GET READY TO STUDY A LEVEL PHYSICS

If you are planning to study A Level Physics with us in September, please review this document and complete the required activities. Please bring the completed activities with you at induction.

FAQ

What specification will I study?

You'll be covering the OCR A specification – you can find it here.

How many lessons will I have a week?

You'll have 3 lessons a week; a total of 4 ½ hours

Who can I contact if I have a question about this subject?

Richard Lees A'level Physics Teacher r.lees@barnsley.ac.uk

What subjects go well with Physics?

It's a challenging subject with a strong mathematical element, so we insist that you take maths alongside physics. Other subjects that offer a strong combination for careers are geography or economics and STEM subjects such as computing, biology, or chemistry to complete your study programme. Many students also take further maths.

What grades should I have?

In addition to the general sixth form entry requirements, learners must have a 6 in physics and another science, or 66 in combined science, as well as a 6or above in maths

WHAT WILL I STUDY?

In Year 1, you will study the following topics:

Foundation skills in physics

- Measurement techniques, Number and Scale, Vectoral values
- Data analysis and spreadsheet analysis

Motion and Forces in Action

- Material properties, Equilibrium in motion and in static structures
- Dynamics, Newtonian mechanics, Motion and Collisions Basic and advanced circuits, Electrical properties of materials, Making sensors

Electrons, Waves & Photons

- Electrons and the Electromagnetic spectrum, Oscillations and Waves, Optical properties
- Quantum properties of atoms, Wave-particle duality

In Year 2, you will study the following topics:

The Newtonian world & Astrophysics

- Circular dynamics, Resonance and Harmonic motion
- Internal energy, Properties of matter, Gases, Kinetic theory, and applications
- Gravitational fields, Astrophysics and Cosmology

Fields, Particles, Nuclear & Medical physics

- Capacitor networks, Logarithmic change and Electrical fields
- Magnetic machines, Particle Accelerators & Detectors, Electromagnetic Induction
- Nuclear properties, Particle physics, Radioactivity and Nuclear energy
- X-rays formation & detection, Ultrasound – Doppler shift, Medical imaging

Practical skills are fundamental to studying physics and so are developed throughout the course

HOW WILL I BE ASSESSED?

A-Level

You're A-level is assessed by 3 written papers that you sit at the end of year 13.

The papers are 3 written papers that cover all the syllabus studied over the 2 years.

In addition to but separate from the A-level grade is the PRACTICAL ENDORSEMENT.

It is assessed by your teacher and granted on your meeting a number of practical skills throughout the 2 years of study.

Whether or not you gain the practical endorsement does not affect your final A- level grade but is often a requirement for University courses.

WHAT WILL I NEED?

To study the course you will need the following equipment:

- A folder with divider sections

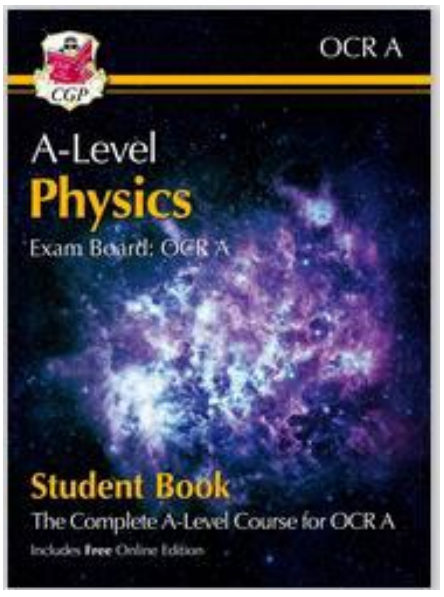
- Pens including green, pencils
- Highlighters
- A 30cm ruler
- Blank flashcards
- A scientific calculator – see requirements for maths department, especially Further Maths students

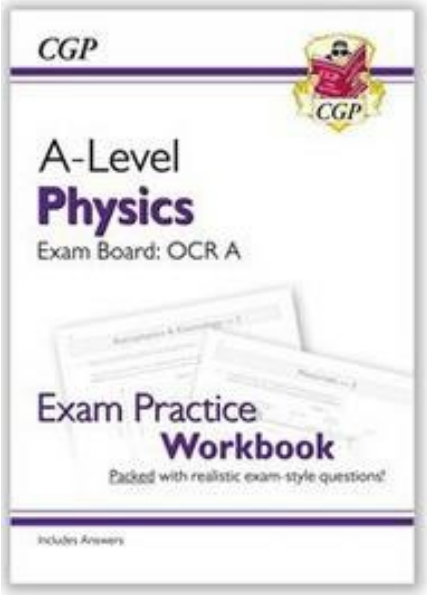
Many students find it useful to also have:

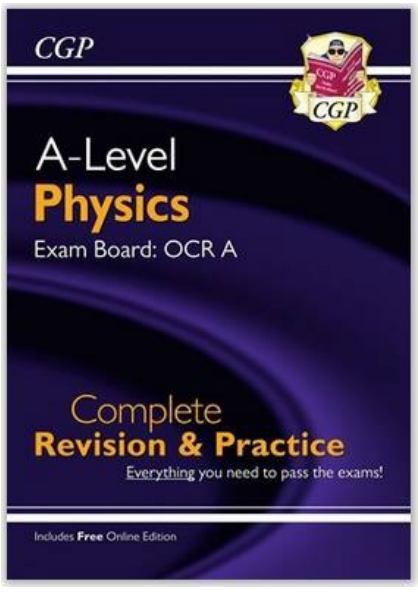
A whiteboard and whiteboard pens

- A pad for summarising ideas & working out ideas

We recommend *all* students buy a textbook and these can be purchased from the college .







FIND OUT MORE

These activities are to help broaden your understanding of the subject in preparation for studying this subject at an advanced level.

Careers	• prospects • Institute of Physics • planet possibility • manchester university • grade ireland • institute of mechanical engineers • Institute Civil Engineers • UCAS • brightnetwork
A-Level Physics on Youtube	PhysicsOnline DrPhysicsA minutephysics
YouTube engineering and science channels	veritasium Vsauce PracticalEngineeringChannel smarter every day SteveMould physics girl
Further Reading / Useful websites	Home – Physics World Institute of Physics the Royal Society Royal Institution Institution of Engineering and Technology

REQUIRED ACTIVITIES

A level physics requires that you are comfortable GCSE algebra and trigonometry.

A Level Physics requires you to be confident with GCSE algebra and trigonometry.

Your required summer activities are to:

1. Practise rearranging equations and substituting values into equations.
2. Practise using Pythagoras' theorem and SOHCAHTOA to solve problems.
3. Apply these skills to solving vector questions in physics.

Complete all questions and answers on the following 9 pages. And then mark these using the answers at the end of this booklet.

If you require additional guidance, follow the links to the YouTube tutorials below:

Addition of Vectors By Means of Components - Physics

Resolving vectors - Splitting a Force into Components | ExamSolutions

Rearranging Equations - GCSE IGCSE 9-1 Physics - Science - Top Grade Top Up for GCSE and IGCSE

Completion of this work will be assessed in the form of a written test during the first week of term.

Task 1 Physics Formula Rearranging and Substitution

Example 1: The equation for electrical power is $P = I^2R$. Rearrange to make I the subject.

$$P = I^2R \qquad I^2 = \frac{P}{R} \qquad \boldsymbol{I = \sqrt{\frac{P}{R}}}$$

Example 2 Given: $P = I^2R$ and $I = Q/t$
Find Q in terms of P, R, and t.

$$I = \frac{Q}{t} \qquad Q = It \qquad and \quad P = I^2R \qquad I = \sqrt{\frac{P}{R}}$$

By substitution $Q = \sqrt{\frac{P}{R}}\ t$

1. The formula for speed is speed = distance / time. Rearrange this formula to make time the subject.

2. The equation for force is F = m × a. Rearrange the formula to make mass the subject.

3. Given the formula v = u + at, rearrange to make t the subject.

4. The kinetic energy of an object is given by $KE = 1/2\ mv^2$. Rearrange to make v the subject.

5. The SUVAT equation is $s = ut + 1/2\ at^2$. Rearrange this to make a the subject.

6. From Newton's law of universal gravitation: $F = Gm_1m_2 / r^2$, rearrange to make r the subject.

7. Given: $V = IR$ and $Q = It$ Substitute I from the second into the first and rearrange to find V in terms of Q, R, and t.

8. Given: $F = ma$ and $a = (v - u)/t$
Substitute the expression for a into the formula for F and rearrange to find F in terms of m, v, u, and t.

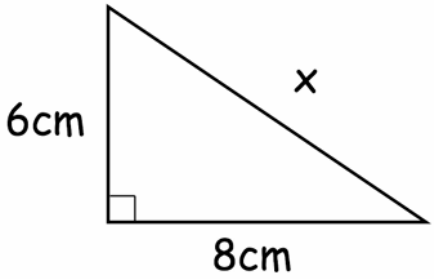
9. Given: $Ek = 1/2\ mv^2$ and $v^2 = u^2 + 2as$
Substitute for v^2 into Ek and simplify to express Ek in terms of m, u, a, and s.

10. Given: $s = ut + 1/2\ at^2$ and $s = 1/2\ (u+v)t$
Find a in terms of s, v, and t.

Task 2 Trigonometry and Pythagoras

1.

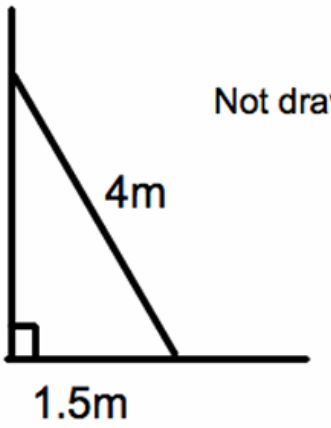
Shown below is a right angled triangle.



Not drawn accurately

Use Pythagoras' theorem to work out the value of x.

2.

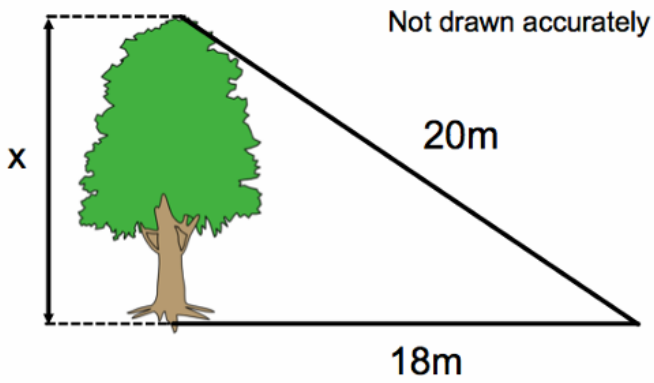


Not drawn to scale

A 4 metre ladder is placed against a vertical wall.
The base of the ladder is 1.5 metres from the base of the wall.

Work out how far the ladder reaches up the wall.

3.



The distance from a point on the ground to the base of a tree is 18 metres.
The distance from a point on the ground to the top of a tree is 20 metres.

Calculate the height of the tree.
Give the answer correct to 1 decimal place.

4.

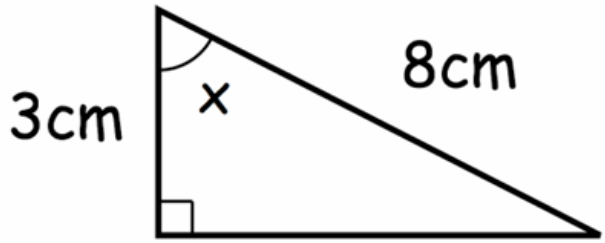
A helicopter is flying from Redville to Leek.

The helicopter departs Redville, flies 60 miles **west**, then 25 miles **north** and arrives in Leek.

Work out the direct distance of Leek from Redville.

5.

Shown below is a right-angled triangle.

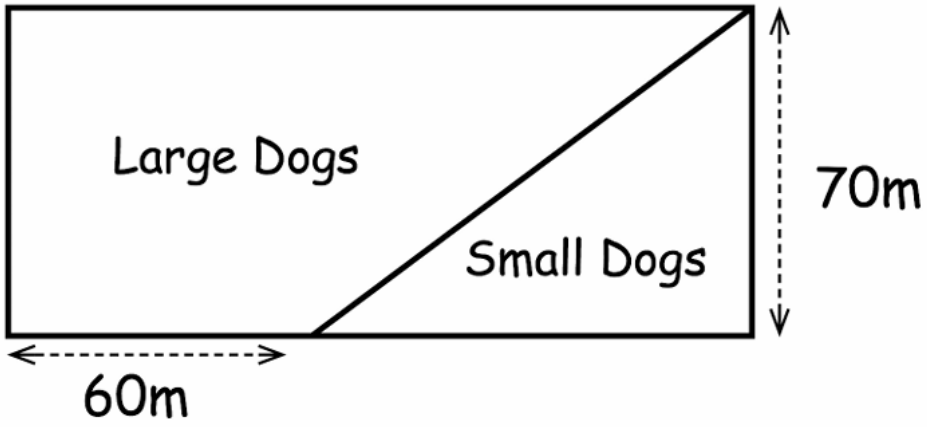


Use trigonometry to work out the size of angle x.

6.

A council are designing a dog park that will be in a rectangular field.
The length of the field is twice the width of the field.

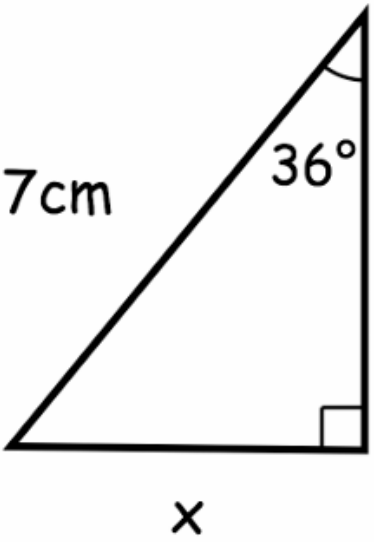
The field will be divided by a wall into two sections, one for large dogs and the other for small dogs.



Work out the length of the wall dividing the two sections.

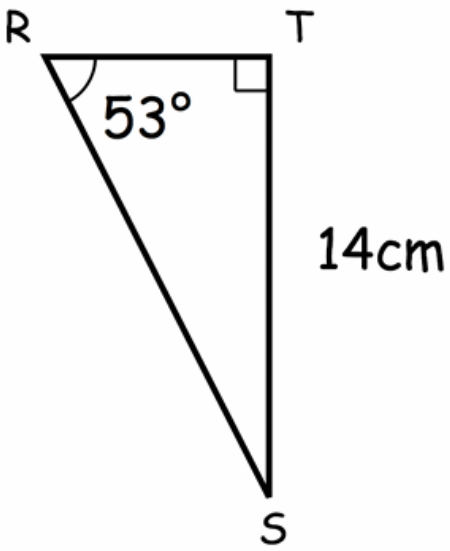
7.

Below is a right-angled triangle.



Use trigonometry to work out the length x.

8.

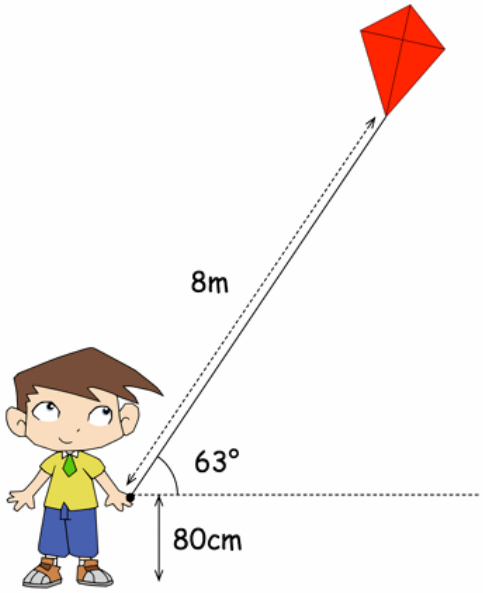


Work out the length of RT.

19

10.

Humphrey is flying a kite.



The handle is held 80cm above the ground.
The kite is on a string which is 8m long.
The string makes an angle of 63° with the horizontal.

Calculate the height of the bottom of the kite above the ground.

Task 3 Resolving and adding vectors in Physics

Question 1

A student walks:

- 3 m east
- then 4 m north

Calculate the magnitude of the resultant displacement.

Answer

Question 2

A force of 12 N east and a force of 5 N west act on an object.

Calculate the resultant force.

Answer

Question 3

A force of 50 N acts at $60°$above the horizontal.

Calculate the horizontal component.

Use:

Question 4

A force of 20 Nacts at $37°$above the horizontal.

Calculate:
a) the horizontal component
b) the vertical component

Answer

Question 5

An object experiences:

- 15 N north
- 8 N east

Calculate the magnitude of the resultant force.

Answer

Question 6

A car travels with:

- velocity 24 m/s east
- velocity 7 m/s north

Calculate:
a) the resultant speed
b) the direction relative to east

Answer

a)

b)

ANSWERS

Task 1 Physics Formula Rearranging and Substitution

Example 1: The equation for electrical power is $P = I^2R$. Rearrange to make I the subject.

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By substitution $Q = \sqrt{\frac{P}{R}}\,t$

1. The formula for speed is speed = distance / time. Rearrange this formula to make time the subject.

time = distance/speed

2. The equation for force is F = m × a. Rearrange the formula to make mass the subject.

m = F/a

3. Given the formula v = u + at, rearrange to make t the subject.

$$t = \frac{v - u}{a}$$

4. The kinetic energy of an object is given by $KE = 1/2\ mv^2$. Rearrange to make v the subject.

$$KE = \sqrt{\frac{2KE}{m}}$$

5. The SUVAT equation is $s = ut + 1/2\ at^2$. Rearrange this to make a the subject.

$$a = \frac{2(s - ut)}{t^2}$$

6. From Newton's law of universal gravitation: $F = Gm_1m_2 / r^2$, rearrange to make r the subject.

$$r = \sqrt{\frac{Gm_1m_2}{F}}$$

7. Given: V = IR and Q = It Substitute I from the second into the first and rearrange to find V in terms of Q, R, and t.

$$V = \frac{QR}{t}$$

8. Given: F = ma and a = (v - u)/t
Substitute the expression for a into the formula for F and rearrange to find F in terms of m, v, u, and t.

$$F = \frac{m(v - u)}{t}$$

9. Given: $Ek = 1/2\ mv^2$ and $v^2 = u^2 + 2as$
Substitute for v^2 into Ek and simplify to express Ek in terms of m, u, a, and s.

$$E_k = \frac{1}{2}mu^2 + mas$$

10. Given: $s = ut + 1/2\ at^2$ and $s = 1/2\ (u+v)t$
Find a in terms of s, v, and t.

$a = \frac{2(vt-s)}{t^2}$

Task 2 Trigonometry and Pythagoras

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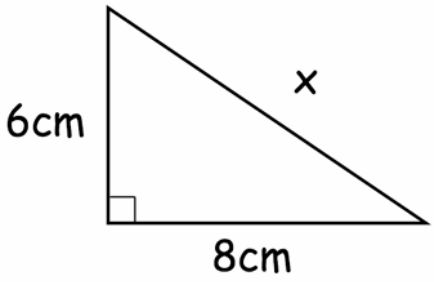
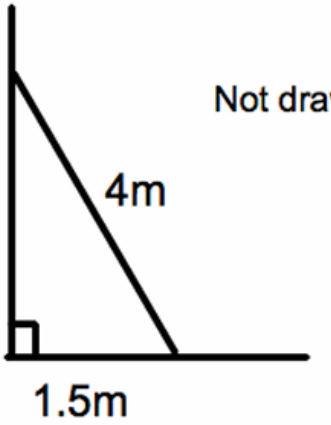


Not drawn accurately

Use Pythagoras' theorem to work out the value of x.

10 cm

2.



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A 4 metre ladder is placed against a vertical wall.
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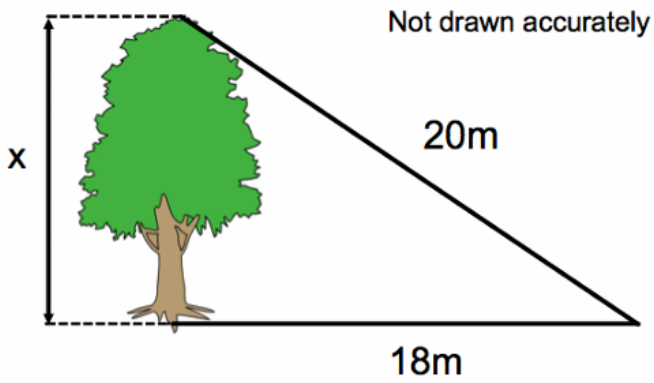
Work out how far the ladder reaches up the wall.

3.7 m

3.



The distance from a point on the ground to the base of a tree is 18 metres.
The distance from a point on the ground to the top of a tree is 20 metres.

Calculate the height of the tree.
Give the answer correct to 1 decimal place.

8.7 m

4.

A helicopter is flying from Redville to Leek.

The helicopter departs Redville, flies 60 miles **west**, then 25 miles **north** and arrives in Leek.

Work out the direct distance of Leek from Redville.

65 miles

5.

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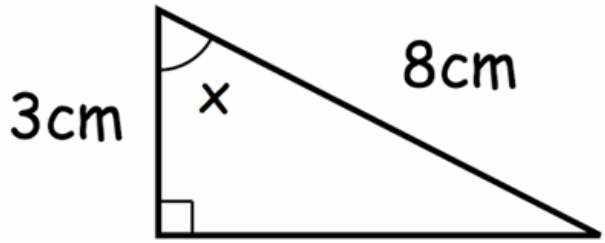


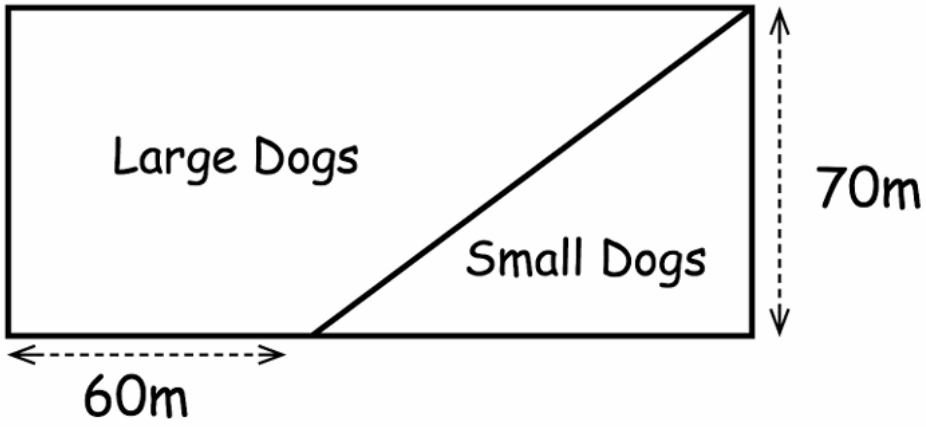
Use trigonometry to work out the size of angle x.

68 degrees

6.

A council are designing a dog park that will be in a rectangular field.
The length of the field is twice the width of the field.

The field will be divided by a wall into two sections, one for large dogs and the other for small dogs.

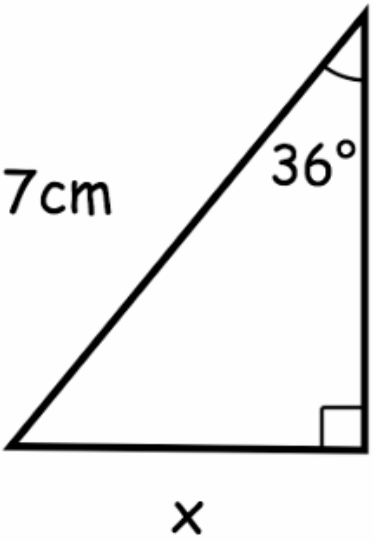


Work out the length of the wall dividing the two sections.

106m

7.

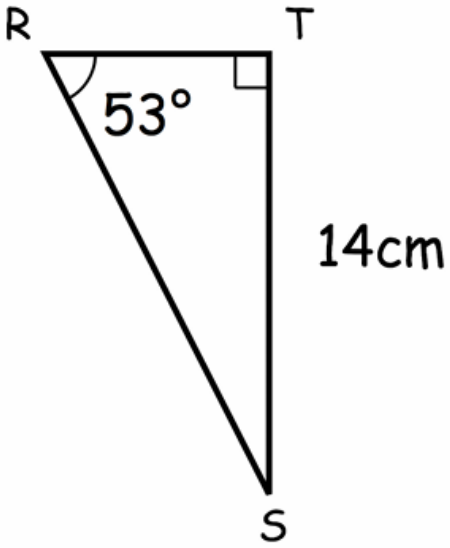
Below is a right-angled triangle.



Use trigonometry to work out the length x.

4.1 cm

8.



Work out the length of RT.

19

11 cm

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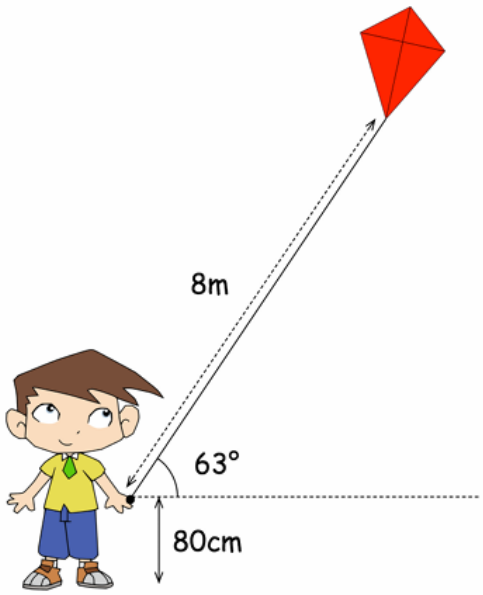

The handle is held 80cm above the ground.
The kite is on a string which is 8m long.
The string makes an angle of 63° with the horizontal.

Calculate the height of the bottom of the kite above the ground.

7.93 m

Task 3 Resolving and adding vectors in Physics

Question 1

A student walks:

- 3 m east
- then 4 m north

Calculate the magnitude of the resultant displacement.

Answer

$$R = \sqrt{3^2 + 4^2} = 5 \text{ m}$$

Question 2

A force of 12 N east and a force of 5 N west act on an object.

Calculate the resultant force.

Answer

$$12 - 5 = 7 \text{ N east}$$

Question 3

A force of 50 N acts at 60°above the horizontal.

Calculate the horizontal component.

Use:

$$= 25 \text{ N}$$

Question 4

A force of 20 Nacts at 37°above the horizontal.

Calculate:
a) the horizontal component
b) the vertical component

Answer

a) 16 N

b) 12 N

Question 5

An object experiences:

- 15 N north
- 8 N east

Calculate the magnitude of the resultant force.

Answer

$$R = 17 \text{ N}$$

Question 6

A car travels with:

- velocity 24 m/s east
- velocity 7 m/s north

Calculate:
a) the resultant speed
b) the direction relative to east

Answer

a) $= 25$ m/s

b) 16° north of east