# PX160-10 Tutorial (Maths/Physics)

## 22/23

**Department**
Physics
**Level**
Undergraduate Level 1
**Module leader**
Michael Pounds
**Credit value**
10
**Module duration**
25 weeks
**Assessment**
100% coursework
**Study location**
University of Warwick main campus, Coventry

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## Description

## Introductory description

The tutor's mark is made up from marks for answers to the assessed weekly problems (50%) and from work associated with five worksheets (50%). The worksheets cover some background mathematical material assumed by other modules. The material covered includes vectors, matrices, waves, multiple integration and integration over surfaces and along contours.

Module web page

## Module aims

To cover some background mathematical material assumed by other modules, to give students experience of learning by self-study.

## Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Worksheets

Vectors:

Vectors have magnitude and direction. Addition and subtraction, the null vector. Geometry of simple figures written in vector notation, equation of lines and planes, equation for centroid of a triangle. The dot product, the normal to a plane and alternative form for equations of planes, perpendiculars from points of a triangle to opposite sides meet at a point. Cross-product and the notion of an area in three dimensions as a vector. Equation of line of intersection of two planes. Triple scalar product, associative law, relation to volume of parallelopiped. Triple vector product

Matrices:
Motivation and definition. The 2 x 2 case: operations on vectors. Eigenvalues and eigenvectors. Diagonalizing matrices. Exponential of a diagonalizable matrix. Mention of the 3 x 3 and N x N cases.

Maths for Waves:
Notation for partial derivatives. Examples of equations admitting wave-like solutions: wave equation, advection equation, traffic flow. Linear operators, principle of superposition. Boundary conditions, reflection and transmission coefficients. Plane waves, exponential form. Energy in waves. Wave groups, group velocity.

Multiple Integration:
Integration of functions of more than one variable. The domain of integration and changing the order of integration. Computing the mass of an object with variable density. Changing variables and the Jacobian with particular reference to the transformation cartesian to polar coordinates

Integration over Lines, Surfaces and Volumes:
Notation for integration of both scalar and vector quantities over lines, surfaces and volumes. Integration along lines using parameterised curves, circulation around a contour. Infinitesimal surface element as a vector in 3D, use to compute flux across a surface. Volume integrals and revision of the Jacobian.
You should answer the questions on each of the worksheets and hand in your answers to your personal tutors as directed.

Weekly Problem Sheets:
You will be asked to hand in written answers to designated problems from the problem sheets and attempt designated problems from the Mastering Physics package.

## Learning outcomes

By the end of the module, students should be able to:

- Work with vectors, partial differentiation, multiple integration and integration over lines, surfaces and volumes at a level necessary to cope with all first year physics modules and to start the second year core module.
- Analyse a simple problem and decide on an approach to its solution

## Subject specific skills

Mathematical techniques, physics problem-solving

## Transferable skills

Communication, group working, problem-solving, self-study

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## Study

## Study time

| Type | Required |
|---|---|
| Seminars | 25 sessions of 1 hour (25%) |
| Tutorials | 25 sessions of 1 hour (25%) |
| Private study | 50 hours (50%) |
| Total | 100 hours |

## Private study description

Studying material on worksheets, answering associated questions. Working on weekly problem sheets and computer problems

## Costs

No further costs have been identified for this module.

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## Assessment

You do not need to pass all assessment components to pass the module.

### Assessment group A

| | Weighting | Study time | Eligible for self-certification |
|---|---|---|---|
| **Assessment component** | | | |
| Coursework<br>Worksheets and examples sheets | 100% | | No |
| **Reassessment component** | | | |
| Assessment of understanding | | | No |

| | Weighting | Study time | Eligible for self-certification |
|---|---|---|---|
| Designed as appropriate | | | |

### Feedback on assessment

Personal tutorials and examples classes

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## Availability

## Courses

This module is Core for:

- Year 1 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
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    - Year 1 of FG31 Mathematics and Physics (MMathPhys)