x, y, 4 - x^2 - y^2)$ and compute the unit normal vector to $S$ where $z > 0$. What is the unit normal to the disk $(x, y, 0) : 0 \leq x^2 + y^2 \leq 4$ lying in the $(x, y)$ plane.

(c)[5] Calculate the surface integral $\int\int_S F \cdot n \, dS$ where $n$ is the unit normal vector to the surface $S$ explicitly i.e. **without** using the divergence theorem.

(d) [5] Calculate the volume of the solid region bounded by the surface $S$.

(e) [5] State the Divergence Theorem. Compute $\int\int_S F \cdot n \, dS$ by using the Divergence Theorem.

(5) Let $A$ be a domain which is the interior of a closed curve $C$ oriented anti-clockwise.

(a) State Green's theorem.

(b) Use Green's theorem or otherwise find the line integral of the vector field

$$F(x, y) = (y + x, 2y - x)$$

counterclockwise around the circle $(x - 1)^2 + (y - 1)^2 = 1$.