



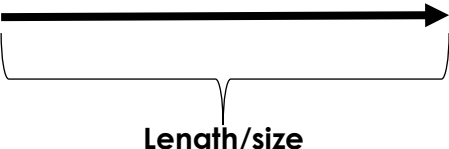
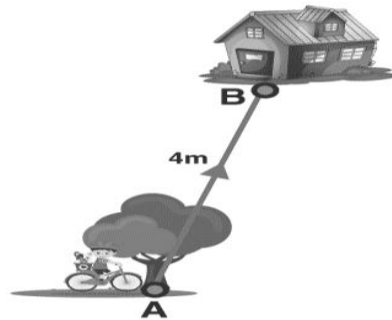




SUBJECT and GRADE	Technical Sciences Grade 11	
TERM 1	Week 1	
TOPIC	<p>MECHANICS</p> <ul style="list-style-type: none"> <li>• Vectors and Scalars.</li> <li>• Motion in one dimension.</li> <li>• Introduction to forces.</li> </ul>	
RESOURCES	<b>Paper based resources</b>	<b>Digital resources</b>
	Technical Sciences learner notebook gr 10	<p><a href="https://intl.siyavula.com/read/science/grade-10/vectors-and-scalars/20-vectors-and-scalars-01">https://intl.siyavula.com/read/science/grade-10/vectors-and-scalars/20-vectors-and-scalars-01</a></p> <p><a href="https://intl.siyavula.com/read/science/grade-10/motion-in-one-dimension/21-motion-in-one-dimension-01">https://intl.siyavula.com/read/science/grade-10/motion-in-one-dimension/21-motion-in-one-dimension-01</a></p> <p><a href="https://intl.siyavula.com/read/science/grade-9/forces/15-forces">https://intl.siyavula.com/read/science/grade-9/forces/15-forces</a></p>
AIMS OF LESSON	<p>This lesson aims to provide you with a revision of the following topics:</p> <ul style="list-style-type: none"> <li>• Vectors and Scalars.</li> <li>• Motion in one dimension.</li> <li>• Introduction to forces.</li> </ul> <p>This lesson should provide you with a basic understanding of the above-mentioned topics as a foundation for Grade 11. You have covered this content in gr 10.</p>	
INTRODUCTION	<p>We come daily into contact with various physical quantities in the natural world. For example, things like time, mass, weight, displacement and velocity are physical quantities with which you should be familiar by now. We know that time passes and objects have mass. Objects have weight due to gravity. We exert forces when we open doors, walk along the street and kick balls. Objects are either stationary or they are in motion.</p> <div style="display: flex; justify-content: space-around; align-items: center;">     </div>	

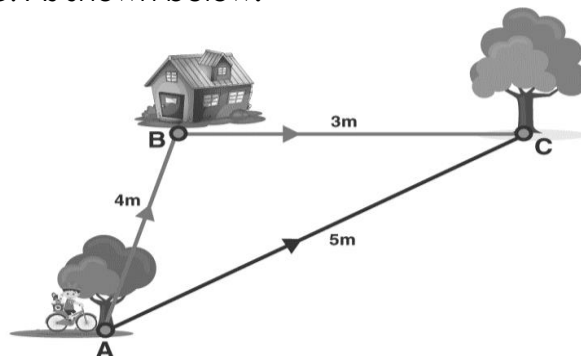
<p>CONCEPTS AND SKILLS</p>	<p><b>Vectors and Scalars</b></p> <p>You already know that we describe physical quantities as either a vector or a scalar. For example quantities such as mass, length and time can only be described as scalar quantities since they have magnitude only. Thus a <u>scalar quantity</u> is defined as a <b>physical quantity that has magnitude only</b>.</p> <p>However, a <u>vector</u> is defined as a <b>physical quantity that has magnitude and direction</b>.</p> <p>Scalar quantities are not represented graphically (a simple sketch) However we can make use of a graphical representation of vectors instead of using words only. We do this by making use of an arrow as shown below.</p> <p style="text-align: center;"><b>Arrow head/point.</b></p>  <p style="text-align: center;"><b>Length/size</b></p> <p>Where the <b>length/size</b> of the arrow represents the <b>magnitude</b> and the <b>arrowhead/point</b> represents the <b>direction</b> of the physical quantity.</p> <p>Multiple vectors can be added together to obtain the resultant vector. We define the resultant vector as <b>a single vector which can produce the same effect as the component vectors</b>.</p> <p><b><u>Motion in one dimension.</u></b></p> <p>In grade 10 you have learned that anything that is moving has motion and that when we talk about one-dimensional motion we are only referring to an object which is moving in a straight line. Thus we define motion in one dimension as <b>the motion along a straight line, either forward or backwards</b>.</p> <p><b><u>Position, distance and displacement.</u></b></p> <p>it is important to remember that <b>position, distance and displacement</b> are all related, but described differently in science. You should know that position is the location of an object with a reference point. For example, in the diagram below we can consider the house (<b>point B</b>) as the</p>	<p><b>Vectors and Scalars</b></p> <p>Can you?</p> <ul style="list-style-type: none"> <li>• Define vectors, scalars, resultant vector.</li> <li>• Write down examples of vectors and scalars.</li> <li>• Draw graphical representations of vectors.</li> <li>• Apply vector addition using calculation or a simple sketch.</li> </ul> <p><b>Motion in one-dimension.</b></p> <p>Can you?</p> <ul style="list-style-type: none"> <li>• Define position, distance and displacement.</li> <li>• Differentiate between distance and displacement.</li> <li>• Determine the distance and displacement.</li> <li>• Define speed, velocity and acceleration.</li> <li>• Calculate speed, velocity and acceleration.</li> </ul> <p><b>Forces</b></p> <p>Can you?</p> <ul style="list-style-type: none"> <li>• Define the term force.</li> <li>• Define a contact force and non-contact force.</li> </ul>
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reference point and the tree (**point A**) to be the position of the boy on the bicycle.



If we measure the length of the path between two known points **A** and **B** we would've measured the **distance** between these two points. We can thus define distance as the **length of the path between two points**.

However, when we refer to the **displacement** of an object we define this quantity as **the length of the shortest line between two points in a particular direction**. Instead of travelling from **A** to **B** to **C**, the boy on the bicycle could travel directly from **A** to **C**. As shown below.



**Note:** when referring to displacement you need to provide a direction when stating the measurement.

### Speed, velocity and acceleration

#### **Speed**

The previously mentioned concepts are applied when we look at calculating **speed, velocity** and **acceleration**.

From Grade 10 you will remember that we define speed as **the rate of change of distance**. That means how fast an object covers a distance.

$$\text{Thus we write } \textit{speed} = \frac{d}{t}$$

- Give examples of a contact force and non-contact force.
- Calculate the force/weight exerted on an object.

### **Velocity**

Speed and velocity are related but they are not entirely the same. Velocity is based on displacement whereas speed is based on distance. Thus we can define velocity as **the rate of change of displacement**.

$$\text{We can thus write } \vec{V} = \frac{\vec{d}}{t}$$

### **Acceleration**

When we talk about the acceleration of an object we are referring to measure of the change of its velocity over time. Thus we define acceleration as **the rate of change of velocity**.

$$\text{We can thus write } \vec{a} = \frac{\vec{\Delta v}}{t}$$

**Note:** When there is a change in the object's velocity then there will be acceleration. However, if the velocity of the object is constant (no change in velocity) then there will be no acceleration. We will say that acceleration is zero ( $\vec{a} = 0m \cdot s^{-2}$ ).

### **Forces**

In grade 10 you learned that a force can be defined as a push or a pull. But we can describe a force by saying that it is an interaction between two objects which causes either a push or a pull effect. The objects can either be in contact with each other or they can be far apart.

You would remember that we can classify forces into two types: **Contact forces** or **non-contact forces**.

A force/weight of an object can be calculated by making use of the following equation:

$$\mathbf{F_g = m \times g}$$

**Very important:** you should be able to manipulate each of the equations mentioned in this lesson to calculate any one of the variables.

**Question 1**

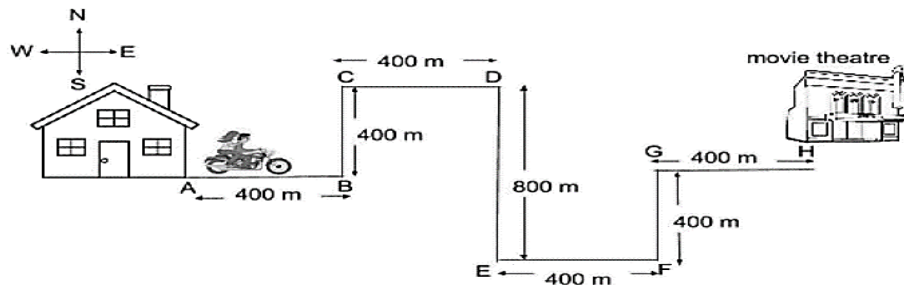
- 1.1 Define the term *vector* in words.
- 1.2 State whether the following is a *vector* or a *scalar*. Provide a reason for each answer.
  - 1.2.1 Time
  - 1.2.2 Displacement
- 1.3 A force of 5 N is applied to the right on the block and a force of 3 N is acting in the opposite direction of the 5 N force as shown in the diagram below.



- 1.3.1 Define the term *resultant* in words.
- 1.3.2 Use a vector scale diagram and determine the net resultant force acting on the block. Include ALL the relevant information in the diagram. Use scale **1 cm = 1 N** for the vector diagram.

**Question 2**

Peter picks up his girlfriend with his motorbike at her home and takes her to the movies. He follows the route as indicated from his girlfriend's house at point **A** to the movie theatre at point **H**. **A** and **H** are on the WEST-EAST axis.



- 2.1 Define *distance*.
- 2.2 Calculate the:
  - 2.2.1 Total distance from **A** to **H**
  - 2.2.2 Displacement from **A** to **H**

After the movie, they go back to the girlfriend's house along the same route and it takes them 15 MINUTES.

- 2.3 Calculate their:
  - 2.3.1 Average speed in  $\text{m s}^{-1}$
  - 2.3.2 Average velocity in  $\text{m s}^{-1}$

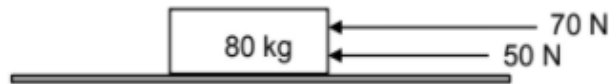
### Question 3

An 80 kg box is at rest on a rough, horizontal surface.



- 3.1 Calculate the magnitude of the weight of the box.
- 3.2 Explain why the box does not fall through the surface.

Thabo and Jimmy push the box to the left with horizontal forces of 50N and 70 N respectively. The box DOES NOT MOVE.



- 3.3 Calculate the magnitude and direction of the resultant of the 50 N and 70 N forces.
- 3.4 Write down the magnitude and direction of the force that keeps the box stationary.
- 3.5 What name is given to the force mentioned in question 3.4?

CONSOLIDATION

By the end of this revision lesson you should be able to:

- Define vectors, scalars and resultant vector.
- Write down examples of vectors and scalars.
- Draw graphical representations of vectors.
- Apply vector addition using a calculation or a simple sketch.
  
- Define position, distance and displacement.
- Differentiate between distance and displacement.
- Determine the distance and displacement.
- Define speed, velocity and acceleration.
- Calculate speed, velocity and acceleration.
  
- Define the term force.
- Define a contact force and non-contact force.
- Give examples of a contact force and non-contact force.
- Calculate the force/weight exerted on an object.

VALUES

**The importance of revision** is twofold. Firstly, it helps you to remember facts, numbers, topics and methodologies that you have covered some time ago. Secondly, If done correctly it will help increase your confidence and lessen anxiety.