Lesson 9.1 Vectors and scalars

Recommended teaching time for this lesson: 0.5 x 60 minute period

• 20 minutes of explicit teaching

• 10 minutes of suggested classroom activities

• 15 minutes homework

Getting started

Key ideas

* A vector quantity needs both magnitude and spatial direction to specify it fully.
* Horizontal and vertical coordinates are used to represent direction.
* Vector quantities can be represented pictorially and symbolically.
* Scalar quantities have magnitude but no spatial direction.

Curriculum links

Science understanding

* Contrast vectors and scalars, and use these terms to categorise physical quantities, e.g. velocity and speed.
* Symbolise vectors graphically and algebraically, e.g. $F, \tilde{F} and \vec{F}$.

Advice for teaching this lesson

Things to know before you start teaching

It is important to establish with students a convention for vector directions early. While these are not necessary and can be changed on any question to benefit students who are capable with mathematical representations down the track, it does remove some stress for students if you demonstrate a simple consistent approach. The general convention is that north, east, up and right are all positive vectors, while south, west, down and left are all negative vectors. In and out of the plane, do not get used very often apart from representations/simple calculations in Electromagnetism (Unit 3, Topic 2 or AS Unit 4 Topic 1).

Common misconceptions

* Students will often ask if energy is a vector as we represent energy changes using positive or negatives depending on if an energy is moving in or out of an object. It is important to remember that the direction is within 3D space, not being given to or taken from something.

Differentiation strategies

Check in with students early that they are able to represent vectors easily on their devices.

Encourage students who are struggling with whether to make a vector positive or negative to draw a compass rose type of diagram they can refer to and label it with positives and negatives.

Starter activity: How to find you?

Approximate time: 5 minutes

**Activity placement:** Place directly after Lesson overview

**Activity summary:** A thinking activity to get students to consider how much information they need in order to locate objects.

Notes for the teacher

If students are having difficulty visualising the task have them close their eyes and then speak somewhere in the room. Ask them to point at you and describe where you are relative to them.

Instructions for students

Consider the information needed to identify a location.

* 1. Identify the minimum amount of information you need in order to locate someone from where you are sitting right now. Note: The answer is NOT a house address.

Helpful hints

* Pick an object in the room and have a friend move it. What changes?
* There are two items of information needed.

Answers

1. Distance and direction. It might not be practical – things tend to get in your way if you just walk in a straight line – but you just need a distance from where you are, and a direction to go.

Classroom activity: How do I write that?

Approximate time: 5 minutes

**Activity placement:** Place directly above “Check your learning 9.1”

**Activity summary:** A research and preparation task so that students are prepared for proper writing in physics.

Notes for the teacher

You should ensure you know how to access the equation editor on whatever word processing software is commonly used in your school. This is probably the equation tool within Microsoft Word and there are plenty of videos on YouTube to help you familiarise yourself with this tool.

Instructions for students

Step 1: Vectors are values that need to be represented differently from scalars. While symbolising a vector by hand is easy to do on an exam, for your student experiment and research investigation you will want to be familiar with how to insert the appropriate symbols.

 a. Identify two ways to represent vectors symbolically.

 b. Represent the vector ‘force’ using the appropriate letter and markings in a word processor.

Helpful hints

* The vector ‘force’ is represented with a capital F.
* Microsoft Word’s equation editor is a very useful tool for representing vectors. Look for the ‘accents’ selection.

Support activity

Notes for the teacher

This activity will point students to the symbols in the text.

Instructions for students

Vectors are values that need to be represented differently from scalars. While symbolising a vector by hand is easy to do on an exam, for your student experiment and research investigation you will want to be familiar with how to insert the appropriate symbols.

1. Identify two ways to represent vectors symbolically. You can find this information in the following image.



1. Represent the vector ‘force’ using the appropriate letter and markings in a word processor.

Challenge activity

Notes for the teacher

Students will need to independently look up an example of a vector and what symbol to use. They can use examples from the textbook or look up their own.

Instructions for students

Vectors are values that need to be represented differently from scalars. While symbolising a vector by hand is easy to do on an exam, for your student experiment and research investigation you will want to be familiar with how to insert the appropriate symbols.

1. Identify two ways to represent vectors symbolically.
2. Represent a vector using the appropriate letter and markings in a word processor.

Answers

1. The letter should have an accent like a bar, an arrow, a half arrow or a tilde. Alternatively, bold the letter.
2. $\tilde{F}, \overbar{F}, \vec{F}, \rightharpoonaccent{F}$, **F**

Support activity

1. The letter should have an accent like a bar, an arrow, a half arrow or a tilde. Alternatively, bold the letter.
2. $\tilde{F}, \overbar{F}, \vec{F}, \rightharpoonaccent{F}$, **F**

Challenge activity

1. The letter should have an accent like a bar, an arrow, a half arrow or a tilde. Alternatively, bold the letter.
2. Student responses will vary in letter, but meet these forms: $\tilde{F}, \overbar{F}, \vec{F}, \rightharpoonaccent{F}$, **F**