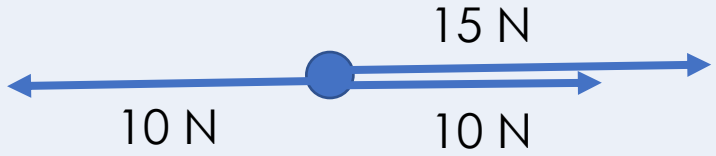
Resolving Vectors



Answer the following questions:

1. State the definition of a resultant vector.
   The combination of two or more single vectors.
2. State the definition of resultant force.
   The net force or the overall effect of all the forces acting on an object.
3. Describe how to calculate a resultant force when two forces are acting in the same direction.
   The resultant force is the sum of the two forces.
4. Calculate the resultant force in the free-body force diagram above.
   15 N right
5. An object is moving at a steady speed. What can be said about the forces acting upon it?
   They must be balanced as only an unbalanced force can change the motion of an object.

Do Now

ArkCurriculum+

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Resolving Vectors

P3.1.4

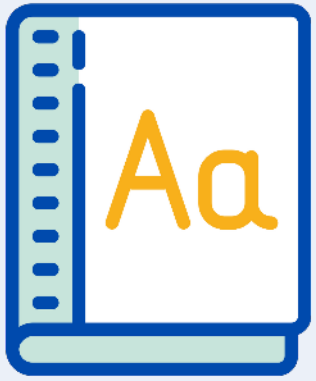
Science
Mastery

P3.1.1 Prior Knowledge Review
P3.1.2 Scalars and Vectors
P3.1.3 Resultant Vectors
➢ **P3.1.4 Resolving Vectors**
P3.1.5 Newton's Third Law
P3.1.6 Newton's First Law
P3.1.7 Acceleration
P3.1.8 Acceleration Investigation
Maths in Science Lesson 17
P3.1.9 Velocity-Time Graphs
P3.1.10 Velocity-Time Graphs 2
P3.1.11 Acceleration Problems

Following this lesson, students will be able to:

- Use scale drawings to determine the resultant of two vectors acting at an angle
- Use scale drawings to resolve vectors into components

Key Words:



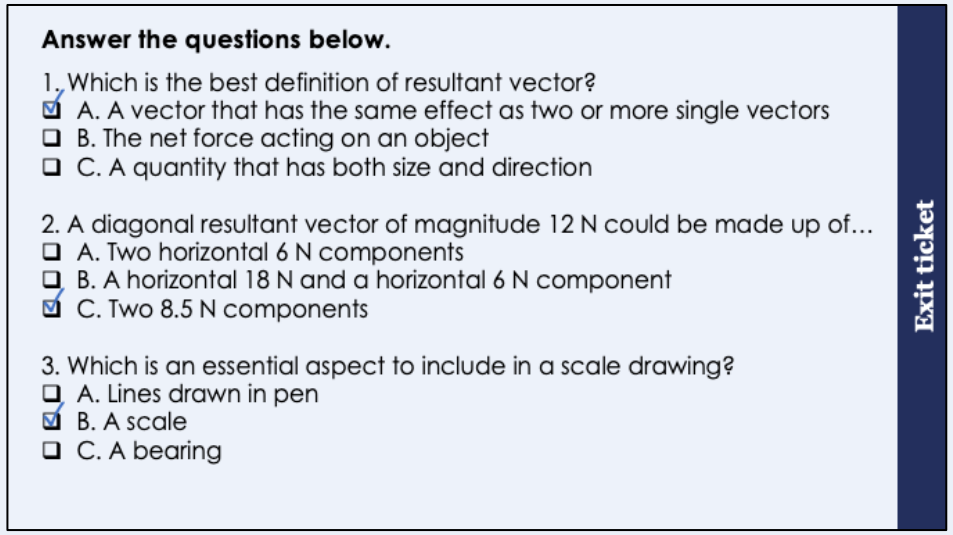
resultant	**vector**	**scale**
horizontal	**vertical**	**component**

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Fix-it

Vocabulary

Component

'The ability to be in the present moment is a major component of mental wellness,'

Abraham Maslow

General Definition

Noun: part of a larger whole or thing.

From the Latin *componere* meaning 'putting together'.

Scientific Definition

- A single horizontal or vertical vector.
- A piece of equipment in an electrical circuit.

Synonyms

Part
Piece
Bit
Section

Antonyms

Sum
Entirety

General Examples

The main components of a pizza are dough, tomato and cheese.

Scientific Examples

Resultant vectors acting at an angle are made up of horizontal and vertical components.

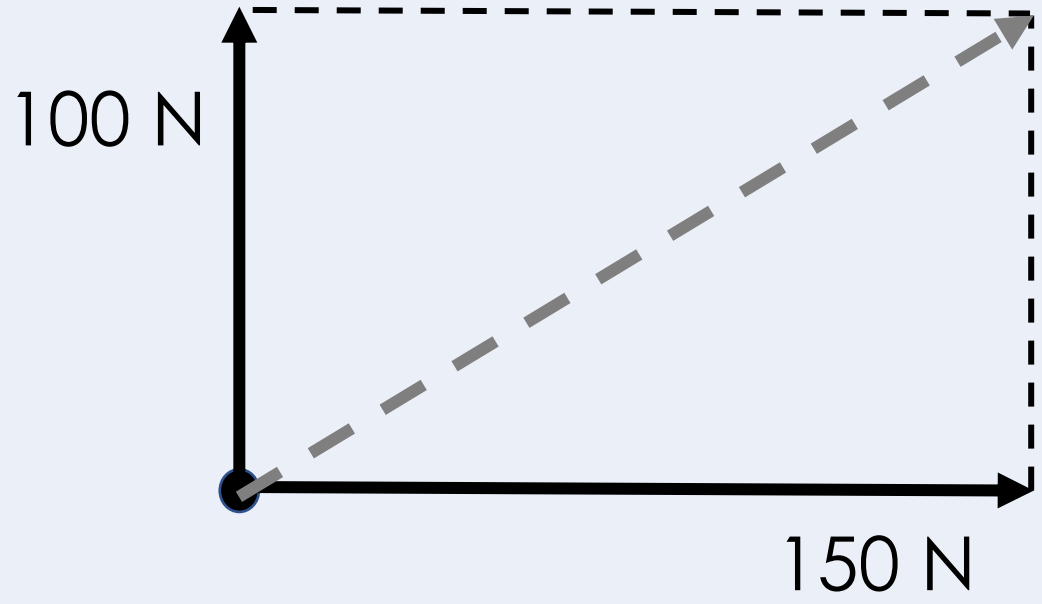
Electrical circuits are made up of components.

Resultant Vectors

What is a resultant vector?

How do find the resultant vector if the vectors are acting:

- *in the same direction*
- *in opposite directions*
- *perpendicular to each other*



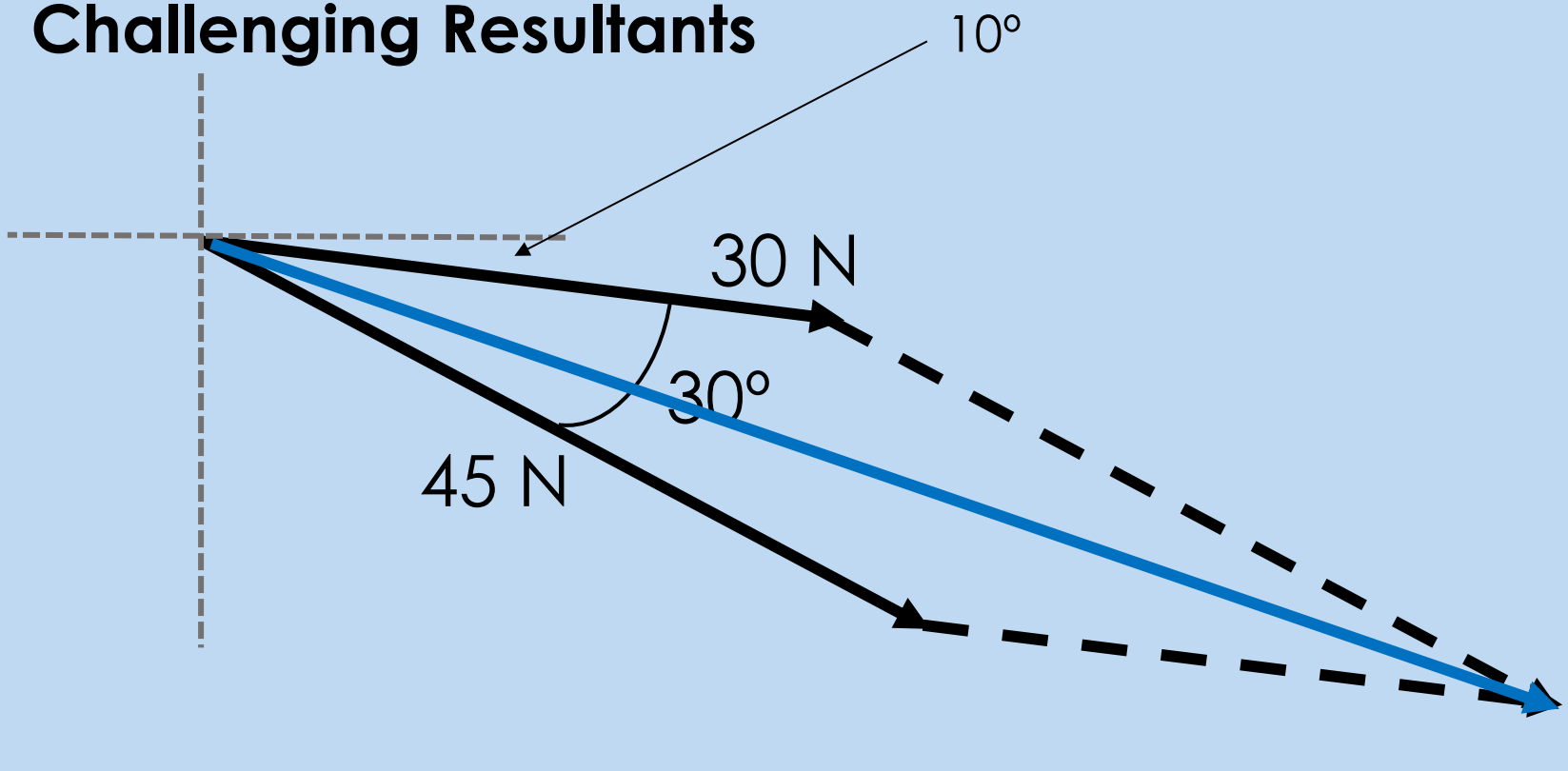
Vectors acting in the **same** direction are **added** together.

Vectors acting in **opposite** directions are **subtracted**.

The resultant vector of single vectors acting **perpendicular** to each other can be determined using a **scale drawing**.

Higher Tier only

Challenging Resultants



We can also find the resultant of two forces that are not acting perpendicular to each other.

We will also use a vector diagram to scale in this case.

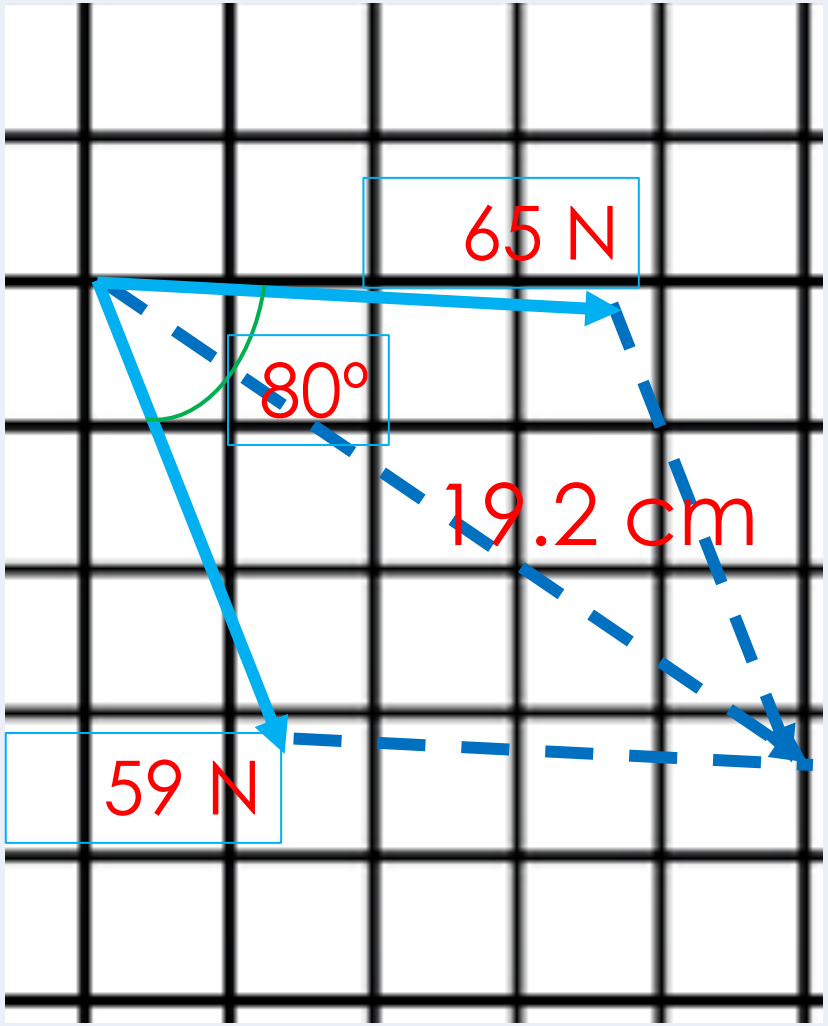
Worked example

Find the resultant vector from this diagram.

Suitable scale: 1cm = 5N

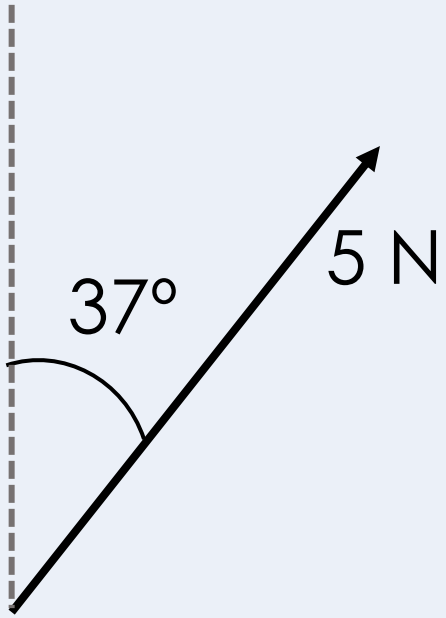
19.2 cm = 5 x19.2 = 96N

Angle from the first vector = 31◦



Apply

What single vectors could have produced this resultant?



Which directions would the single forces have been acting in?

Would these forces have been the same size?

What would a free-body force diagram of the single forces look like?

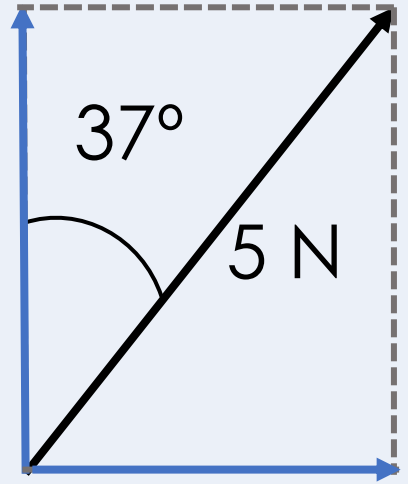
Talk Task

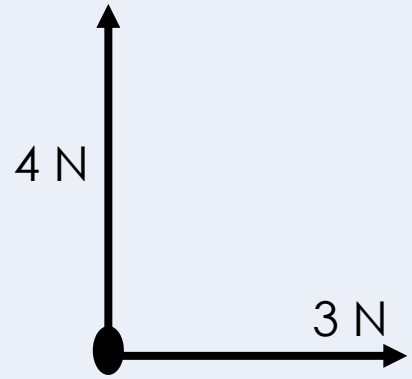
Resolving Vectors

Higher Tier only

The components of a resultant vector acting at an angle can be determined using a **scale drawing.**

1. Choose a suitable scale to use for the scale drawing (e.g. 1 N = 1 cm)
2. Use a protractor to measure the given angle and mark this on your page
3. Use your scale to draw the resultant at this angle
4. Draw dotted lines to make a right-angled triangle on either side of the resultant (which together make a rectangle)
5. Measure the length of the horizontal and vertical components
6. Use your scale to determine the actual magnitudes of these components and give their directions



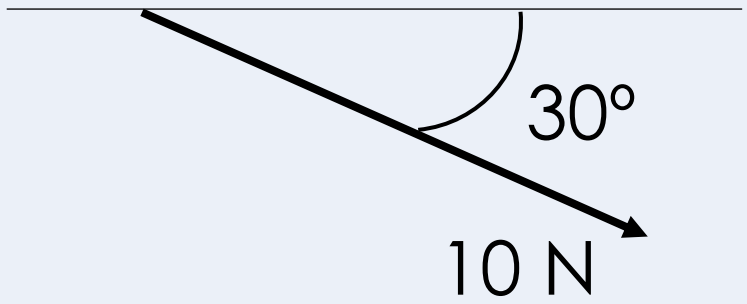


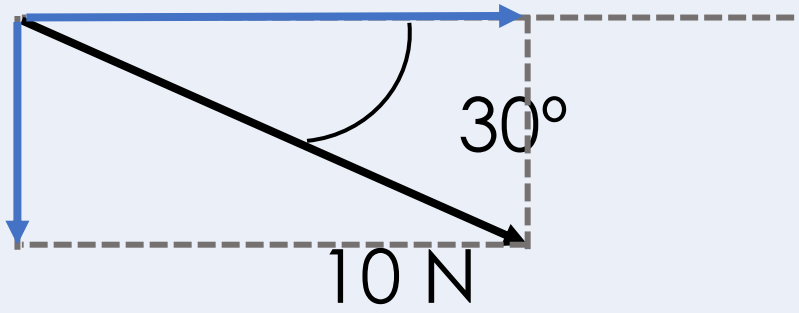
Resolving Vectors

Use a scale drawing to resolve the resultant vector into its horizontal and vertical components.

An object has a resultant force of 10 N at an angle of 30° below horizontal.

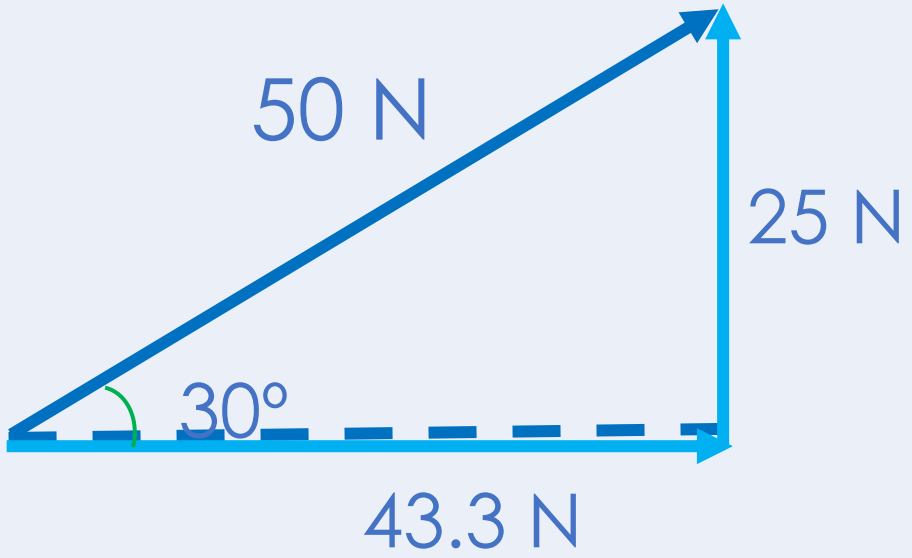
1 N = 1 cm





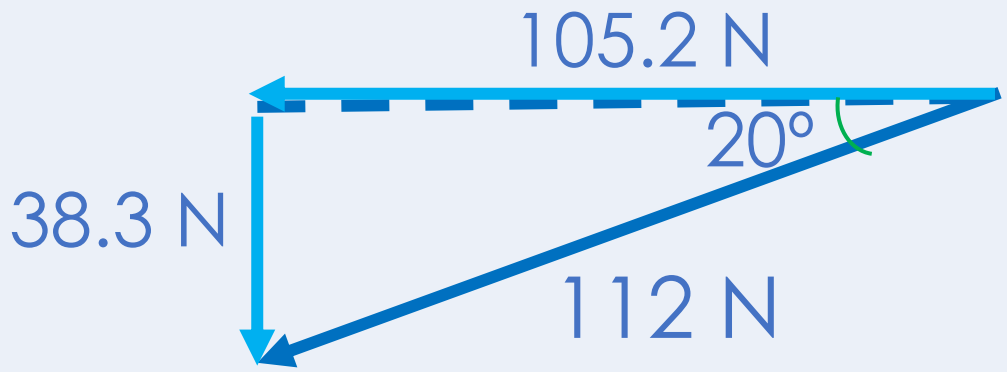
I: Worked example

Resolve this vector into its components.



We: Worked example

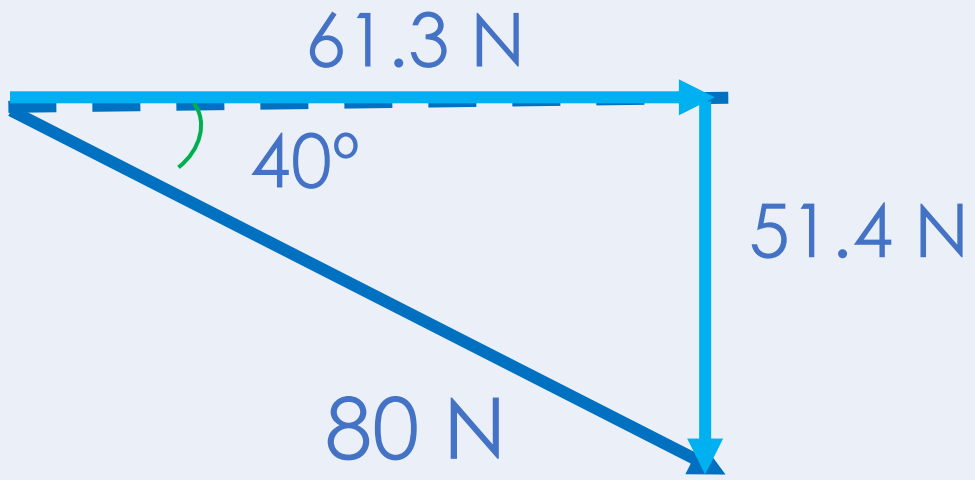
Resolve this vector into its components.



Apply

You: Worked example

Resolve this vector into its components.



Determine the missing words needed to complete each sentence:

1. Resultant vectors acting at an angle can be resolved into __horizontal__ and __vertical__ components.

2. All scale drawing should have a __scale__ and be drawn using a __pencil__ and a __ruler__.

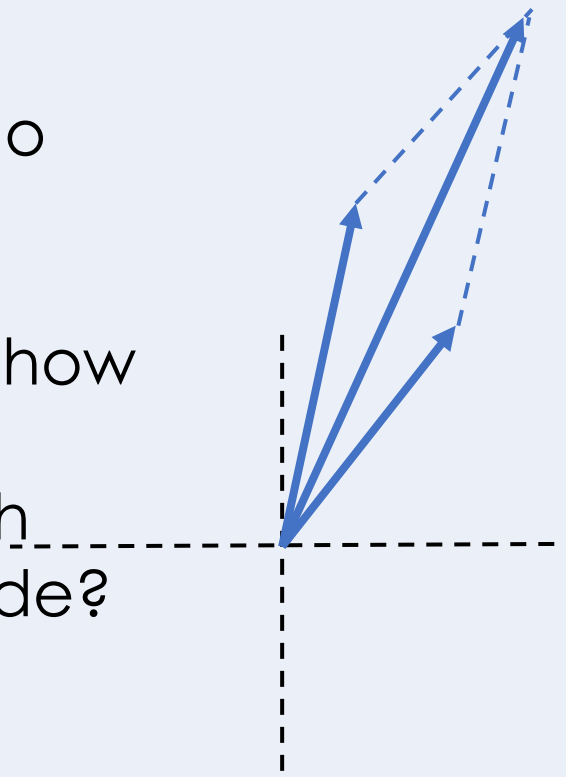
3. A __protractor__ should be used to measure angles.

4. Components should be described with both __magnitude__ and __direction__.

Check for understanding

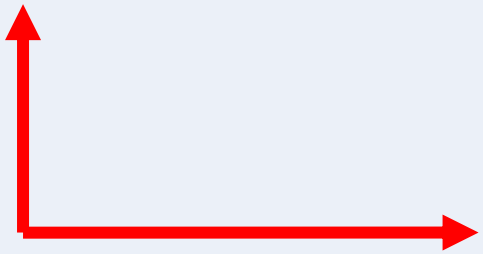
Drill

1. What is a component?
2. How do you calculate the resultant vector if they are acting in the same direction?
3. If the vectors are acting in opposite directions, how do you calculate the resultant vector?
4. Draw perpendicular lines.
5. If the vectors are acting perpendicular to each other how do you find the resultant vector?
6. When you have measured your resultant vector length with a ruler how do you convert it to the real magnitude?
7. Where must you measure the angle of your resultant vector when using perpendicular vectors?
8. What is the difference in finding a resultant vector from perpendicular and non-perpendicular lines?
9. Where would you start measuring the angle of the resultant line in this diagram?

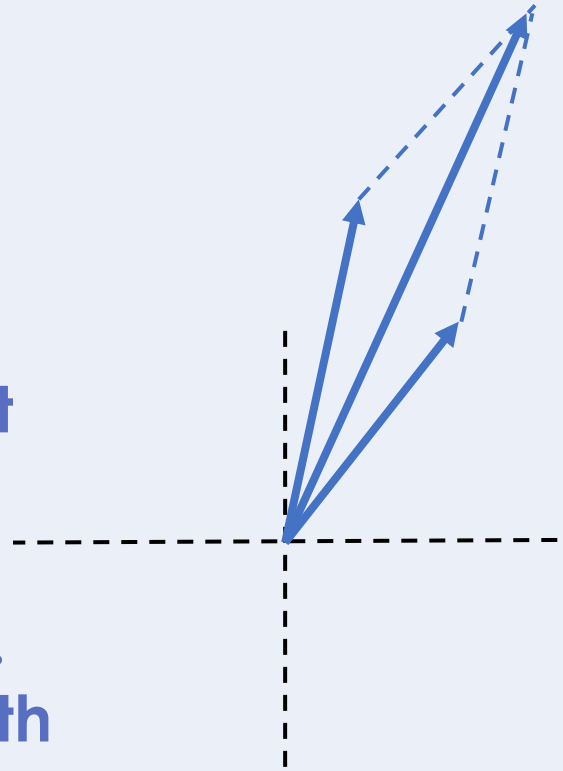


Check for understanding

Drill answers



1. A single horizontal or vertical vector.
2. Add up vectors acting in the same direction.
3. Subtract vectors acting in the opposite directions
4. Diagram
5. Draw scale drawings for vectors that are perpendicular.
6. To convert your length to the real magnitude, look at the scale and multiply it by your length. (Scale x length)
7. You always measure the angle from your first vector.
8. With non-perpendicular you start from the y axis . With perpendicular you start from the first vector.
9. From the y axis



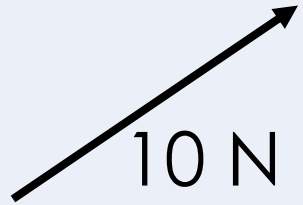
Check for understanding

Answer the questions below.

1. What is the difference between scalars and vectors?

- ☐ A. Scalars always have a direction
- ☑ B. Vectors always have a direction
- ☐ C. Vectors sometimes have a direction

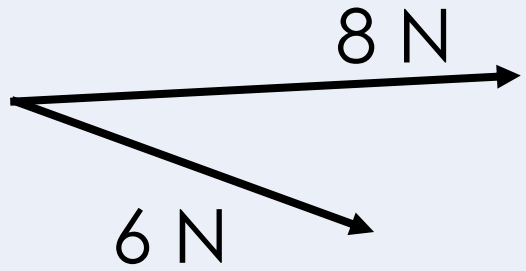
2. Which are the most likely components of this resultant vector?



- ☐ A. 20 N up and 15 N right
- ☑ B. 8 N right and 6 N up
- ☐ C. 5 N right and 15 N down

3. Which is most likely to be the resultant of these single vectors?

- ☐ A. 18 N
- ☐ B. 2 N
- ☑ C. 13 N



Exit ticket

Feedback

Lesson P3.1.4	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!