MATH2020
Vector Calculus and Complex Analysis
Session 2, Special circumstances 2021
Department of Mathematics and Statistics

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Disclaimer
Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

Notice
Some on-campus classes have moved online for the first two weeks of Session, before returning to campus in Week 3. If you are studying a unit outside of the primary Session 2 timetable, please contact your teaching staff team for further details.

Some classes/teaching activities cannot be moved online and must be taught on campus. To find out if you are enrolled in one of these classes/teaching activities, you can check to see if your unit is on the list of units with mandatory on-campus classes/teaching activities.

Your Unit Convenor will provide more information via an iLearn announcement when your iLearn unit becomes available.

https://unitguides.mq.edu.au/unit_offerings/138177/unit_guide/print
## General Information

<table>
<thead>
<tr>
<th>Unit convenor and teaching staff</th>
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<tbody>
<tr>
<td>Unit Convenor/Lecturer</td>
<td>Paul Bryan</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:paul.bryan@mq.edu.au">paul.bryan@mq.edu.au</a></td>
</tr>
<tr>
<td>Contact via Email</td>
<td>Please refer to iLearn</td>
</tr>
<tr>
<td>Lecturer</td>
<td>Ross Moore</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:ross.moore@mq.edu.au">ross.moore@mq.edu.au</a></td>
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| Credit points                   | 10 |

| Prerequisites                   | MATH2010 or MATH2055 or MATH235 |

| Corequisites                    | |

| Co-badged status               | |
Unit description
The topics covered in this unit lay the foundations for further study in modern areas of mathematics (such as partial differential equations, fluid mechanics, and mathematical biology). This unit builds on the first year single variable calculus units by extending calculus to several variables, and focuses primarily on integration techniques for complex functions and vector fields. Complex analysis is the study of complex-valued functions of complex variables. The main properties of complex functions of a single complex variable will be presented, including the important concepts of analyticity and singularity structure. This will be followed by a treatment of Cauchy's theorem and the residue theorem to evaluate contour integrals of complex functions around various curves in the complex plane. Vector calculus is the study of vector fields in two and three dimensions, and facilitates the modelling of a variety of physical phenomena, for example in fluid mechanics and electromagnetism. By introducing the gradient, divergence and curl operators, the main properties of vector fields can be analysed. A variety of integrals of vector fields over paths, surfaces and volumes will be performed, and the application of three important integral theorems of vector calculus due to Green, Stokes and Gauss to evaluate these integrals will be demonstrated.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://students.mq.edu.au/important-dates.

Learning Outcomes
On successful completion of this unit, you will be able to:

**ULO1:** Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.

**ULO2:** Evaluate contour integrals of complex functions by applying Cauchy's theorem and the residue theorem.

**ULO3:** Analyse the main properties of vector fields using the gradient, divergence and curl operators.

**ULO4:** Evaluate path, surface and volume integrals of vector fields.

**ULO5:** Apply the important theorems due to Green, Stokes and Gauss to physical applications.

General Assessment Information

**HURDLES:** This unit has no hurdle requirements.

**ASSIGNMENT SUBMISSION:** Assignment submission will be online through the iLearn page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission
statement carefully before accepting it as there are substantial penalties for making a false declaration.

• Assignment submission is via iLearn. You should upload this as a single scanned PDF file.
• Please note the quick guide on how to upload your assignments provided on the iLearn page.
• Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
• It is your responsibility to make sure your assignment submission is legible.
• If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

LATE SUBMISSION: All assignments must be submitted by the official due date and time. No marks will be given to late work unless an extension has been granted following a successful application for Special Consideration. Please contact the unit convenor for advice as soon as you become aware that you may have difficulty meeting any of the assignment deadlines. It is in your interests to make frequent submissions of your partially completed work. Note that later submissions completely replace any earlier submission, and so only the final submission made before the due date will be marked.

FINAL EXAM POLICY: You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via ask.mq.edu.au.

SUPPLEMENTARY EXAMINATIONS:

IMPORTANT: If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. If you apply for special consideration, you must give the supplementary examination priority over any other pre-existing commitments, as such commitments will not usually be considered an acceptable basis for a second application for special consideration. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (https://bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification sometime in the week prior to the exam with the exact date and time of their supplementary examination.
## Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 (Online)</td>
<td>15%</td>
<td>No</td>
<td>Week 4</td>
</tr>
<tr>
<td>Assignment 1</td>
<td>10%</td>
<td>No</td>
<td>Week 6</td>
</tr>
<tr>
<td>Test 2 (Online)</td>
<td>15%</td>
<td>No</td>
<td>Week 10</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>10%</td>
<td>No</td>
<td>Week 12</td>
</tr>
<tr>
<td>Final exam</td>
<td>50%</td>
<td>No</td>
<td>Exam period</td>
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### Test 1 (Online)

**Assessment Type**: Quiz/Test  
**Indicative Time on Task**: 10 hours  
**Due**: Week 4  
**Weighting**: 15%

Online test

On successful completion you will be able to:

- Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.
- Evaluate contour integrals of complex functions by applying Cauchy's theorem and the residue theorem.
- Analyse the main properties of vector fields using the gradient, divergence and curl operators.
- Evaluate path, surface and volume integrals of vector fields.
- Apply the important theorems due to Green, Stokes and Gauss to physical applications.

### Assignment 1

**Assessment Type**: Problem set  
**Indicative Time on Task**: 10 hours  
**Due**: Week 6  
**Weighting**: 10%

The assignments reinforce and build on material from lectures, and involve calculations and explanations.

On successful completion you will be able to:
• Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.
• Evaluate contour integrals of complex functions by applying Cauchy’s theorem and the residue theorem.
• Analyse the main properties of vector fields using the gradient, divergence and curl operators.
• Evaluate path, surface and volume integrals of vector fields.
• Apply the important theorems due to Green, Stokes and Gauss to physical applications.

Test 2 (Online)
Assessment Type 1: Quiz/Test
Indicative Time on Task 2: 10 hours
Due: Week 10
Weighting: 15%

On successful completion you will be able to:
• Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.
• Evaluate contour integrals of complex functions by applying Cauchy’s theorem and the residue theorem.
• Analyse the main properties of vector fields using the gradient, divergence and curl operators.
• Evaluate path, surface and volume integrals of vector fields.
• Apply the important theorems due to Green, Stokes and Gauss to physical applications.

Assignment 2
Assessment Type 1: Problem set
Indicative Time on Task 2: 10 hours
Due: Week 12
Weighting: 10%

The assignments reinforce and build on material from lectures, and involve calculations and explanations.

On successful completion you will be able to:
• Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.
• Evaluate contour integrals of complex functions by applying Cauchy’s theorem and the residue theorem.
• Analyse the main properties of vector fields using the gradient, divergence and curl operators.
• Evaluate path, surface and volume integrals of vector fields.
• Apply the important theorems due to Green, Stokes and Gauss to physical applications.

Final exam
Assessment Type 1: Examination
Indicative Time on Task 2: 15 hours
Due: Exam period
Weighting: 50%

Summative examination, held during the university examination period.

On successful completion you will be able to:
• Analyse the main properties of functions of a single complex variable, such as analyticity and singularity structure.
• Evaluate contour integrals of complex functions by applying Cauchy’s theorem and the residue theorem.
• Analyse the main properties of vector fields using the gradient, divergence and curl operators.
• Evaluate path, surface and volume integrals of vector fields.
• Apply the important theorems due to Green, Stokes and Gauss to physical applications.

1 If you need help with your assignment, please contact:
• the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
• the Learning Skills Unit for academic skills support.

2 Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Classes
Lectures: there 2 x 1hr lectures and a 1hr SGTA each week.
Required and Recommended Texts and/or Materials

Lecture notes will be available on iLearn.

The following texts provide useful references for various sections of the course:

- Churchill and Brown; *Complex variables and applications*, (McGraw–Hill) library call number QA331 .C524
- Marsden and Tromba; *Vector Calculus*, (Wiley) library call number QA303 .M338

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(Note: The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Students seeking more policy resources can visit the [Student Policy Gateway](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/admin/other-resources/student-conduct](https://students.mq.edu.au/admin/other-resources/student-conduct)

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)
Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Enquiry Service

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

Equity Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.