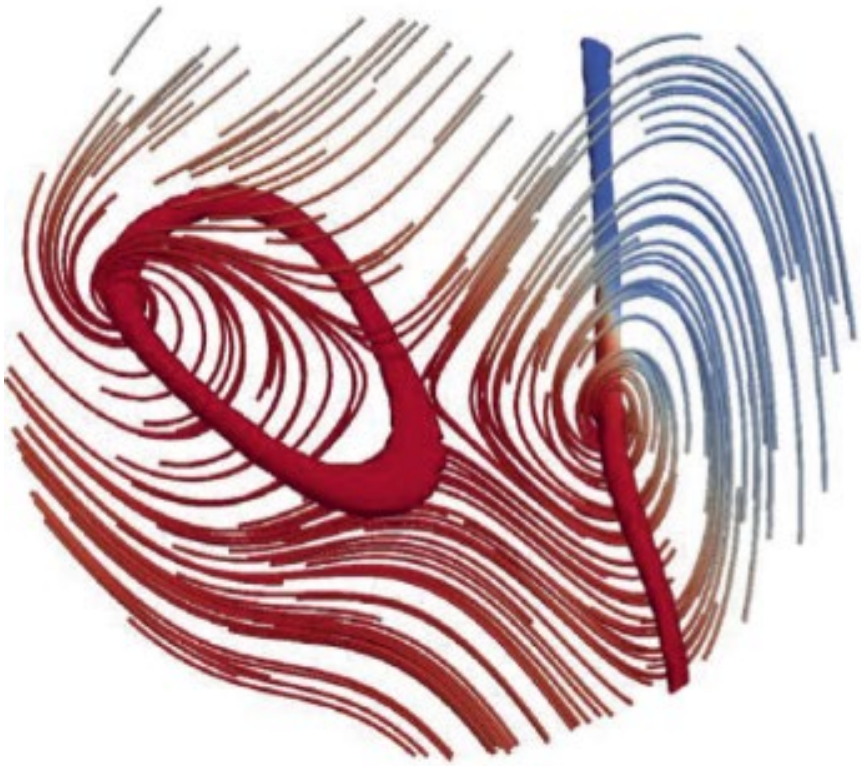
Researchers in Schools



Magnificent magnets and whirling vortices: a dive into micromagnetics

Key Stage 4 Programme

Pupil Name

Coursebook Designed by Dr Marco Bafetti

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Timetable and Assignment Submission

Timetable – Tutorials

Tutorial	Date	Time	Location
1			
2			
3			
4			
5			
6 (Feedback)			
7 (Feedback)			

Timetable – Homework Assignments

Homework Assignment	Description	Due Date
Tutorial 1		
Tutorial 2		
Tutorial 3		
Tutorial 4		
Tutorial 5		

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after midnight on 9th August	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Course Rationale

Magnetism is a topic that has fascinated humanity for a very long time, and for millennia its effects were known even if the explanation and description of this phenomenon remained beyond human understanding. Since Maxwell came up with the equation that describe electromagnetism we have deepened a lot our understanding of magnetism, to the point that magnetic devices are at the heart of many of the things that we use every day, even though we might be unaware of this! One example of this are magnetic memories which are used in computers to store data.

In this course we will study a very interesting aspect of magnetism, called micromagnetics, which is an exciting and lively field of research in modern academia, covering a range of subjects that goes from engineering – looking at the applications of micromagnetics to practical questions – to abstract mathematics – where we investigate properties of the physical models that we use to describe the behaviour of magnetic objects.

So what is micromagnetics? It is the study of magnetic objects whose shape has one dimension which is much smaller than the other ones: these could be long and thin wires or very thin films. In this course we will focus on thin films and explore some interesting objects that arise in this context, namely micromagnetic vortices.

In Tutorial 1 we will learn about magnetism and some basic properties.

In Tutorial 2 we will learn about mathematical modelling and its fundamental features.

In Tutorial 3 we will learn about vectors, how to perform operations on them and how to find their length.

In Tutorial 4 we will learn about the model of micromagnetics and its key aspects.

In Tutorial 5 we will learn about vortices and how they relate to electric charges.

Uni Pathways Mark Scheme 2020 – Essay-based assignments

	Subject Knowledge	Critical Thinking	Written Communication
1st	The essay shows a breadth of knowledge and understanding of the key concepts and issues, through engaging with and interpreting a wide range of relevant sources. Knowledge is used to build and support highly effective arguments.	Analyses, key ideas, information, and arguments. Interprets meaning and makes connections. Identifies and critically evaluates key arguments and statements, deciding on their credibility, strength and relative significance, drawing convincing conclusions.	The essay has a clear and engaging structure, taking the reader on a journey from the introduction to the conclusion. The writing style is appropriate; key terms are used with fluency. There are no, or very few, errors in spelling or grammar. Referencing is used consistently and matches the style taught in the course.
2:1	The essay shows an understanding of key concepts and issues, drawing on a range of relevant sources Knowledge is used to build and support effective arguments	Analyses key ideas, information and arguments. Identifies relevant arguments and statements, deciding on their credibility and strength, drawing reasonable conclusions. Shows some understanding of the relative importance of arguments.	The essay has a clear structure and the arguments are easy to follow. The introduction outlines the essay effectively and the conclusion summarises the arguments. The writing style is appropriate; key terms are used correctly. There are few errors in spelling or grammar. Referencing is mostly consistent and matches the style taught in the course.
2:2	The essay shows an understanding of key concepts and issues, with no major misconceptions. Beginning to apply this knowledge to build and support arguments.	Begins to analyse ideas, information and arguments. Identifies some arguments and statements and attempts to evaluate their quality. Not yet showing understanding of the relative strengths and weaknesses of arguments.	The essay structure could be made clearer to better guide the reader through the arguments. The writing style can sometimes be informal. Occasionally key terms are not used when it would be appropriate to do so. There are some errors in spelling or grammar, but they do not get in the way of communicating the content.

			There is some consistency to the referencing.
3rd	Shows a developing understanding of key concepts and issues, with some misconceptions. Not yet applying this knowledge to build and support arguments.	Begins to analyse ideas and information. Describes statements and arguments while not yet evaluating them.	The grammar, spelling, style, and structure of the work need improving in order to communicate ideas to the reader. The essay has no or a limited introduction and conclusion. Key terms and references are not always used correctly.

Uni Pathways Mark Scheme 2020 – maths-based assignments

	Subject Knowledge	Critical Thinking	Written Communication
1st	The work shows a depth of knowledge and understanding of key concepts and mathematical methods, drawing on sources of evidence where appropriate. Knowledge is used to build and support highly effective mathematical arguments and explanations.	Analyses the available data/evidence and identifies all the relevant mathematical information. Identifies and critically evaluates available mathematical approaches and evidence, deciding on their credibility, strength and relative significance. Makes connections between different pieces of information and puts them together to form accurate solutions and verify answers and assumptions.	Mathematical arguments are complete, and the reasoning behind each step has been clearly communicated to the reader. The work has a coherent flow and is well structured. The writing style is appropriate; mathematical language and key mathematical terms are used accurately and effectively to support the arguments and explanations made. There are no, or very few, errors in spelling or grammar. Consistent referencing, appropriate paragraphing and use of correctly labelled tables and figures; matching the style taught in the course.
2:1	The work shows an understanding of key concepts and mathematical methods, drawing on sources of evidence where appropriate. Knowledge is used to build and support effective mathematical arguments and explanations.	Analyses the available data/evidence and identifies all the relevant mathematical information. Engages with multiple approaches and critically evaluates their utility, forming judgements and using reasoning and evidence to inform problem solving strategy. Shows some understanding of the relative value of evidence and data.	Mathematical arguments are clearly made, with few gaps in logical reasoning. The work is well-structured. The writing style is appropriate; mathematical language and key terms are used correctly. There are few errors in spelling or grammar. Mostly consistent referencing and use of tables and figures; matching the style taught in the course.
2:2	The work shows an understanding of key concepts and mathematical methods, with no major misconceptions. Beginning to apply this knowledge to build and support effective mathematical arguments and explanations.	Identifies and uses basic mathematical evidence and reasoning. Evaluates the quality of mathematical reasoning and evidence, forming judgements. Not yet showing understanding of the relative value of	Mathematical arguments have been constructed, but there is little explanation from step to step. The work has some structure. The writing style can sometimes be informal; occasionally key terms are

		evidence and reasoning.	not used when it would be appropriate to do so. There are some errors in grammar and spelling, but these do not get in the way of communicating the content. Referencing has some consistency; matching the style taught in the course. Limited use of tables and figures.
3rd	Shows a developing understanding of key concepts and mathematical methods, with some misconceptions. Not yet applying this knowledge to build and support mathematical arguments and explanations.	Beginning to analysis mathematical evidence and reasoning. Describes or attempts to solve the problem without any/or little evaluation of whether the approach was reasonable or accurate.	Mathematical arguments to solve problems are poorly sequenced, with little or no explanation. The grammar, spelling, style, and structure of the work need improving in order to communicate ideas to the reader. Key terms are not always used correctly. Limited, or no use of referencing, tables and figures.

Baseline Assignment (essay based): Pupil Feedback Report

Name of Pupil	
Name of School	
Name of RIS teacher	
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Subject knowledge	
	Mark
Critical thinking	
	mark
Written communication	
	mark

Baseline Assignment (problem-set): Pupil Feedback Report

Name of Pupil	
Name of School	
Name of RIS teacher	
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
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Extreme plagiarism	Automatic fail

Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Subject knowledge	
	mark
Critical thinking	
	mark
Written communication	
	mark

Problem Set	
Comment	*mark*

Final Assignment (essay based): Pupil Feedback Report

Name of Pupil	
Name of School	
Name of RIS teacher	
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
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Extreme plagiarism	Automatic fail

Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Subject knowledge	
	mark
Critical thinking	
	mark
Written communication	
	mark

Final Assignment (problem-set): Pupil Feedback Report

Name of Pupil	
Name of School	
Name of RIS teacher	
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
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Working towards a pass	0-39	Performing below a good standard at GCSE
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Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Subject knowledge	
	mark
Critical thinking	
	mark
Written communication	
	mark

Problem Set	
Comment	*mark*

Subject Vocabulary

Word	Definition	In a sentence
Magnet	An object (often made of iron or other metals) which has the property that it can attract other object of the same kind.	A lot of people like to put magnets on their fridge to decorate it.
Magnetic field	A physical quantity defined at each point in space generated by a magnet, which describes the effects of the magnet on its surroundings.	The Earth generates a magnetic field all around it: a compass uses the magnetic field of the Earth to point towards the North.
Energy	A physical quantity that describes the ability to do work.	To bring a heavy suitcase to the seventh floor you need to use a lot of energy.
Model	A description of a phenomenon which uses mathematical language.	The standard model is one of the most important physical theories in modern physics.
Assumption	A fact or a statement that we take for granted before we do something. In mathematics, a synonymous of hypothesis.	I made the wrong assumption that 100 people would come to my birthday party when I started planning it, but only 10 showed up.
Parameter	(In this context) A fixed number which describes an important characteristic of a physical system.	If we are working with a piece of iron, its density will be a parameter of our physical system.
Charge	A property of a particle which allows it to generate an electric or magnetic field. An object with a charge can interact with the magnetic and electric fields generated by other objects. An object can have positive, negative or no charge.	Electrons have negative charge, protons have positive charge and neutrons have no charge.
Magnetization	The magnetization is a physical quantity of a magnetic object. It is a vector of length one defined at each point of the object.	The study of the magnetization for a thin magnetic film is one of the most important topics in micromagnetics.
Vortex	A vortex is a small region in space where the magnetization changes its value very rapidly.	An interior vortex is a vortex which is inside the magnetic object. A boundary vortex is on the surface.
Vector	A vector is quantity that has a direction and a size.	The velocity of an object is given by a vector.

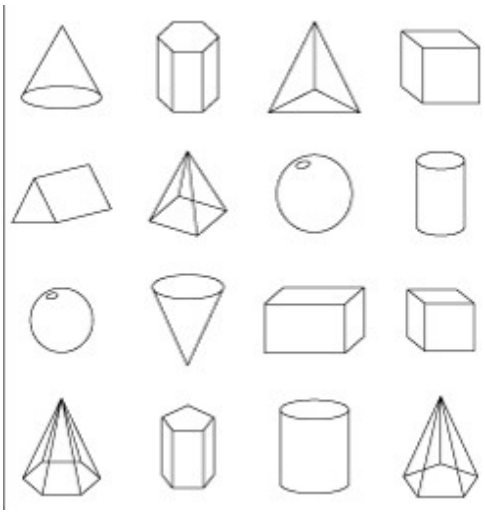
Baseline assignment question / questions:

Details of the assignment:

<u>Essay:</u> Write a short paragraph (max 300 words) explaining what magnets are and what a magnetic field is. Research examples of magnets in real life and give a short description of them (hint: the Earth)

<u>Questions and problem set:</u> Give the definition of a prism and describe one.

Name the following geometrical shapes. In particular, say which ones are prisms.



Success criteria – how to structure your assignment and what to include:

- **Write clearly and concisely**
- **Connect your sentences in a coherent explanation**
- **Give the correct definitions**
- **Recognize prisms**

In this assignment, show me that you **understand**:	Show me that you **are able to**:
- What magnets and magnetic fields are - What prisms are and what the base, height and faces of the prisms are.	- Summarize something you have learned and understood. - Name different 3D shapes and recognize prisms

Launch Event

The launch event is your opportunity to learn more about this course and Uni Pathways. You will watch some videos, listen to your teacher and have some discussion. Below is some room to make notes for some of the videos you will watch during the event.

Virtual Campus Tours

Notes…

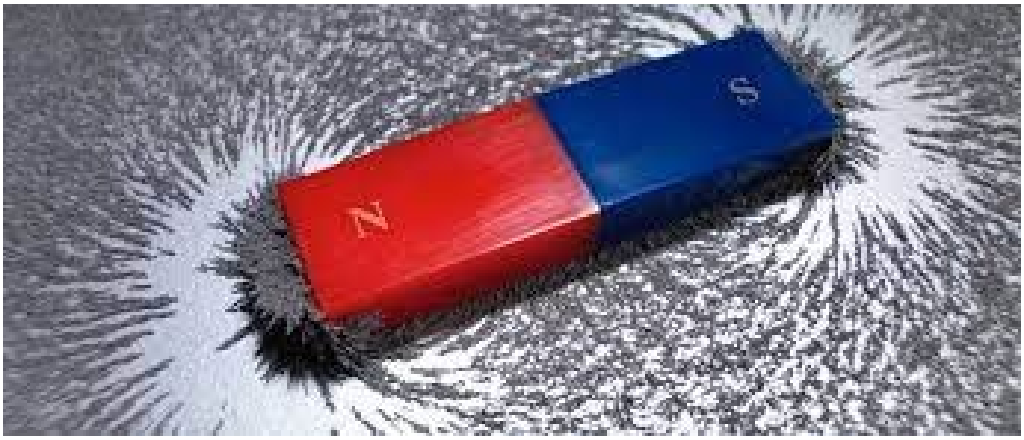
The Scholars Programme Alumni

Notes…

Student Ambassadors

Notes…

Tutorial 1 – Magnets, magnetic fields and energy



What is the Purpose of Tutorial 1?

- To learn what magnets and magnetic fields are
- To know what field lines are and to sketch the field lines for a magnet
- To know what energy is and be able to name a few kinds of energies

Starter Activity

Answer the following questions in the space provided

1. **You may know what magnets are. In your own words, give a definition of what a magnet is.**

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2. **Can you think of any examples of magnets from your every day experience?**

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3. **Which of the following objects do you think are magnets? Put a tick on them.**

Recap activity 1

Answer the following questions in the space provided

1. **Give the definition of a magnet. Try to be as concise and precise as possible.**

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2. **What is a magnetic field? Give a short definition of it and describe its effects on magnets.**

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Recap activity 2

Answer the following questions in the space provided

1. **Give the definition of energy. Try to be as concise and precise as possible.**

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2. **What are the two categories we can divide different types of energy into? Answer the question giving a short description of these two. Also give at least three examples of the more specific types of energy that you just saw.**

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Final activity

Which of the following is the energy of a moving object?

a) **Potential energy**
b) **Kinetic energy**
c) **Magnetic energy**
d) **Electric energy**

If an object is placed (still) on top of a hill, which energy does it posses?

a) **Nuclear energy**
b) **Kinetic energy**
c) **Electric energy**
d) **Magnetic energy**

Two energies are closely related in the field of electromagnetism, as the name itself suggests? Which are they (cross all correct answers)?

a) **Nuclear energy**
b) **Potential energy**
c) **Magnetic energy**
d) **Electric energy**
e) **Kinetic energy**
f) **Elastic energy**

HOMEWORK

Complete the baseline assignment.

Tutorial 2 – Mathematical models

What is the Purpose of Tutorial 2?

- The students will be able to define what the assumptions of a mathematical model are.
- The students will be able to define what the governing equations of a model are
- The students will be able to define what the parameters of a model are

Starter Activity

Answer the following questions in the space provided

4. **Have you heard of mathematical modelling? Write below what you know about it.**

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5. **How can mathematics be useful in describing the real world?**

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Recap activity 1

Answer the following questions in the space provided

6. **Give the definition of a mathematical model.**

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7. **What are the assumptions of a model?**

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Recap activity 2

Answer the following questions in the space provided

3. **What are the governing equations of a model?**

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4. **What are the parameters of a model?**

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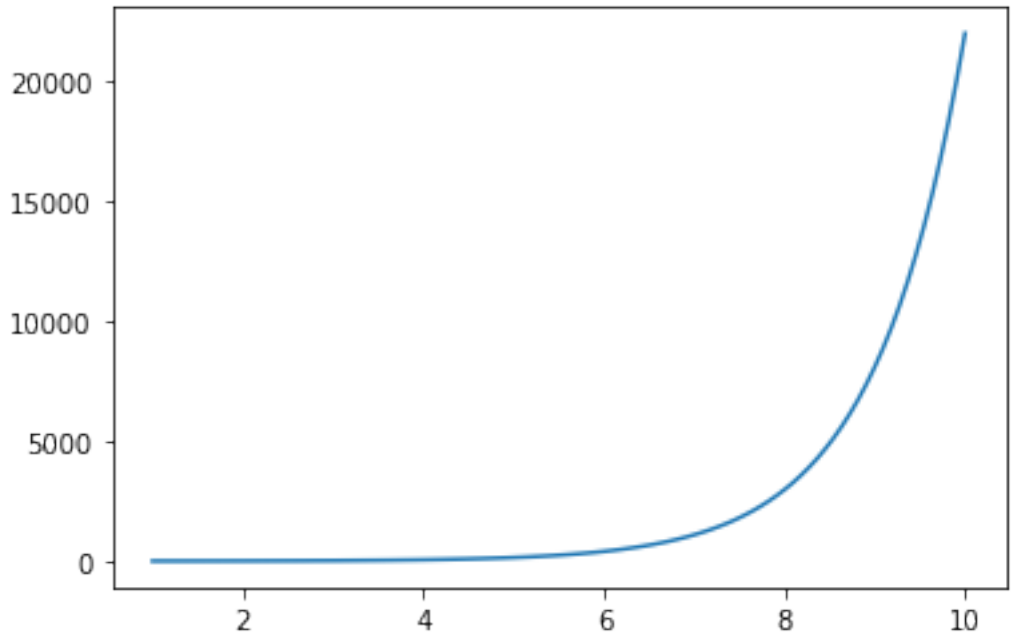
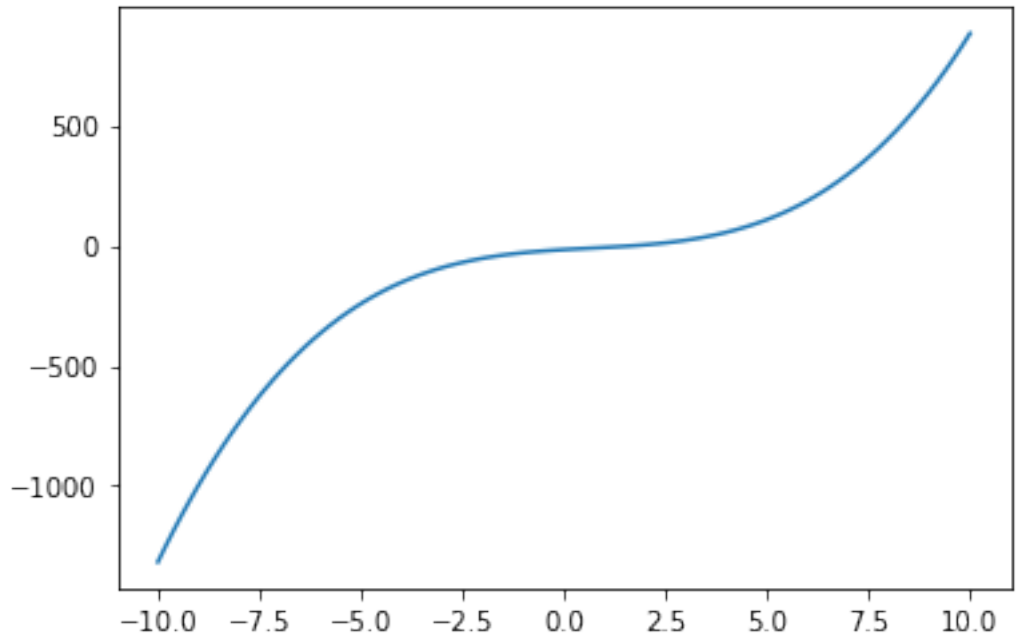
Activity

Of the following graphs, which do you think could represent the evolution in time of a population which has no predators (assuming no animal in the population dies)?

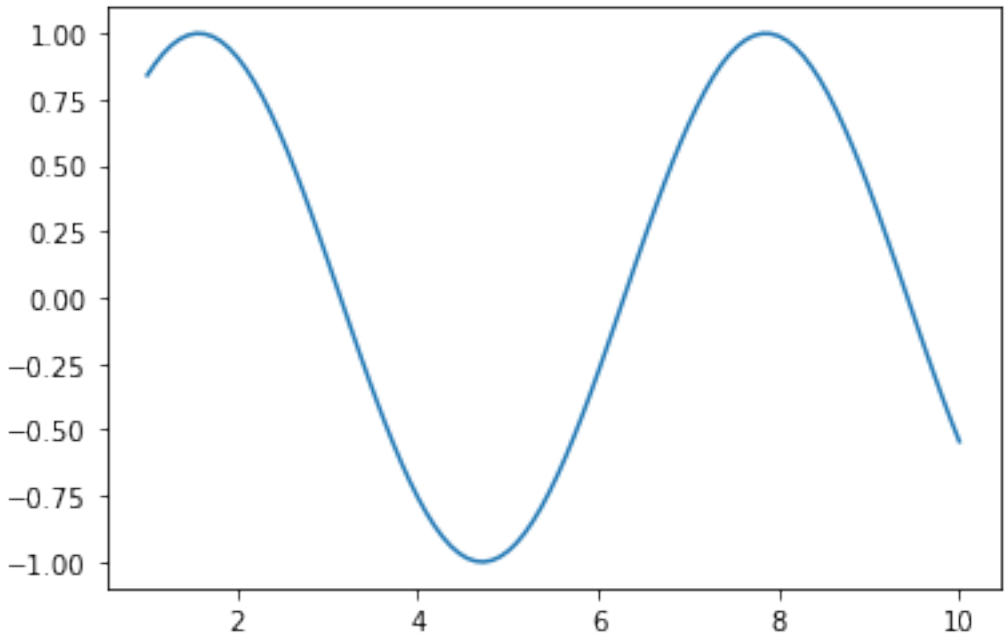
a)



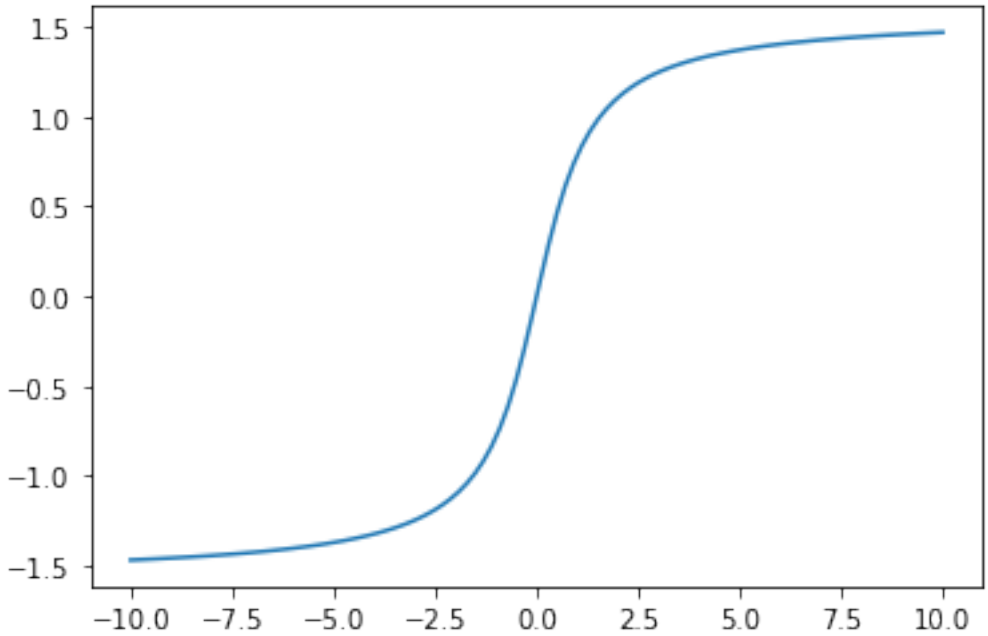
b)



c)



d)



ADD GRAPHS

Assume that we have predators. What changes do you expect the graph to exhibit?

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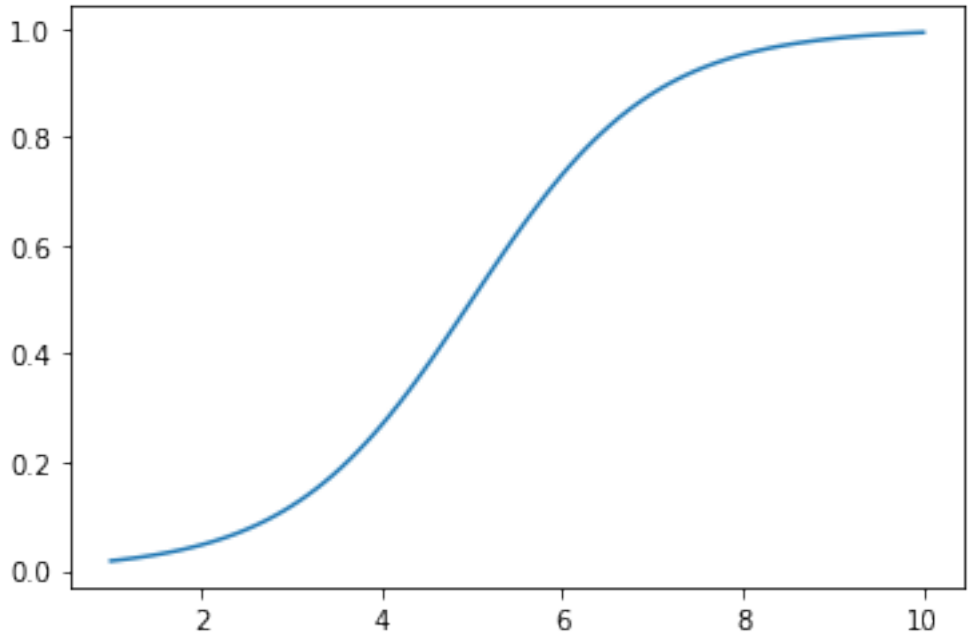
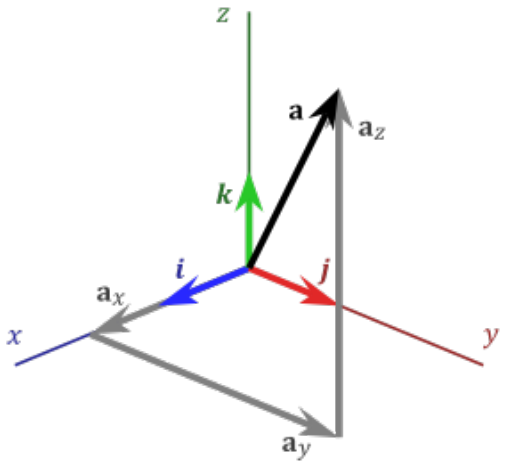
Which of the following graphs do you think could represent the evolution in time of a population of prey animals in the presence of predators?



HOMEWORK: A car travels on a straight road at constant speed v. Write an equation for the space s the car has travelled at time t (the space at time t=0 is 0 since the car has not moved yet). Draw a graph for s at time t (with t on the horizontal axis and s on the vertical axis).

Tutorial 3 – Vectors

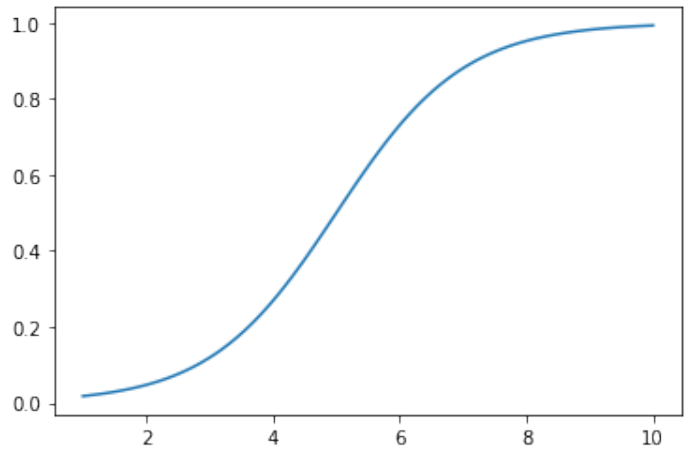


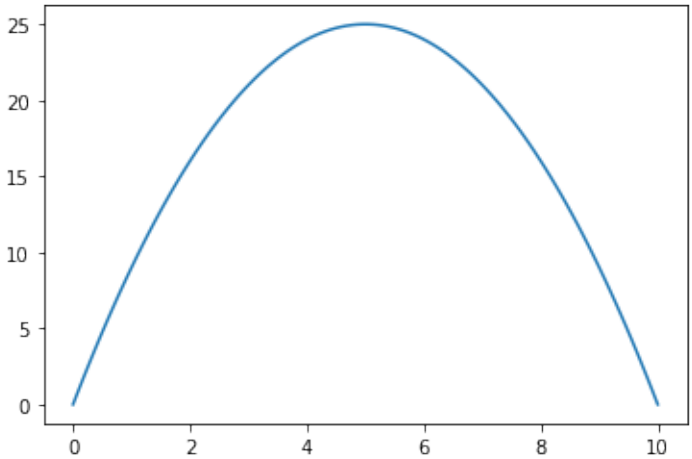
hat is the Purpose of Tutorial 3?

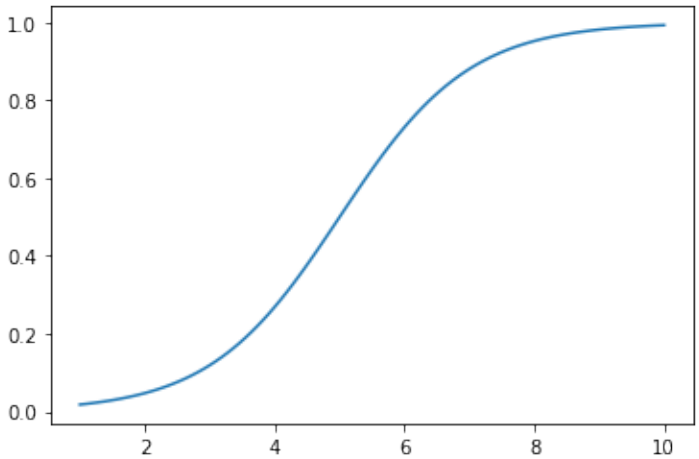
- Learn what a vector is and be able to manipulate vectors: add them, multiply a vector by a number, calculate their length.
- Understand the vector representation of a magnetic field.

Starter activity: Combine the description of the graph to the situation it represents:

a) The distance from home (on the vertical axis) in time (on the horizontal axis) of a family which leave home to go to the sea 20 km away and comes back at the end of the day
b) The number of COVID-19 cases with no containment measures in place and with a large population so that they never stop increasing.
c) The wealth (on the vertical axis) of company which first increases rapidly in time (on the horizontal axis) to then reach a constant value.

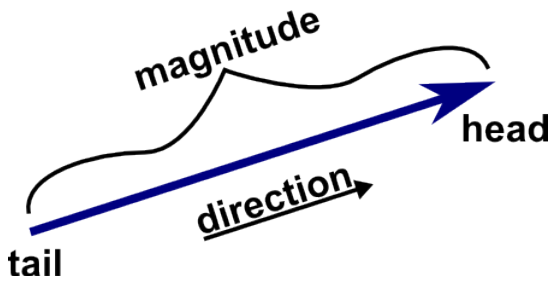






Vectors

A vector is a quantity that has a direction and a size (also called magnitude). We can visualize it as an arrow pointing in the given direction with a length that is proportional to the magnitude.



Looking at the projection on each dimension in 3D we can write a vector in 3D as (x,y,z) where x,y,z are numbers, called the components of the vector. In 2D a vector is written as (x,y). We can add (or subtract) vectors by adding (or subtracting each component). For example:

(2,0) – (1,3) = (2-1,0-3) = (1,-3)
(1, -4, 5) + (0, 6, -3) = (1, 2, 2)

Independent practice: Operations on vectors

1. **Sum of vectors** Compute:
   - $(1,3)+(0,4)=(\quad,\quad)$
   - $(2,17)+(-5,6)=(\quad,\quad)$
2. **Difference of vectors** Compute:
   - $(-3,7)-(1,19)=(\quad,\quad)$
   - $\left(\frac{1}{2},-3\right)-(-5,-10)=(\quad,\quad)$
3. **Multiplying a vector by a number** Compute:
   - $3\,(2,1)=(\quad,\quad)$
   - $-2\,(1,11)=(\quad,\quad)$
   - $-7\,(3,-8)=(\quad,\quad)$

Independent practice: Length of vectors

4. Compute the length of the following vectors:

- $(1, 2)$
- $(-3, 4)$
- $(-5, 7, -3)$

Final activity: Compute the sum of multiple vectors and then calculate the length

5. Compute the following and find the length of the result:

- $(1, -2) + (-5, 10)$
- $(-3, 1, .8) - (4, 1, 0)$
- $(2, 3) - (-1, 0) - (3, -7) + (0.11)$

HOMEWORK:

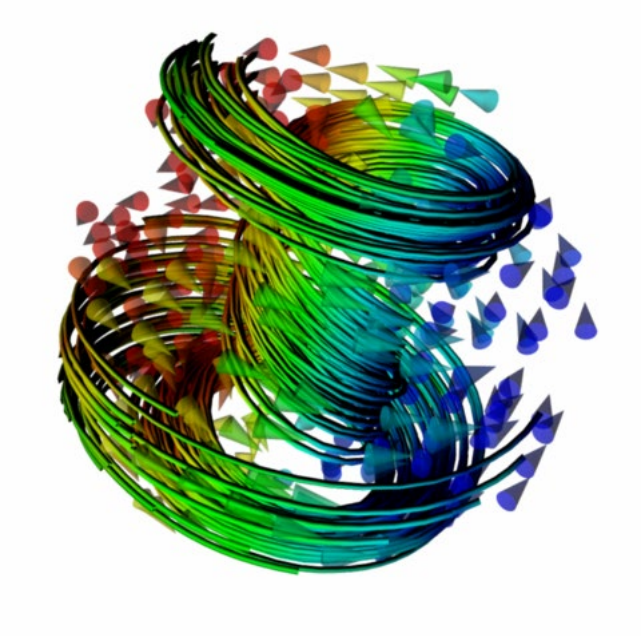
Calculate the following:

- (0.5, 0) + (-1, 7)
- (9,4) – (3, -6)
- (4, 3, -1) – 2(-2, 3, -11)
- 3(9,6,0) – 2 (4, -3, 2)

Calculate the length of

- (3, - 6, 4)
- (2, 1, -9)

Tutorial 4 – Micromagnetics, microstructures and vortices



What is the Purpose of Tutorial 4?

- Know what the magnetization is
- What are the different energy terms and what their effect are on the magnetization
- Know what vortices are and recognize pictures of vortices among other magnetic microstructures

Starter activity: Operations with vectors

Calculate the following:

- **(3, 1) + (-2, - 9)**
- **(7, 0 ,4) – (1, -3)**
- **3(1, -5, 11)**
- **2(1, 0, -4) – 5(-3, 6, 10)**

Calculate the length of the following vectors:

- **(2,-3, 6)**
- **(1, 4, 7)**

Question 1: Give the definition of the magnetization

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Question 2: How many parameters do we have in the model? Which ones are intrinsic and which ones are extrinsic? What is the difference?

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Question 3: Question on energy terms

Which of the following describes the effect of the exchange energy?

a) It favour a magnetization that changes very often
b) It favours a constant magnetization
c) It favours a magnetization that has a periodic behaviour
d) None of the above

What is the effect of the anisotropy energy?

a) It favours a constant magnetization
b) It favours an oscillating magnetization
c) It favours alignment of the magnetization with some given directions
d) None of the above

Which of the following describes the effect of the magnetostatic energy?

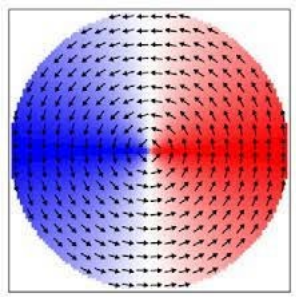
a) It favours a constant magnetization
b) It favours alignment to some directions
c) It favours alignment to an external field
d) None of the above

What is the effect of the external field energy

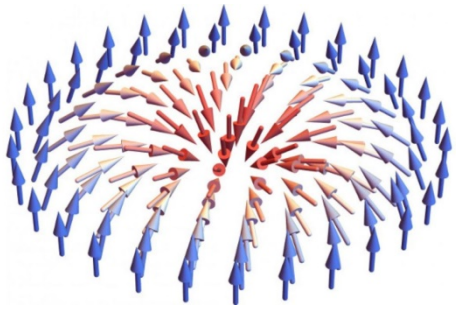
a) It favours a constant magnetization
b) It favours alignment to some directions
c) It favours alignment to an external field
d) None of the above

Look at the following magnetic microstructures: which ones represent vortices?

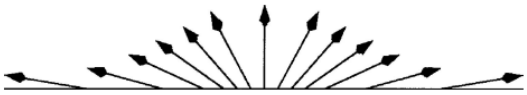
a)



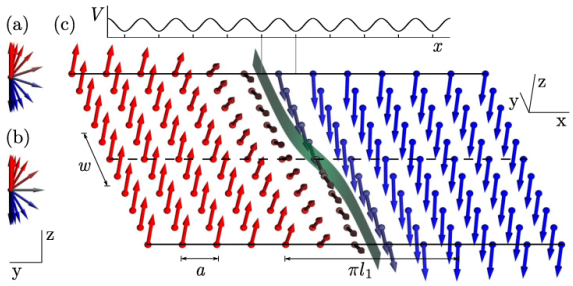
b)



c)



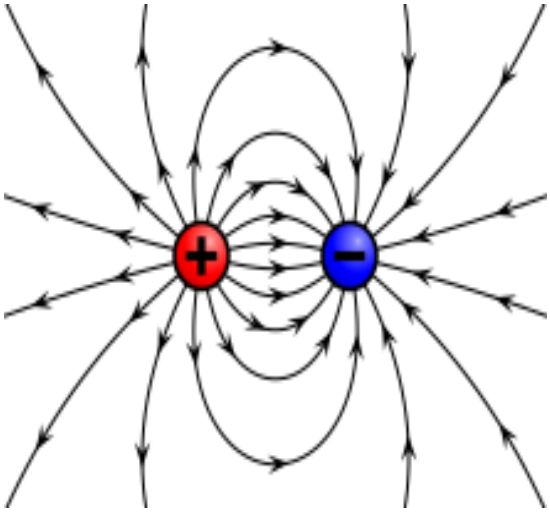
d)



HOMEWORK:

Write a short paragraph (300 words max) explaining what the effect of the different energy terms on the magnetization is.

Tutorial 5 – Vortices and the equilibrium of electric charges



What is the Purpose of Tutorial 5?

- The students will be able to define electric charge.
- They will know about positive and negative charges and about attraction/repulsion of charges.
- The students will be able to explain the similarity between vortices and electric charges.

Starter activity: Sketch the picture of an interior and a boundary vortex.

Recap activity: Describe what we mean by electric charge and give an example of everyday life where electric charges are used.

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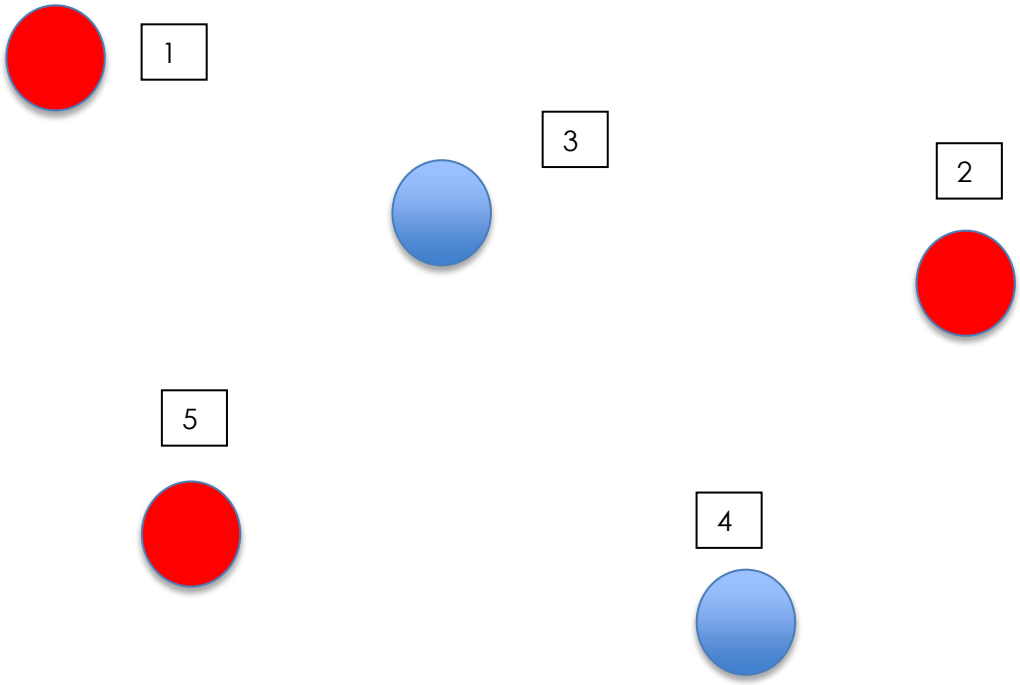
Look at the following pictures. For each given pair - where we write (1,2) to mean "1 and 2") – write R if the corresponding charges repel each other and A if heir attract each other. Red discs represent positive charges and blue discs represent negative charges.



(1,5)
(2,3)
(4,2)
(1,4)

Recap activity: describe how we can see the vortices as being similar to electric charges

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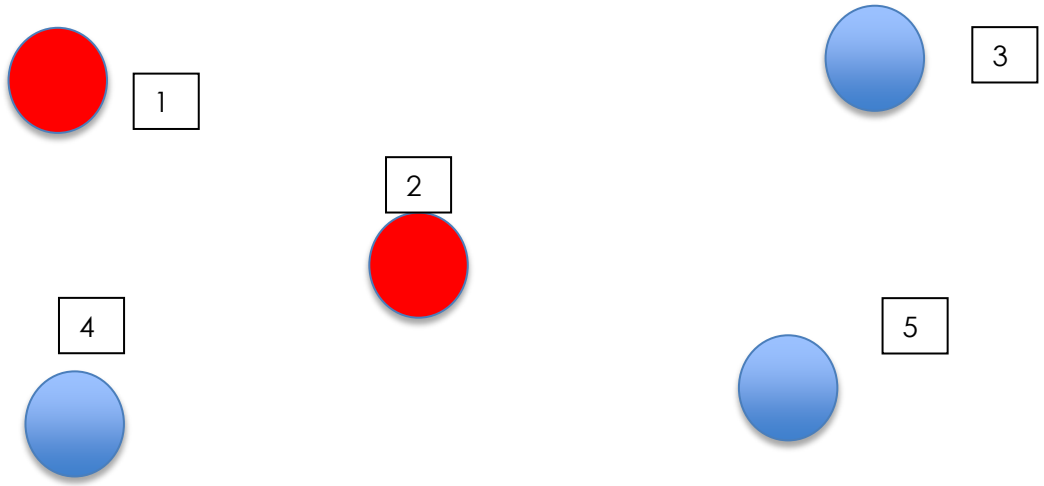
HOMEWORK:

1) **In a short paragraph (200 words maximum) explain what the similarity between vortices and electric charges is.**
2) **Look at the following pictures. For each given pair - where we write (1,2) to mean "1 and 2") – write R if the corresponding charges repel each other and A if heir attract each other. Red discs represent positive charges and blue discs represent negative charges.**

A)



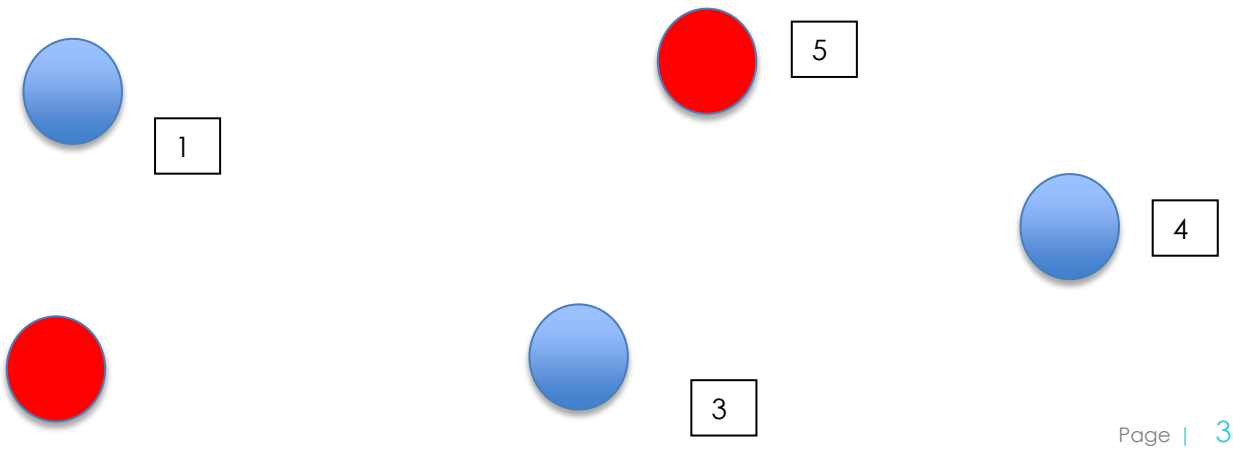
(1,2)

(3,5)

(1,3)

(4,5)

B)



(1, 5)

(4, 2)

(3, 1)

(2, 5)

Final assignment question:

Write an essay (1000 words +/- 10%) answering the two questions below

Answer the questions.

Details of the assignment:

Write an essay (1000 words +/- 10%) answering the following questions:

1) What is mathematical modelling and what are some of its most important features?
2) Describe the model for micromagnetics: explain what micromagnetics is, what the parameters of the model are and the key equations and constraints. Describe the effects of the different energy terms and what relationship there is between the energy and the observable configurations for the magnetization.

Calculate the following:

- (3, 4) + (1, 11)
- (5, 1) – (3, 2)
- (-5, 1) – (-6, 9)
- (3, 1, -2) + (2, -5, -7)
- (1, -4, 10) – (3, -11)

Compute the length of the following vectors:

- (1,2)
- (-1,4)
- (1, -2) + (2,1)
- (-4, 5) – (-3, 2)
- (1.7, 2, 5,4) – (1, 9, 1.5)

Success criteria – how to structure your assignment and what to include:

1) Include all the topics in the previous points
2) Establish connection between the different parts
3) Give your essay a clear structure

In this assignment, show me that you **understand**:	Show me that you **are able to**:
What the key features of a mathematical model are. What micromagnetics is What dimension reduction is What a vortex is and how we can see it as an electric charge	Give a clear outline of the content of the course Use the appropriate terminology Correctly reference the material

Tutorial 6 – Feedback tutorial

What is the Purpose of Tutorial 6?

- To receive feedback on your final assignment
- To respond to the feedback from your Uni Pathways teacher
- To write targets for improvement on your final assignment

Final assignment feedback from your Uni Pathways Teacher

(Remember to look at the mark scheme to help you understand what you have done well so far, and how you can do even better in your final assignment)

Here are three things that my Uni Pathways Teacher thought I did well in my draft assignment
•   •   •

Here are three things that my Uni Pathways Teacher thinks that I could do to get a higher mark in my final assignment
•   •   •

Tasks from my Uni Pathways Teacher to do during the feedback tutorial to help me improve
•   •   •
My response:

Actions I will take to improve my final assignment after this tutorial…

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-
-

Hand in date for my final assignment:	

Tutorial 7 – Final tutorial

What is the Purpose of Tutorial 7?

- To receive feedback and a grade on your final assignment.
- To reflect on the programme including what you enjoyed and what was challenging.
- To ask any questions you may have about university.

Final assignment feedback from my Uni Pathways Teacher

Final mark:	University style grade:
Feedback: Here are three things that my Uni Pathways teacher thought I did well in my final assignment • • •	

Here are three things that my Uni Pathways teacher thinks I should remember for when I am doing this kind of study in the future
• • •

University

What questions do you still have about University after taking part in Uni Pathways?
• • •

Reflecting on Uni Pathways

What did you most enjoy about Uni Pathways?
• • •

What did you find challenging about the programme?	How did you overcome these challenges?
• • •	• • •

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should you use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

1. **A marker in your assignment**: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].
2. **Bibliography**: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

    a. **Websites** – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

    E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

    b. **Books** – Author, date published, title of book (in italics), pages where the information came from.

    E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

    c. **Articles** – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

    E.g. Maev Kennedy, 'The lights to go out across the UK to mark First World War's centenary', Guardian, 10 July 2014.

Notes

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