

# *A Guide to Vectors and Scalars*

## **Teaching Approach**

Learners have little prior knowledge of vectors and scalars and will be introduced to these concepts for the first time in this topic. In this grade, learners focus on vectors in only one dimension. It is really important that they understand the concept of a number line, and that they link this knowledge with the idea of a vector in a positive or negative direction.

This series serves primarily to distinguish between vector and scalar quantities. This is foundational knowledge for Motion in One Dimension in which further vector quantities such as displacement and velocity are studied in more detail. Force vectors are also discussed in this series as a basis for later work.

To contextualise this topic for learners, the teacher could discuss situations in everyday life in which forces might need to be added, such as a tug of war competition, two children fighting over and pulling at a toy, or to discuss the Angry Birds game, in which forces are used to hit a target.

In this topic, learners will study:

- Defining vectors and scalar quantities
- Graphical representation of vector quantities in one dimension
- Properties of vectors – positive and negative vectors, addition and subtraction of vectors
- Defining resultant
- Finding the resultant graphically and by calculation

## Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch or show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next day's lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

### 1. An Introduction to Vectors and Scalars

In this lesson, learners are introduced to the vector and scalar quantities. The two quantities are defined and examples are discussed. Learners are also taught how to represent the magnitude and direction of a vector quantity.

### 2. Adding Vectors in One Dimension

In this lesson, learners are taught how to add vectors.

## Resource Material

1. Vectors and Scalars	<a href="http://www.physicsclassroom.com/class/1dkin/u1l1b.cfm">http://www.physicsclassroom.com/class/1dkin/u1l1b.cfm</a>	This site describes motion with words.
	<a href="http://m.everythingscience.co.za/grade-10/20-vectors-and-scalars/20-vectors-and-scalars-01.cnxmlplus">http://m.everythingscience.co.za/grade-10/20-vectors-and-scalars/20-vectors-and-scalars-01.cnxmlplus</a>	Here you will find definitions and examples of vectors and scalars.
	<a href="http://webphysics.iupui.edu/JITworks/hop/152Basics/vectors/vectors.html">http://webphysics.iupui.edu/JITworks/hop/152Basics/vectors/vectors.html</a>	A comprehensive resource on vectors and scalars.
2. Adding Vectors in One Dimension	<a href="http://phet.colorado.edu/en/simulation/forces-1d">http://phet.colorado.edu/en/simulation/forces-1d</a>	A teaching resource on vectors and scalars.

## Using Games and Videos in the Vectors and Scalars Series

<p>Teachers may wish to use games/videos based on vectors, as examples, the basis for class discussions, information for questions or exercises, etc.</p>	<a href="http://www.youtube.com/watch?v=87BJgcJoFtc">http://www.youtube.com/watch?v=87BJgcJoFtc</a>
	<a href="http://www.youtube.com/watch?v=D8Kbdce0Zrg">http://www.youtube.com/watch?v=D8Kbdce0Zrg</a>
	<a href="http://www.youtube.com/watch?v=z_Qkb8ELJcA&amp;list=TLHiTJQttGfVKazpTEH5RuB8PE5_x1Hp26">http://www.youtube.com/watch?v=z_Qkb8ELJcA&amp;list=TLHiTJQttGfVKazpTEH5RuB8PE5_x1Hp26</a>
	<a href="http://www.youtube.com/watch?v=JOYEhovxp0s">http://www.youtube.com/watch?v=JOYEhovxp0s</a>
	<a href="http://www.youtube.com/watch?v=ewSgBHuMa0U">http://www.youtube.com/watch?v=ewSgBHuMa0U</a>
	<a href="http://www.youtube.com/watch?v=-oeYDvLim3s">http://www.youtube.com/watch?v=-oeYDvLim3s</a>
	<a href="http://www.youtube.com/watch?v=l3xHFues2Ok">http://www.youtube.com/watch?v=l3xHFues2Ok</a>
	<a href="http://www.youtube.com/watch?v=1E5Oa7xctXA">http://www.youtube.com/watch?v=1E5Oa7xctXA</a>
	<a href="http://www.youtube.com/watch?v=CtGzEKMv9BI">http://www.youtube.com/watch?v=CtGzEKMv9BI</a>
	<a href="http://www.youtube.com/watch?v=QOX6ypmN054">http://www.youtube.com/watch?v=QOX6ypmN054</a> (2:00 – 04:00)

## Task

### Question 1

State whether the following are examples of vector or scalar quantities:

- 1.1 A distance of 2 m
- 1.2 A force of 35 N acting  $30^\circ$  W of N
- 1.3 A velocity of  $3 \text{ m}\cdot\text{s}^{-1}$  on a bearing of  $115^\circ$
- 1.4 55 s
- 1.5  $4 \text{ m}\cdot\text{s}^{-1}$
- 1.6 165 m North

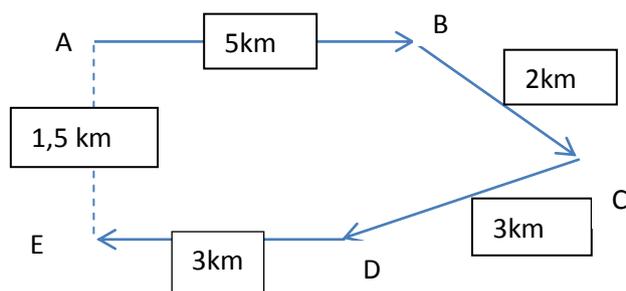
### Question 2

How long should a line be to represent 19 N if you use a scale of:

- 2.1 1 cm: 2 N?
- 2.2 1 cm: 3 N?
- 2.3 1 cm: 5 N?

### Question 3

3.1 Find the total distance travelled from A to B to C to D to E in this journey



3.2 What is the displacement in the journey given in 3.1, if the start of the journey was going East?

### Question 4

Give the definition for 'resultant force'.

### Question 5

Take right as the positive direction.

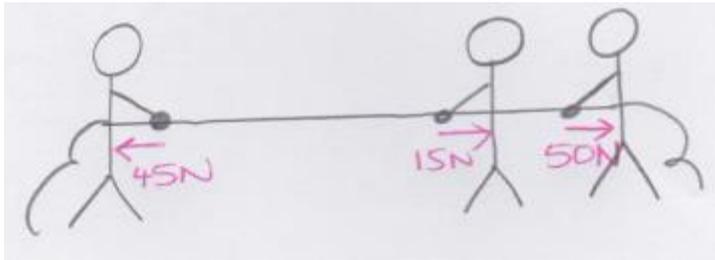
Find the resultant of the following forces:

- 5.1 2 N right; 7 N right
- 5.2 4 N right; 12 N left
- 5.3 12 N left; 16 N left
- 5.4 3 N right; 6 N left; 15 N right; 8 N left
- 5.5 16 N left; 24 N right; 13 N left

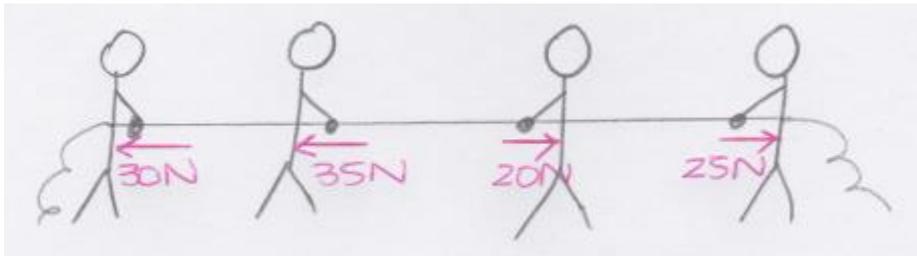
### Question 6

Determine the resultant of the following vectors, using a scale diagram.

6.1



6.2



## Task Answers

### Question 1

- 1.1 Scalar
- 1.2 Vector
- 1.3 Vector
- 1.4 Scalar
- 1.5 Scalar
- 1.6 Vector

### Question 2

- 2.1 9,5 cm
- 2.2 6,33 cm
- 2.3 3,8 cm

### Question 3

- 3.1 13 km
- 3.2 1,5 km south

### Question 4

The resultant of a number of forces is the single force that will have the same effect as the original forces acting together.

### Question 5

5.1

$$\begin{aligned}
 F_{res} &= (+2) + (+7) \\
 &= +9 \\
 &= 9 \text{ N to the right}
 \end{aligned}$$

5.2

$$\begin{aligned}
 F_{res} &= (+4) + (-12) \\
 &= -8 \\
 &= 8 \text{ N to the left}
 \end{aligned}$$

5.3

$$\begin{aligned}
 F_{res} &= (-12) + (-16) \\
 &= -28 \\
 &= 28 \text{ N to the left}
 \end{aligned}$$

5.4

$$\begin{aligned}
 F_{res} &= (+3) + (-6) + (+15) + (-8) \\
 &= +4 \\
 &= 4 \text{ N to the right}
 \end{aligned}$$

5.5

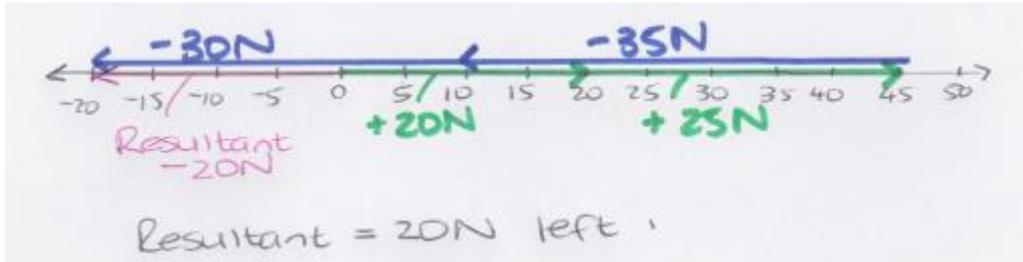
$$\begin{aligned}
 F_{res} &= (-16) + (+24) + (-13) \\
 &= -5 \\
 &= 5 \text{ N to the left}
 \end{aligned}$$

**Question 6**

6.1



6.2



## Acknowledgements

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