



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                     |        |                                                                                |           |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                     |        |                                                                                | 2022/23   |
| Subject (*)         | Mathematics 2                                                                                                                                                                                       |        | Code                                                                           | 610G01002 |
| Study programme     | Grao en Química                                                                                                                                                                                     |        |                                                                                |           |
| Descriptors         |                                                                                                                                                                                                     |        |                                                                                |           |
| Cycle               | Period                                                                                                                                                                                              | Year   | Type                                                                           | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                               | First  | Basic training                                                                 | 6         |
| Language            | Spanish                                                                                                                                                                                             |        |                                                                                |           |
| Teaching method     | Face-to-face                                                                                                                                                                                        |        |                                                                                |           |
| Prerequisites       |                                                                                                                                                                                                     |        |                                                                                |           |
| Department          | Matemáticas                                                                                                                                                                                         |        |                                                                                |           |
| Coordinador         | Otero Verea, Jose Luis                                                                                                                                                                              | E-mail | luis.verea@udc.es                                                              |           |
| Lecturers           | Calvo Garrido, María Del Carmen<br>Jacome Pumar, Maria Amalia<br>Otero Verea, Jose Luis                                                                                                             | E-mail | carmen.calvo.garrido@udc.es<br>maria.amalia.jacome@udc.es<br>luis.verea@udc.es |           |
| Web                 |                                                                                                                                                                                                     |        |                                                                                |           |
| General description | This course aims to develop the necessary skills to obtain a critical knowledge in differential and integral calculus as well as a small introduction to linear algebra and differential equations. |        |                                                                                |           |

## Study programme competences

| Code | Study programme competences                                                                                                        |
|------|------------------------------------------------------------------------------------------------------------------------------------|
| A15  | Ability to recognise and analyse new problems and develop solution strategies                                                      |
| A16  | Ability to source, assess and apply technical bibliographical information and data relating to chemistry                           |
| A20  | Ability to interpret data resulting from laboratory observation and measurement                                                    |
| A24  | Ability to explain chemical processes and phenomena clearly and simply                                                             |
| A25  | Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life |
| A27  | Ability to teach chemistry and related subjects at different academic levels                                                       |
| B1   | Learning to learn                                                                                                                  |
| B2   | Effective problem solving                                                                                                          |
| B3   | Application of logical, critical, creative thinking                                                                                |
| B6   | Ethical, responsible, civic-minded professionalism                                                                                 |
| C1   | Ability to express oneself accurately in the official languages of Galicia (oral and in written)                                   |
| C3   | Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life  |
| C6   | Ability to assess critically the knowledge, technology and information available for problem solving                               |

## Learning outcomes

| Learning outcomes                                                                                 | Study programme competences            |                      |                |
|---------------------------------------------------------------------------------------------------|----------------------------------------|----------------------|----------------|
| The study, representation and interpretation of elementary functions of one and several variables | A15<br>A16<br>A20<br>A24<br>A25<br>A27 | B1<br>B2<br>B3<br>B6 | C1<br>C3<br>C6 |
| Use skilfully the techniques of calculation of primitive and its applications.                    | A15<br>A16<br>A20<br>A24<br>A25<br>A27 | B1<br>B2<br>B3<br>B6 | C1<br>C3<br>C6 |



|                                                                                               |     |    |    |
|-----------------------------------------------------------------------------------------------|-----|----|----|
| Set out and solve simple models that comport equations and systems of differential equations. | A15 | B1 | C1 |
|                                                                                               | A16 | B2 | C3 |
|                                                                                               | A20 | B3 | C6 |
|                                                                                               | A24 | B6 |    |
|                                                                                               | A25 |    |    |
|                                                                                               | A27 |    |    |
| Solve problems of basic statistical methods from the descriptive point of view                | A15 | B1 | C1 |
|                                                                                               | A16 | B2 | C3 |
|                                                                                               | A20 | B3 |    |
|                                                                                               | A24 | B6 |    |
|                                                                                               | A25 |    |    |
|                                                                                               | A27 |    |    |

| Contents                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                             | Sub-topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Differentiation of functions of several variables | <p>Functions of several variables.</p> <p>Topological notions. Flat curves and parametric equations. Surfaces in space. Polar, cylindrical and spherical coordinates. Real functions of several variables. Scalar and vector functions. Graphs and level sets. Concept of continuity.</p> <p>Differentiation of functions of several variables.</p> <p>Partial derivatives. Directional derivative. Differential of a function. Higher order partial derivatives. Jacobean Matrix. Chain rule. Taylor's theorem. Plane tangent to a surface.</p> <p>Function ends of two variables. Lagrange multipliers.</p> |
| Integration of functions of several variables     | <p>Multiple integration. Integral line.</p> <p>Iterated integrals. Double integrals. Change of variables: polar coordinates. Triple integrals Change of variables: cylindrical and spherical coordinates. Applications. Line integrals of scalar and vector functions. Applications. Green and Stokes theorem.</p>                                                                                                                                                                                                                                                                                            |
| Differential Equations                            | <p>First order differential equations.</p> <p>Separable variables. Homogeneous equations.</p> <p>Exact equations</p> <p>Linear equations.</p> <p>Differential equations as mathematical models.</p> <p>Linear differential equations of order n.</p> <p>Homogeneous linear differential equations.</p> <p>Variation of parameters. Indeterminate coefficients.</p> <p>Linear systems of differential equations.</p> <p>Modeling with systems of differential equations.</p>                                                                                                                                   |
| Descriptive statistics                            | <p>Statistical description of a variable</p> <p>Joint statistical description of several variables</p> <p>Regression curves: least squares.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Planning                       |                                |                      |                               |             |
|--------------------------------|--------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies                   | Ordinary class hours | Student's personal work hours | Total hours |
| Guest lecture / keynote speech | A15 A16 A24 A27 B1<br>B2 B3 B6 | 32                   | 64                            | 96          |
| Problem solving                | A20 A25 B2 B3 C1               | 8                    | 18                            | 26          |



|                                                                                                                                 |                           |   |    |    |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------|---|----|----|
| Supervised projects                                                                                                             | A15 A20 B1 B3 C1<br>C3 C6 | 8 | 16 | 24 |
| Multiple-choice questions                                                                                                       | B2 B3                     | 3 | 0  | 3  |
| Personalized attention                                                                                                          |                           | 1 | 0  | 1  |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |                           |   |    |    |

| Methodologies                  |                                                                                                                                                                         |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                  | Description                                                                                                                                                             |
| Guest lecture / keynote speech | concept development and problem solving                                                                                                                                 |
| Problem solving                | Questionnaires, bulletins and exams from other courses that will be periodically made available to students on different contents and that students will have to solve. |
| Supervised projects            | Working on topics proposed by the teacher, a theoretical summary will be presented along with a bulletin of solved problems on the corresponding topic                  |
| Multiple-choice questions      | Multiple answer test                                                                                                                                                    |

| Personalized attention |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Supervised projects    | <p>The personalized attention described in relation to these methodologies is conceived as face-to-face moments of work for the students with the teacher, for which they imply a participation for the students; the form and the moment in which it will be carried out will be indicated in relation to each activity throughout the course according to the work plan of the subject.</p> <p>The specific personalized attention measures for or &amp;quot;Students with recognition of part-time dedication and academic exemption from attendance exemption&amp;quot; for the study of the subject, will be delivery of questionnaires, bulletins and exams of other courses that will be periodically made available to the students about different contents and that the student will have to solve.</p> |

| Assessment                |                           |                                                                                                    |               |
|---------------------------|---------------------------|----------------------------------------------------------------------------------------------------|---------------|
| Methodologies             | Competencies              | Description                                                                                        | Qualification |
| Supervised projects       | A15 A20 B1 B3 C1<br>C3 C6 | Development of specific aspects with examples and solved problems. Competence B3 will be assessed. | 10            |
| Multiple-choice questions | B2 B3                     | Multiple-choice questions                                                                          | 70            |
| Problem solving           | A20 A25 B2 B3 C1          | Delivery of exercises and solved exams. Competences A15, B2 and C3 will be assessed.               | 20            |

| Assessment comments |
|---------------------|
|---------------------|



To pass the course, it will be necessary to obtain, added the marks of all the activities, a minimum grade of 50% of the total and 50% of the multiple-choice test. To obtain the grade of not presented, it will be sufficient that the student does not participate in the multiple-choice test and has not been evaluated in the supervised Works in more than 50%. In the second chance test, the criterion to pass the subject will be the previous one. The teaching-learning process, including assessment, refers to one academic course, and therefore a new course would be restarted, including all assessment activities and procedures that were scheduled for that course; however, it is allowed to request to maintain the practical qualification of a previous course.

Students enrolled in part-time regime and academic exemption from attendance exemption, can be evaluated in a personalized way regarding the methodologies of Maxistral Session, Problem Solving and Tutored Jobs. Students enrolled in part-time regimen are required to sit the multiple-choice test, as well as the partial tests throughout the course. For the first and second opportunity, the evaluation criteria for this student body is the same as for the others and the attendance waiver percentage will be 80%.

Students at the first opportunity have priority in the granting of honors.

Fraud in tests or evaluation activities will

directly involve the implementation of the current rules in the Assessment, review and complaint regulation of the UDC and the Student Statute of the UDC

## Sources of information

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- LARSON (2006). CALCULO. McGrawHill</li> <li>- Jon Rogawski (). Cálculo varias variables. Reverté</li> <li>- Zill (). Ecuaciones diferenciales con aplicaciones de modelado. Thomson-Learning</li> <li>- CAO ABAD, R. y otros (2001). Introducción a la estadística y sus aplicaciones.</li> <li>- MILLER, J.C. Y MILLER, J.N. (2002). Estadística para Química Analítica. Addison-Wesley Iberoamericana</li> <li>- TOMEIO PERUCHA V. y UÑA JUÁREZ I. (2003). Lecciones de Estadística Descriptiva. Paraninfo</li> <li>- W. Keith Nicholson (2019). Linear Algebra with Applications. Lyryx Learning Team</li> </ul>                                                                             |
| <b>Complementary</b> | <ul style="list-style-type: none"> <li>- Alegre (). Problemas de funciones de varias variables. PPU</li> <li>- Alfonsa García (). Cálculo I. CLGSA</li> <li>- Alfonsa García (). Cálculo II. CLGSA</li> <li>- Rainville (). Ecuaciones diferenciales. Prentice Hall</li> <li>- Ayres (). Ecuaciones diferenciales. McGraw-Hill</li> <li>- Bradley (). Cálculo. Prentice Hall</li> <li>- Finney (). Cálculo. Addison-Wesley</li> <li>- Salas / Hille / Etgen (). Cálculus. Reverté</li> <li>- GARCÍA ÁLVAREZ-COQUE, C. Y RAMIS RAMOS, G. (2001). Quimiometría. Editorial Síntesis</li> <li>- GONICK, L. Y SMITH, W. (2001). A estatística ¡en caricaturas! . SGAPEIO</li> <li>- Quimiometría (2005). MONGAY FERNÁNDEZ, C.. PUV</li> </ul> |

## Recommendations

### Subjects that it is recommended to have taken before

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

## Other comments

It is convenient to have knowledges of mathematics of 2 bachillerato, if it does not have them recommend do the course of nivelación.&nbsp;



(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.