# Theatre of Science IGCSE Physics
# Forces and Motion 1: Distance-Time Graphs

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This lesson will cover the following points:

## Edexcel Specification

*Plot* and explain distance time graphs. Know that average speed = distance moved / time taken

## Cambridge Specification

Same! They specify 'calculate speed from their gradients' but Edexcel will need you to do that too. Also use the equation v = s / t

**To join in bring:**
Pencil and paper

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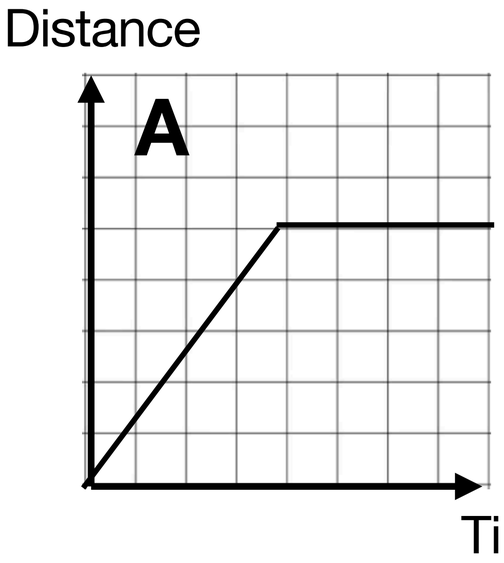
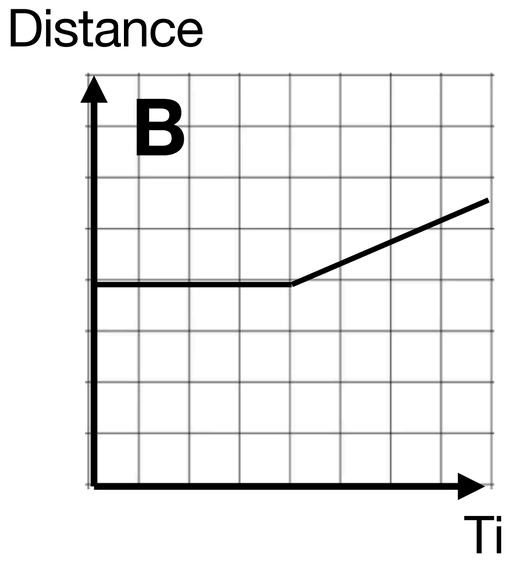
**If you know the distance something travelled.**

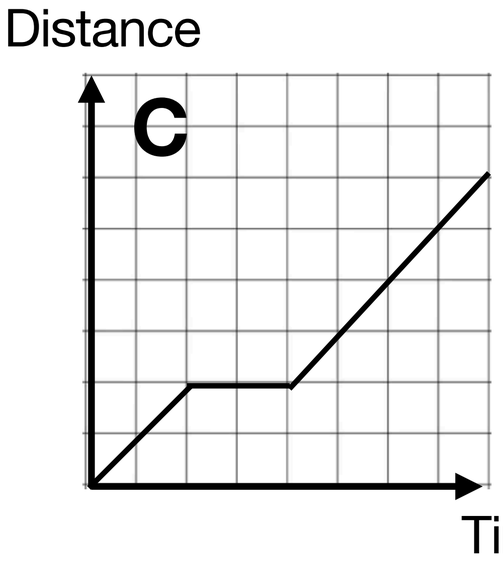
**And you know how long it took.**

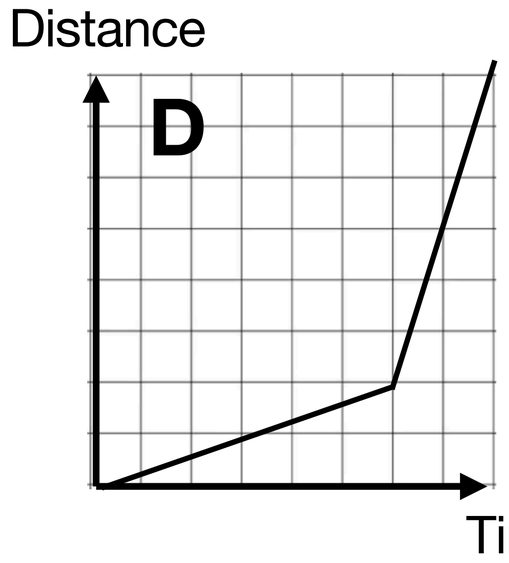
**What else do you know?**

If you think you know, be careful! The answer is two words not one.



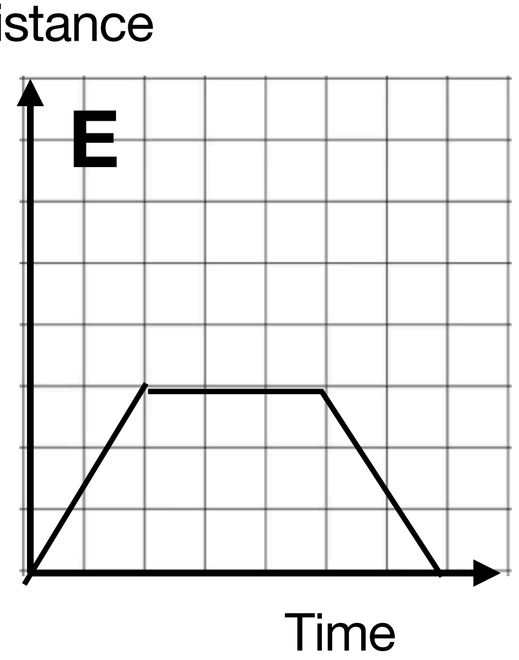

1) Match graph A, B, C or D to these descriptions:

You stay still for ages then move away at a constant speed _____

You move at a constant speed and then stop _____

You walk at a constant speed then run at a constant speed _____

You run at a constant speed, stop for a rest, then run on _____



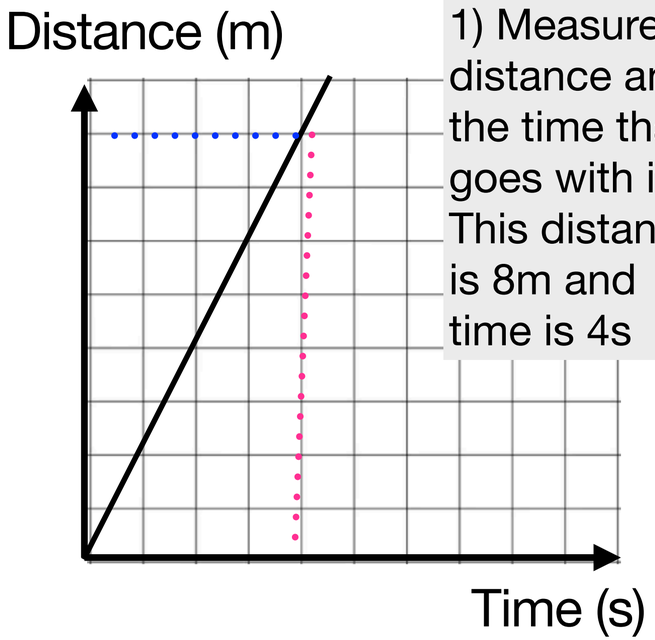

2) Which graph shows the fastest speed? _____

3) What's happening in graph E?!

4) Sketch a graph of your movements over the last hour.

**Find the speed these objects were going when they were moving.**

*Example:*

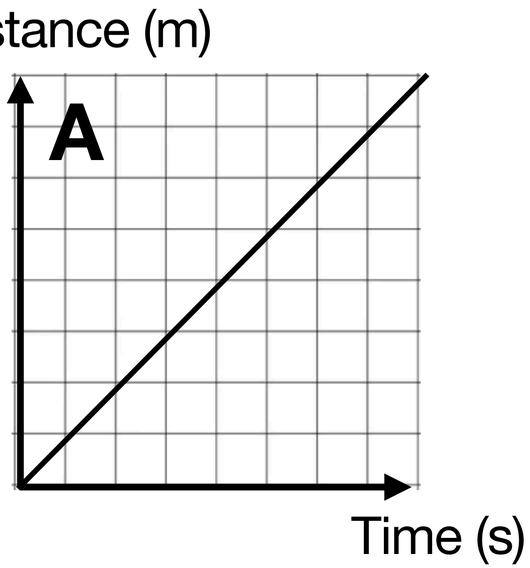


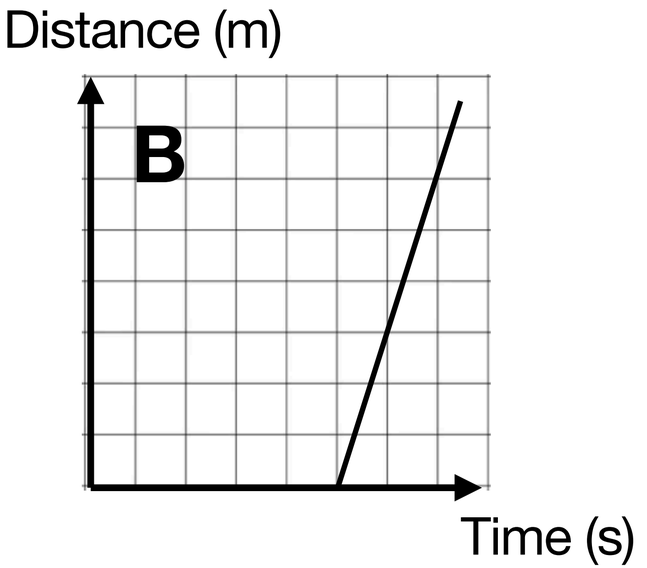

1) Measure a distance and the time that goes with it. This distance is 8m and time is 4s

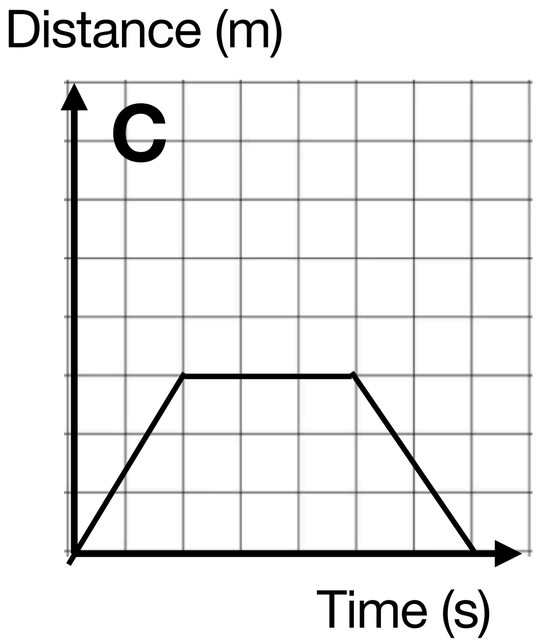
2) Divide the distance by the time.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\frac{8\text{m}}{4\text{s}} = 2 \text{ metres per second (m/s)}$$




**Now see the homework pdf for questions you can try to practice what you've learned this lesson!**

# Theatre of Science IGCSE Physics
# Forces and Motion 2: Speed-Time Graphs

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This lesson will cover the following points:

## Edexcel Specification

Plot and explain velocity time graphs and use them to work out acceleration and distance

## Cambridge Specification

Same! They specify that from a graph or data, you should "know when an objepct is still, or moving at a constant speed".

1. Sketch 3 graphs, one for each table. (See graphs on next page).
Draw a line through all the points using a ruler.
2. Describe the speed of the object in each case.

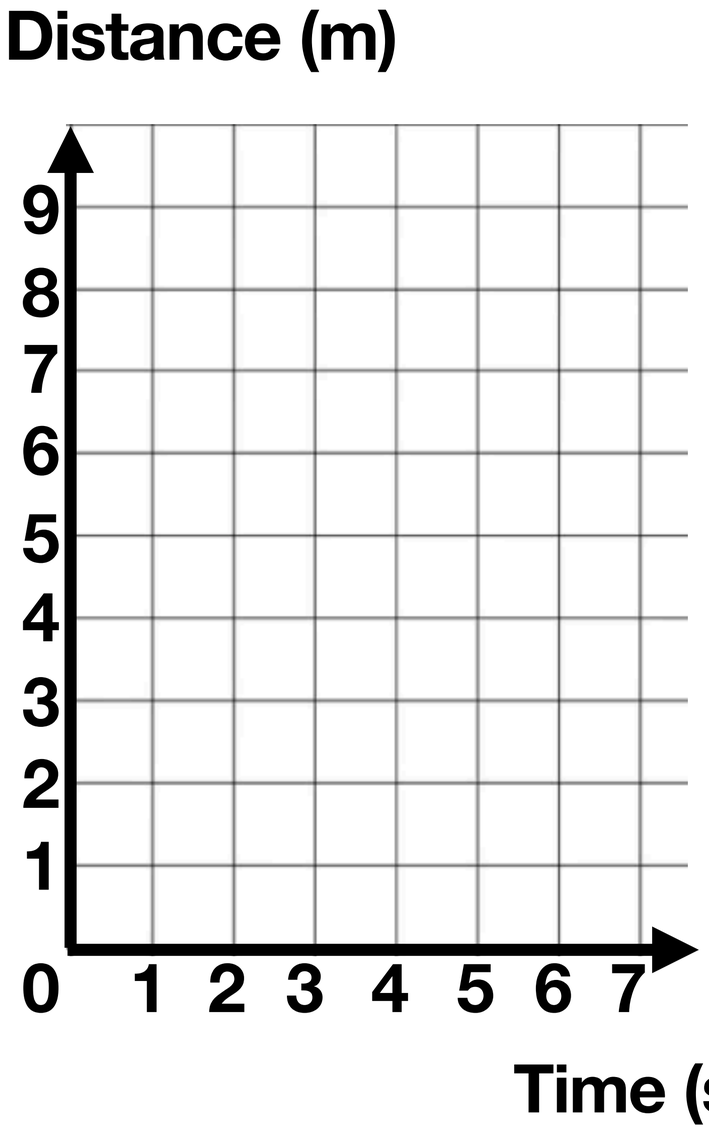
Finished? Add a 3rd column to this table headed ‘speed’ and fill it in.
Remember
speed = distance / time

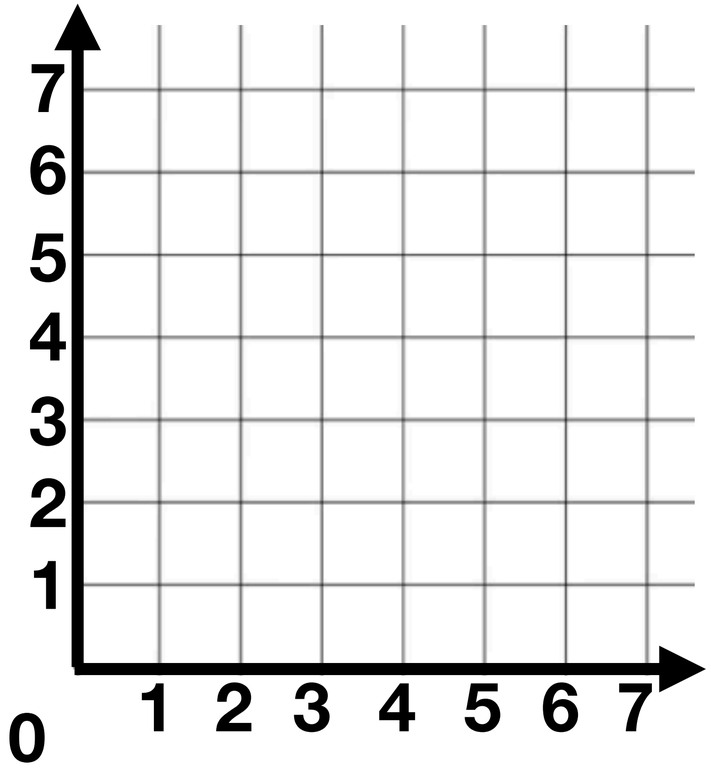
| Distance (m) | Time (s) |
|---|---|
| 0 | 0 |
| 3 | 1 |
| 6 | 2 |
| 9 | 3 |

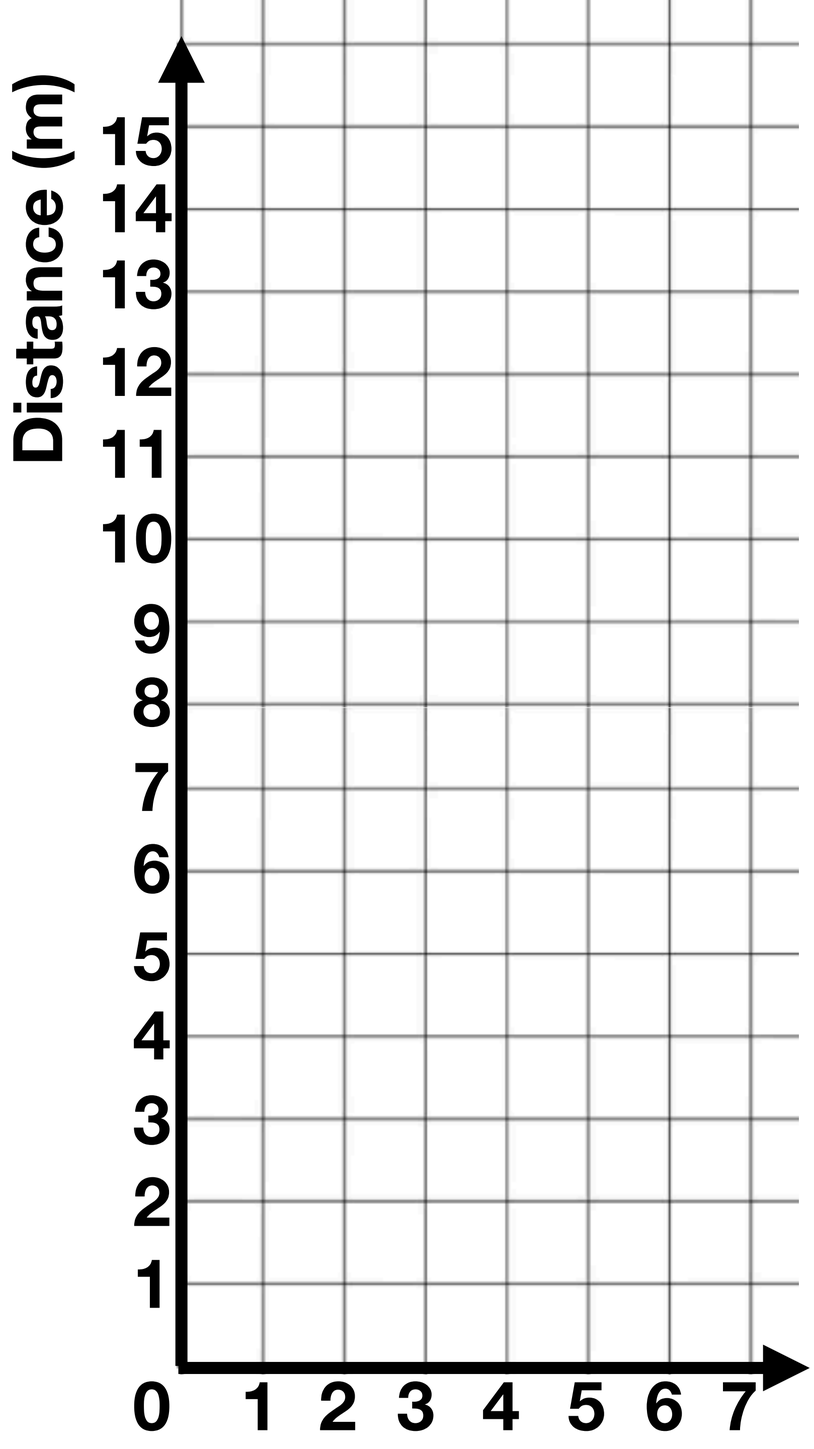
| Distance (m) | Time (s) |
|---|---|
| 0 | 1 |
| 1 | 3 |
| 2 | 5 |
| 3 | 7 |

| Distance (m) | Time (s) |
|---|---|
| 0 | 2 |
| 3 | 3 |
| 8 | 4 |
| 15 | 5 |

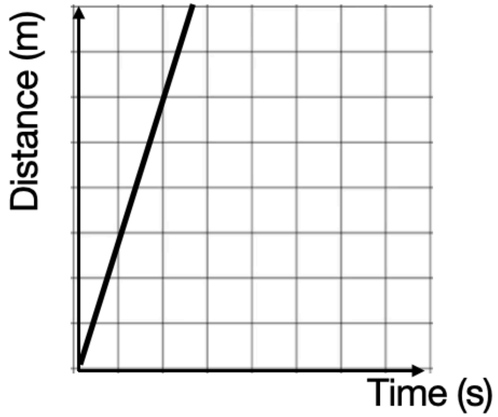
Use to sketch the three graphs.



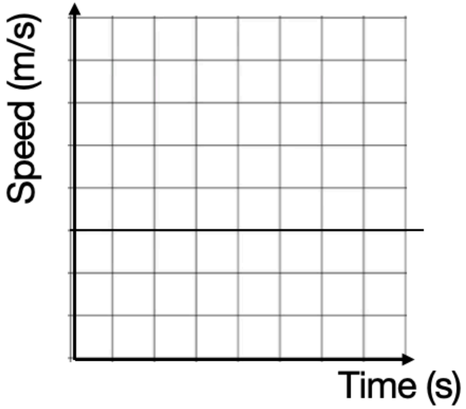



# Last questions! In no particular order!




**Does this graph show..?**

A: Constant speed
B: Constant acceleration
C: No movement

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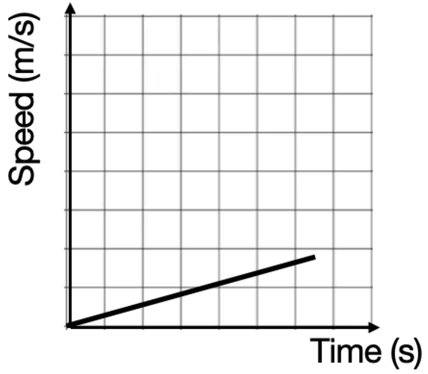


**Does this graph show..?**

A: Constant speed
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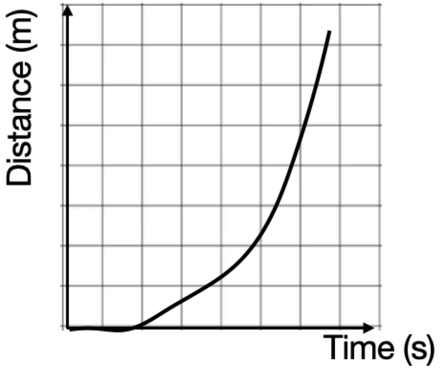


**Does this graph show..?**

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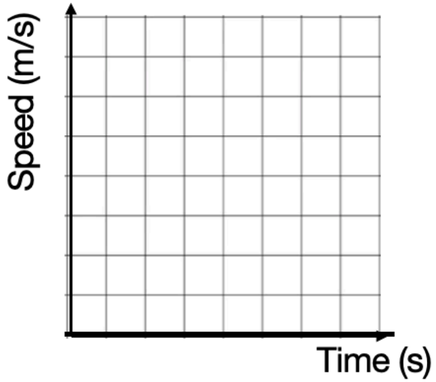


**Does this graph show..?**

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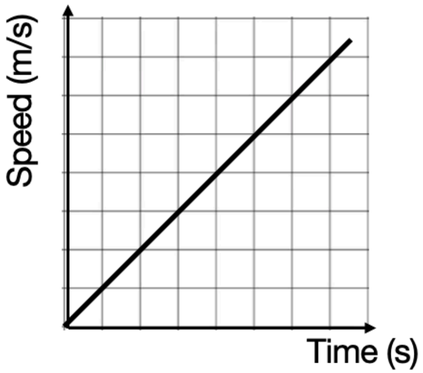


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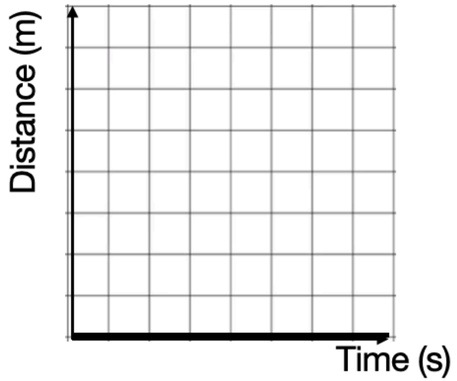


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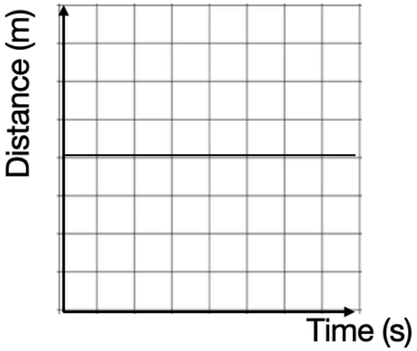
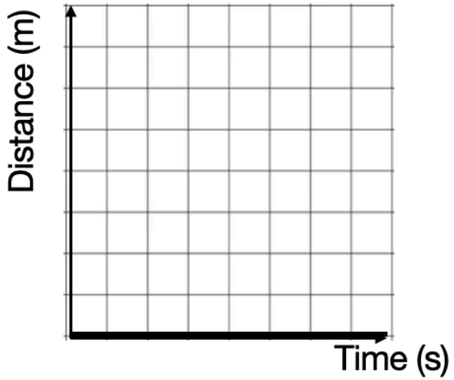



**Does this graph show..?**

A: Constant speed
B: Constant acceleration
C: No movement

# Answers to last questions!




**Does this graph show..?**

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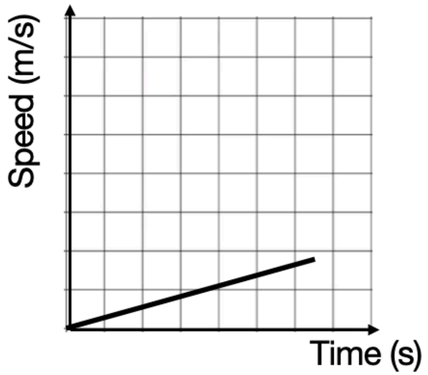


**Does this graph show..?**

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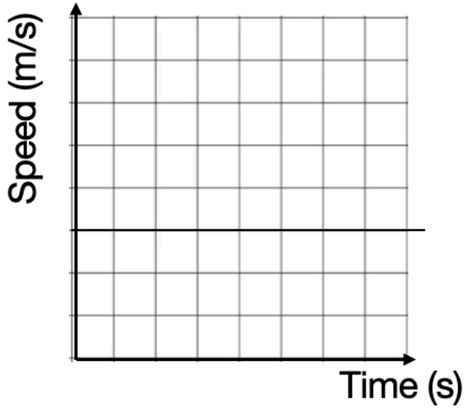


**Does this graph show..?**

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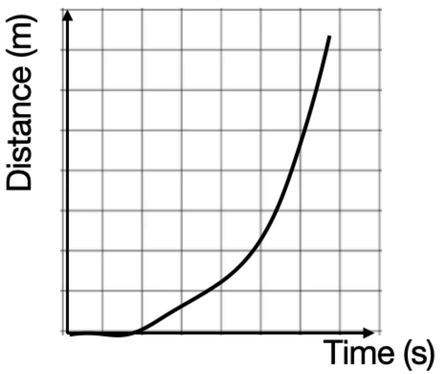
C: No movement

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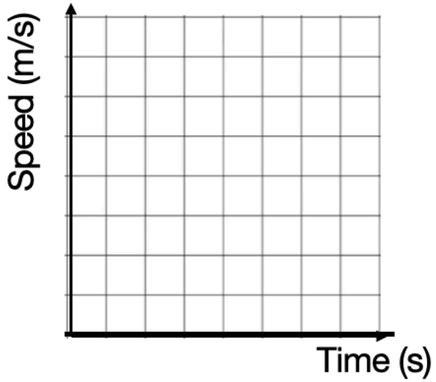


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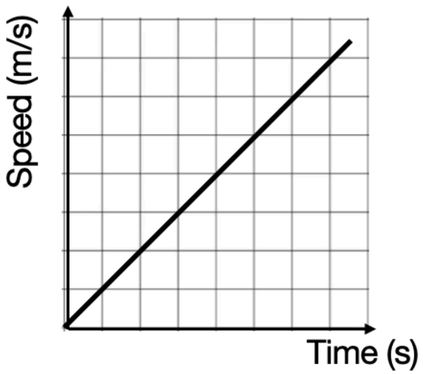


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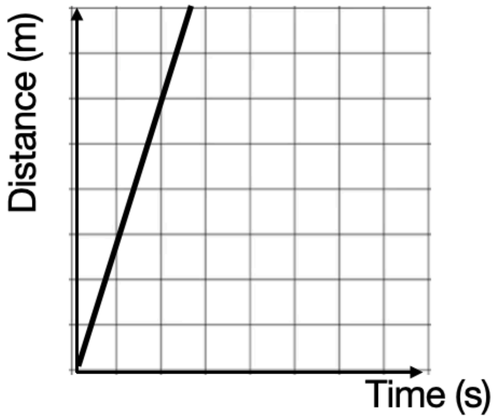


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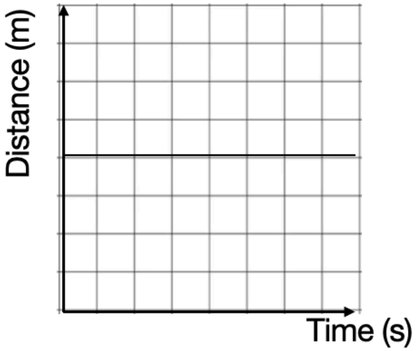


**Does this graph show..?**

A: Constant speed
B: Constant acceleration
C: No movement

# Theatre of Science IGCSE Physics
# Forces and Motion 3: Vectors!

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This lesson will cover the following points:

## Edexcel Specification

understand how vector quantities differ from scalar quantities
understand that force is a vector quantity

## Cambridge Specification

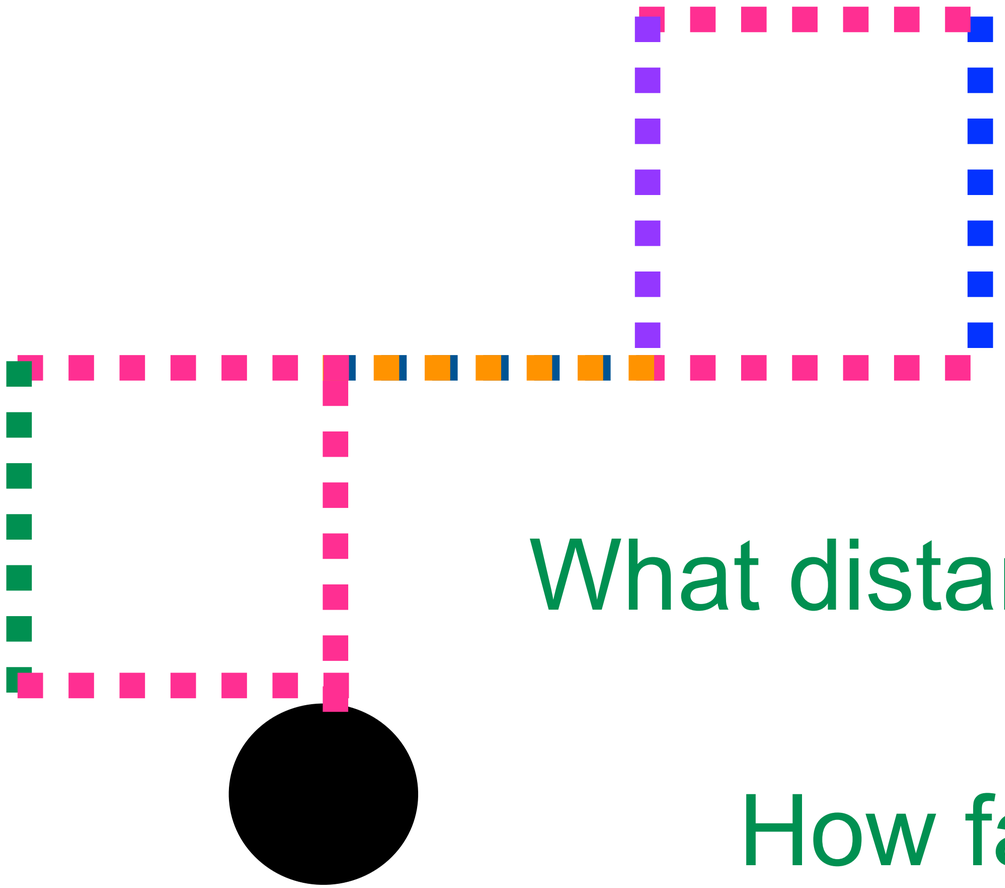
Define velocity as speed in a given direction
deceleration is negative acceleration.
*Understand that a scalar quantity has magnitude (size) only and that a vector quantity has magnitude and direction. Know that the following quantities are scalars: distance, speed, time, mass, energy and temperature
displacement v = s/t

**Put these amounts into two categories:**

**15°C  2m/s to the left  6kg  12m**

**8m/s² East  1cm  50N rightwards**

(Draw straight lines under some and wiggly lies under others?!)



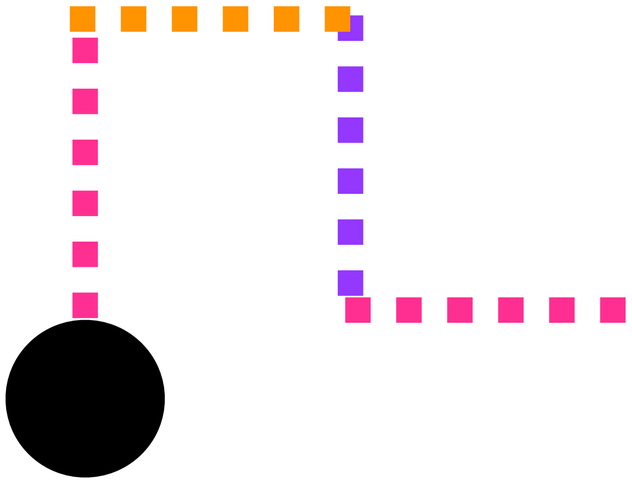
**Walk 1 step forward, 2 steps to the right, 1 step forward, 1 to the left, 1 step back, 2 steps to the left, 1 step back, and 1 step to the right.**

What distance have you covered?

How far have you gone?

How out of place are you?!

Distance travelled
= 4m



Displacement
= 2m **to the right**.

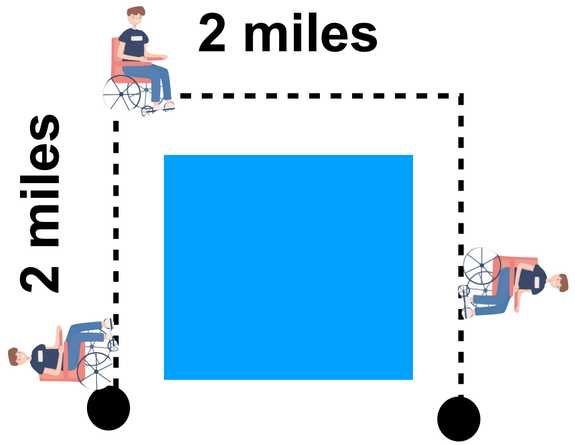
(Or “to the East” or “rightwards” or whatever)

Distance is a **scalar**. Scalars can be described with just a number and a unit.

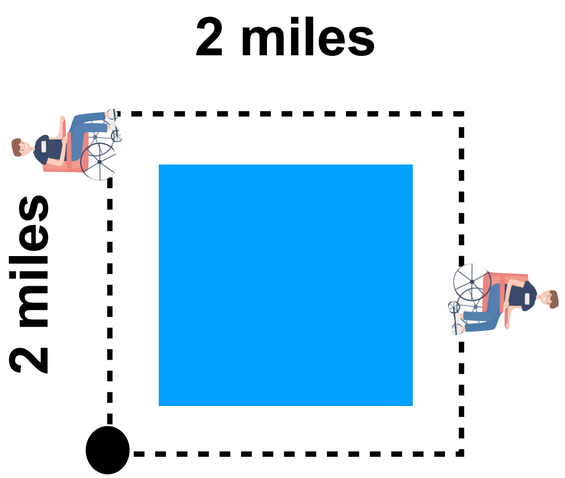
Eg: “2m” “3kg” “4cm”

Displacement is a **vector**. They have to be described with a number, unit and **direction**.

Sam strolls round a lake. Calculate the distance travelled **and** his displacement in these cases:



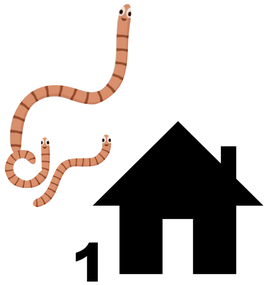

a. He gets 3/4 of the way round & gets picked up




b. He completes the circuit

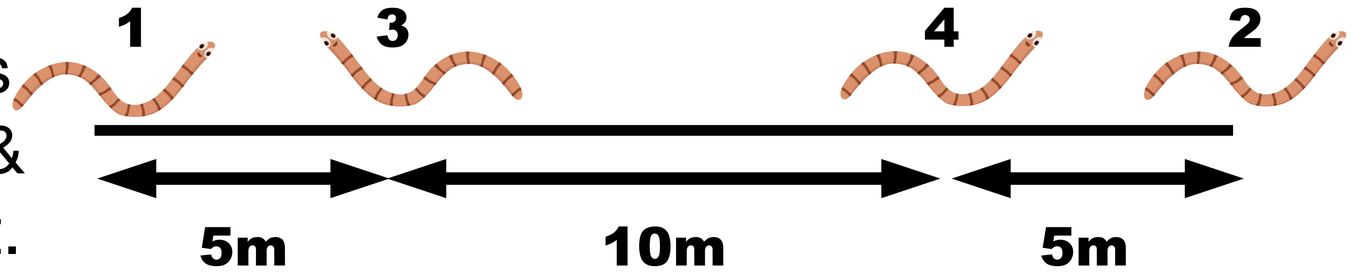
Wormy and kids go to the seaside, then return & camp in the garden.


Draw lines to show their distance travelled, and displacement from home.





Wormy's going bowling. She sets off from point 1, reaches point 2 & realises she's forgotten her wallet. She borrows money from someone at point 3, then goes to point 4.




Calculate the distance Wormy travelled, and her displacement.

# Theatre of Science IGCSE Physics
# Forces and Motion 4: Forces

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**To join in bring:**
Any ball (tennis, marble, rolled up paper!). String. Paper.

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This lesson will cover the following points:

| Edexcel Specification | | Cambridge Specification |
|---|---|---|
| Describe the effects of forces between bodies such as changes in speed, shape or direction | ⟷ | Know that forces may produce changes in the size and shape of an object |
| understand that force is a vector quantity | ⟷ | Know that an object either remains at rest or continues in a straight line at constant speed unless acted on by a resultant force |
| know that friction is a force that opposes motion | ⟷ | Same. And can cause a heating effect |

Images by vecteezy.com

# Is the force causing each change of movement a push or a pull? What's causing the force?

(You might not know! But thinking about it is great brain exercise and will help you remember the answer)

**Example: A ball stopping rolling across a carpet**

Push [x] Pull [ ]

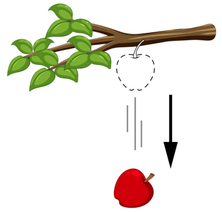
What exactly causes the force?
***Friction from the carpet***

## 1) Moving your arm from straight to bent

Push [ ] Pull [ ]

What exactly causes the force?

## 2. An apple falling from a tree



Push [ ] Pull [ ]

What exactly causes the force?

## 3. A bike braking

Push [ ] Pull [ ]

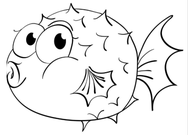
What exactly causes the force?

## 4. You stopping because you walked into a lamppost

Push [ ] Pull [ ]

What exactly causes the force?

## 5. Puffer fish going from un-puffed to puffed.



Push [ ] Pull [ ]

What exactly causes the force?

## 6. A frog's fart rising through a pond

Push [ ] Pull [ ]

What exactly causes the force?

## 7. A hot air balloon taking off

Hint - picture air as being lots of tiny balls floating the sky!

Push [ ] Pull [ ]

What exactly causes the force?

## 8. A poo coming out of a kitten

Push [ ] Pull [ ]

What exactly causes the force?

## 9. Coke coming out of can because your friend shook it and didn't tell you

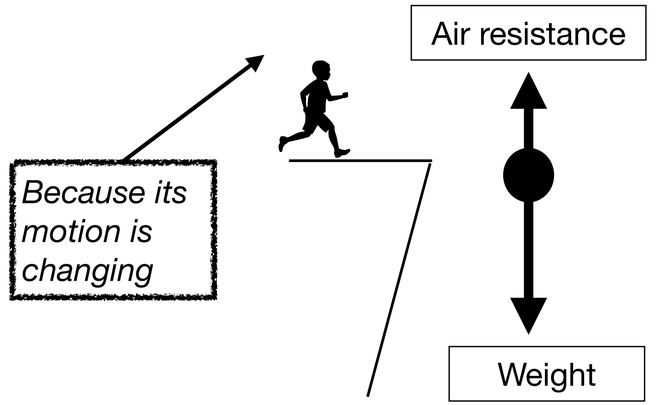
Push [ ] Pull [ ]

What exactly causes the force?

# Are the forces acting on these objects balanced or unbalanced?
# Finish labelling the forces using the words in the box

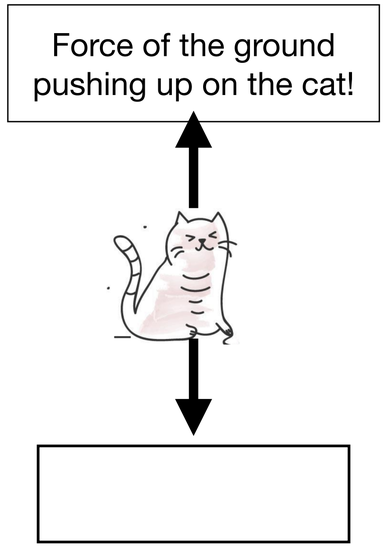
**Example:**
**Ball starting to fall off a cliff**

Unbalanced [X] Balanced [ ]




## 1. Cat sitting on a mat

Balanced [ ] Unbalanced [ ]

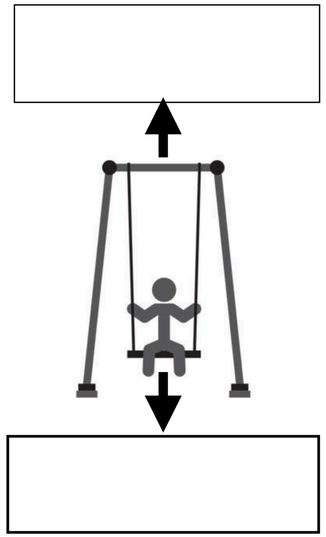



## 2. Pushing a trolley at three miles per hour.

Balanced [ ] Unbalanced [ ]


## 3. Sitting still on a swing

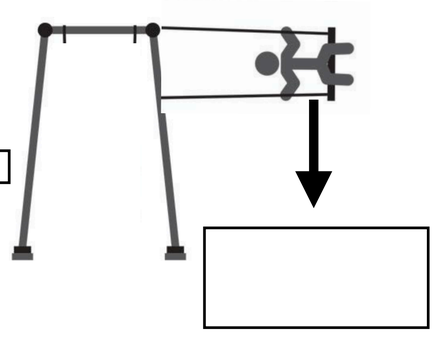
Balanced [ ] Unbalanced [ ]



## 4. At top of swing about to fall

Balanced [ ]

Unbalanced [ ]



## 5. Balloon starting to lift off

(You draw the arrows this time!)

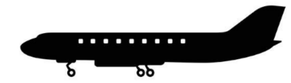
Balanced [ ] Unbalanced [ ]

Thrust of engine

## 6. Aeroplane speeding up in forwards direction

(Draw the arrows)

Balanced [ ] Unbalanced [ ]



**Use some words more than once!**

Push

Weight

Pull

Upthrust
(air pushing up)

Air resistance

If the _____ acting on a still object are balanced, it will _____. If the _____ acting on a moving object are _____, it will _____ _____ at the _____ _____.

stay still | moving | forces | balanced

forces | stop | same | keep | speed

# GCSE Questions

A car travels along a straight road.

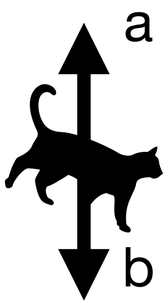
The forces on it are balanced.
Describe the movement of the car.

_____

_____

_____

A cat jumps to the ground.




A cat jumps to the ground. Forces a and b act on the cat. What is causing force a?

Friction
Weight
Gravity

# Theatre of Science IGCSE Physics
# Forces and Motion 5: Resultant Forces

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**To join in bring:** Washing up bowl of water, plastic bottle (no lid required!) that fits comfortably in the bowl and is covered by the water

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This lesson will cover the following points:

## Edexcel Specification

Understand that force is a vector quantity
Calculate the resultant force of forces that act along a line

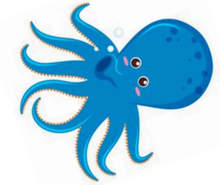
## Cambridge Specification

Same as Edexcel!
Know that an object either remains at rest or continues in a straight line at constant speed unless acted on by a resultant force

**1. Explain, by talking about the forces acting on an octopus, how it moves forwards.**

"An octopus fills its body with water, then…"

**These words might help; can you use them all?!**



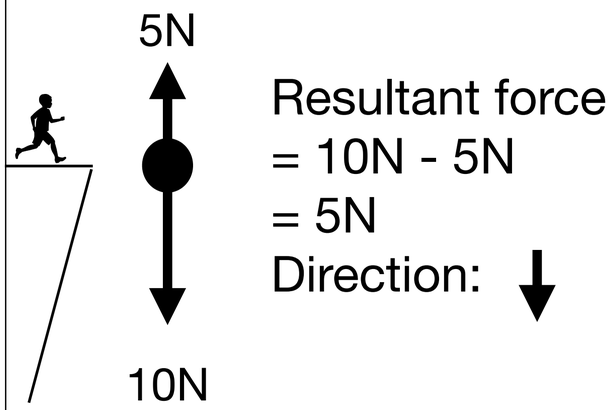
| | | | |
|---|---|---|---|
| Equal | Opposite | Force | |
| Forwards | Newton's third law | | |

**2. Draw a force diagram of ALL the forces acting on the octopus. Remember to show larger forces with longer arrows.**

**3. You push a ball. According to Newton's 3rd law, the ball pushes back with an equal and opposite force. So aren't the forces balanced? So why does the ball move? Explain! Or attempt to explain!**

# For each situation, state the resultant force and draw an arrow to show *the direction the force is acting*.

**Example:**
**Ball starting to fall off a cliff**




## 1. Supermarket trolley


Resultant Force = _____N

Direction:

## 2. Rolling hedgehog


Resultant Force = ____N

Direction:

## 3. Hot air balloon


Resultant Force = _____N

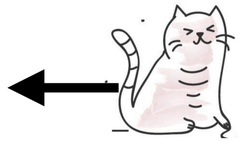
Direction:

## 4. Sledge


Resultant Force = ____N

Direction:

## 5. Cat sliding on ice




Resultant Force = ____N

Direction:

## Finished?

**a)**


Resultant Force = ____N

Direction:

**b)** Describe how the objects in 1 - 5 could be moving. Staying still, speeding up, slowing down, moving forwards, moving backwards? There's more than one choice for each!

# Theatre of Science IGCSE Physics
# Forces and Motion 6: Weight and Mass

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**To join in bring:** A4 paper, blue tack / play dough, a can of chick peas or similar with 'weight' written on it!

This lesson will cover the following points:

## Edexcel Specification

Know & use the relationship between weight, mass & gravitational field strength:
weight = mass × gravitational field strength
$W = m \times g$

## Cambridge Specification

- State that mass is a measure of the quantity of matter in an object at rest relative to the observer
- State that weight is a gravitational force on an object that has mass
- Describe, and use the concept of, weight as the effect of a gravitational field on a mass
- Define gravitational field strength as force per unit mass; recall and use the equation $g = W / m$ and know that this is equivalent to the acceleration of free fall
- State that the acceleration of free fall g for an object near to the surface of the Earth is approximately constant and is approximately $9.8 m/s^2$
- Know that weights (and masses) may be compared using a balance

A great example of the difference between the specs. They both want you to learn the same thing, but Cambridge have listed it in detail and Edexcel have left it brief.

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## Draw lines to match the description to the word

A scalar

Measured in kilograms (kg)

Measured in newtons (N)

A force

**Weight**

**Mass**

The same wherever you go

A vector

Different on different planets

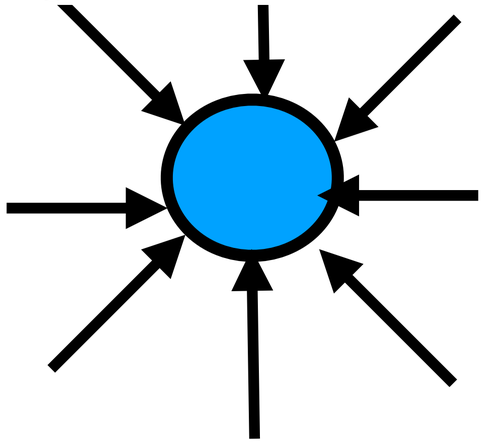
**Finished?**

1) Which planet do you think has the strongest gravitational field?

2) Think about / explain whether scales measure weight or mass.

3) Draw a force diagram to show the forces acting on the scales as you place an apple on them.

Gravitational field strength on… Earth = 10



moon = 2

Mercury = 4

Mars = 4

(It's been pointed out that Neptune's is 11. Should've checked my sources!)

Neptune = 14

Jupiter = 25

**Weight = mass x gravitational field strength**
(Write mass in kilograms (kg) & weight in newtons (N)

1) How much does a cat with a mass of 2 kg weigh on Neptune? (2 marks)

2) How much does an elephant with a mass of 100kg weigh on the moon? (2 marks)

3) A dog's weight on Earth is 10N. How much does it weigh on Jupiter? (2 marks)

4) Your mass on Mars is 40kg. What's your mass on Jupiter? (2 marks)

Finished?

a) Could you jump higher on Mars or on the moon?

b) Your weight on Earth is 40 newtons. How much more massive are you on Saturn?

A Level Question!!!
Out of interest.

**Weight = mass x gravitational field strength**
(Write mass in kilograms (kg) & weight in newtons (N)

NASA's Spae Launch System has a mass of 3kg. It will take off vertically with a thrust force of 40N. Show that the resultant force on the rocket is about 10N.

(Numbers have been changed to make things simpler for you!)

# Theatre of Science IGCSE Physics
# Forces and Motion 7: Terminal Velocity

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This lesson will cover the following points:

**To join in bring:** Tall, clear bottle filled with water. (Old ketchup/squash/wine bottle? A pint glass would do). Teaspoon of rice or similar small thing that will sink slowly in water!

## Edexcel Specification

Describe the forces acting on falling objects (and explain why falling objects reach a terminal velocity)

## Cambridge Specification

- State that the acceleration of free fall g for an object near to the surface of the Earth is approximately constant and is approximately 9.8m/s2
- *Describe the motion of objects falling in a uniform gravitational field with and without air/ liquid resistance (including reference to terminal velocity)

Another good example of the difference between the specs. They both want you to learn the same thing here, but Cambridge have listed it in detail and Edexcel have left it open. There are very few topics that only appear on one spec - I'll let you know when they come up. So no rush to pick which one you're doing.

# 1. Something in free fall is ONLY being acted on by the force of gravity. There are no air parties pushing against it; no air resistance. Which of these are in Free Fall?

Elephant falling to Earth from space where there are no air particles.

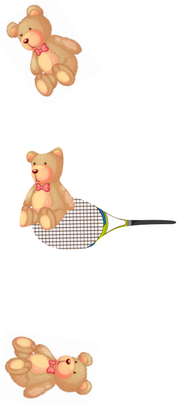
Freefall? _____

Monkey parachuting through the air

Freefall? _____

Kitten falling through the air with no parachute.

Freefall? _____



Teddy bear falling above Earth's atmosphere where there are no air particles, but you're falling with it and whack it upwards with a tennis racket every 5 seconds.

Freefall? _____

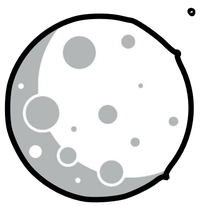
More to say?!

_____

_____

_____

_____



The Moon

Freefall? _____

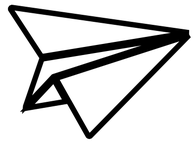
Your birthday present falling to Earth from space where there are no air particles. It's got a parachute on!

Freefall? _____

**Finished? Can you remember the TWO definitions of 'mass' we looked at last week?**
Write them down or saying them aloud:

## 2. A parachutist leaps out of a plane. Draw lines to put the descriptions of what happens to her in order, and draw force diagrams for stages 1, 3 and 4!

| | | |
|---|---|---|
| Until finally the force of the air resistance equals her weight. | 1 | |
| As her speed increases, air resistance increases… | 2 | |
| Because the forces on her are unbalanced, she accelerates downwards. | 3 | |
| The force of gravity (her **weight**) pulls her down and there is hardly any air resistance. | 4 | |
| This speed is called her terminal velocity. | 5 | |
| And increases! | 6 | |
| Now the forces on her are balanced, so she falls at a constant speed. | 7 | |



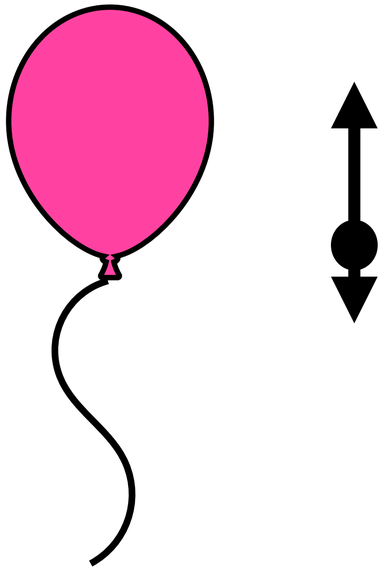
**Finished? Complete this explaining what happens when she opens her ‘chute.**

When the parachute opens, air resistance _____. So the _____ force is in the upwards direction. The parachutist _____ _____ . This means air resistance _____! Eventually the air resistance and _____ balance again, and the parachutist reaches a new, _____, _____ _____.

**3. Evil and brilliant iGCSE question!**

**A child lets go of a helium balloon. The upwards force acting on the balloon is 5N. The balloon's weight is 1N. Describe how the speed, acceleration and forces acting on the balloon change in the minute after the child lets go.**

**(4 marks)**



# Theatre of Science IGCSE Physics
# Forces and Motion 8: Hooke's Law

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This lesson will cover the following points:

## Edexcel Specification

practical: investigate how extension varies with applied force for helical springs, metal wires and rubber bands

know that the initial linear region of a force-extension graph is associated with Hooke's law

describe elastic behaviour as the ability of a material to recover its original shape after the forces causing deformation have been removed

## Cambridge Specification

- Define the spring constant as force per unit extension; recall and use the equation k = F x
- Define and use the term 'limit of proportionality' for a load–extension graph and identify this point on the graph (an understanding of the elastic limit is not required)

**To join in bring:** Small piece of bread! (about 2cm square would do!), or blue tack, or play dough. Elastic band. Scissors, scrap A4 paper.

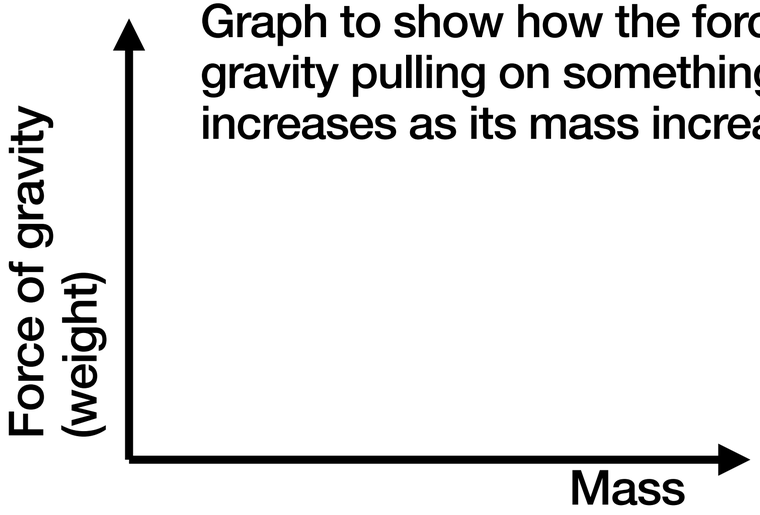
For the following relationships, sketch a simple graph. You may add numbers if you like.
In each case note: does the graph go through zero? Is it a straight line?

Graph to show how the water level of a pond changes as rainfall increases

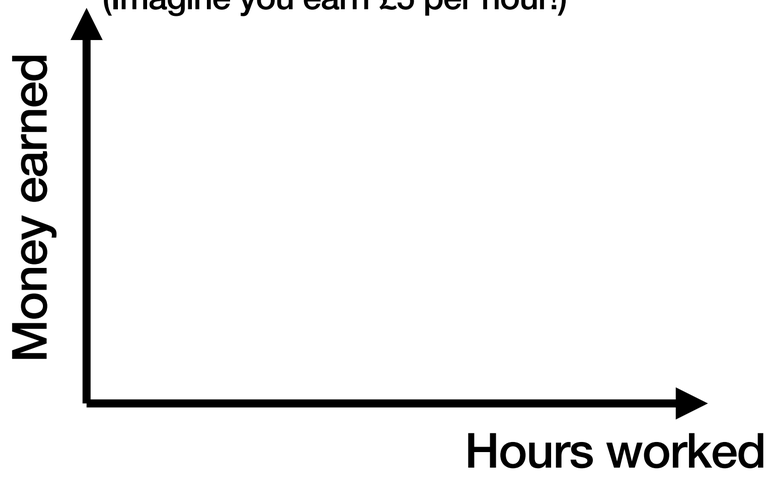

Graph to show how the amount of layers you wear changes as snowfall increases


Your own example of a straight line graph

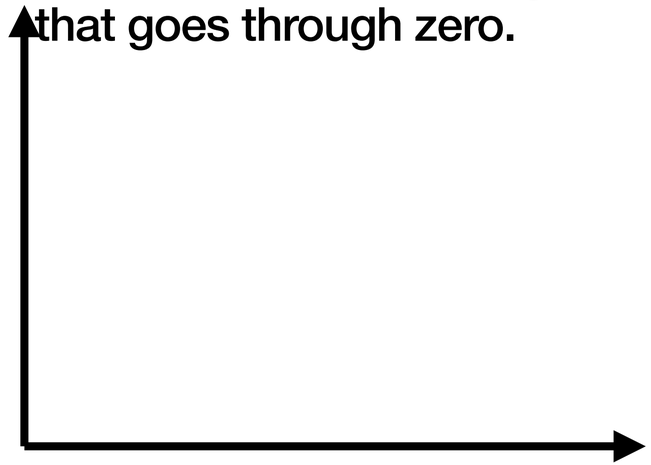
Graph to show how the force of gravity pulling on something increases as its mass increases




Graph to show how the amount of money you have increases as the time you work increases. (Imagine you earn £5 per hour!)

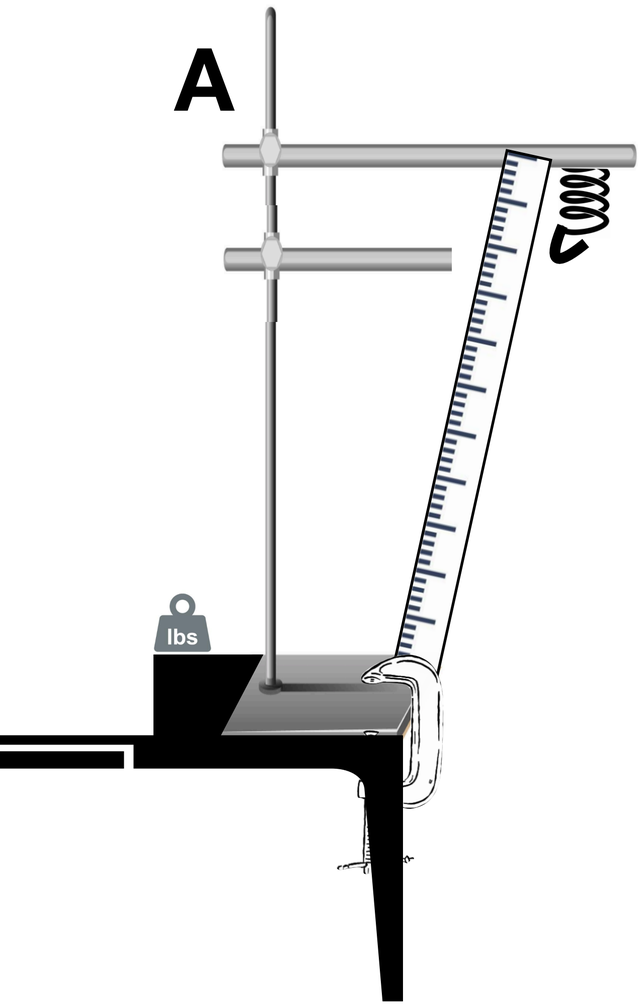



Your own example of a graph that goes through zero.



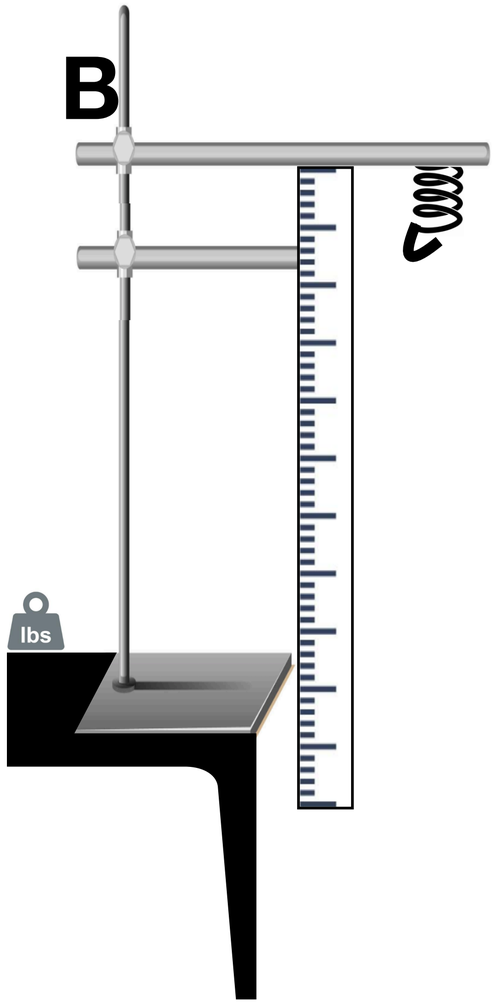
**Students A and B are about to collect their results. They've both made two mistakes.**

A




| Force (N) | Extension (cm) |
|---|---|
| | |

B




| Force | Length |
|---|---|
| | |

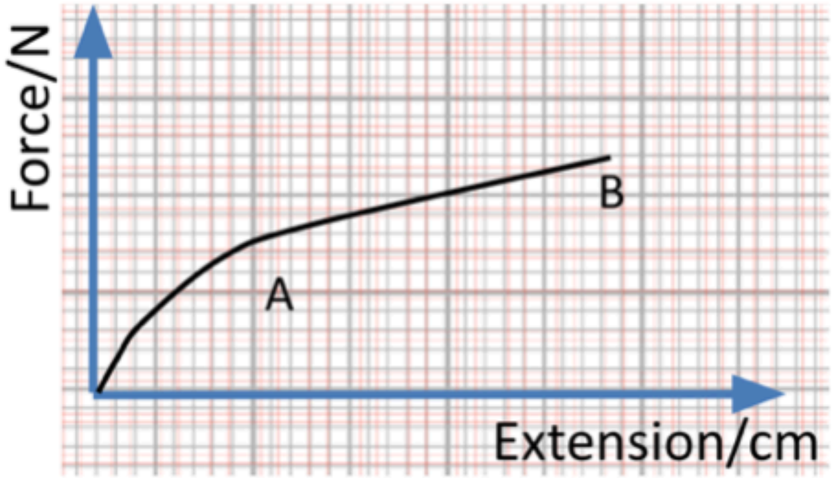
**Spot the mistakes and explain why it's important to correct each one.**

# iGCSE / A Level Questions

**What is Hooke's Law?**

2 marks

**A student investigates how a piece of gym equipment behaves. They draw this graph.**




The student notices that the graph is a straight line between points A and B and decides the gym item obeys Hooke's Law.

Does it obey Hooke's Law? Explain why / why not.

2 marks

Notes!

# Theatre of Science IGCSE Physics
# Forces and Motion 10: Momentum!

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**Bring: Pen, paper and a calculator**

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This lesson will cover the following points from BOTH specifications:

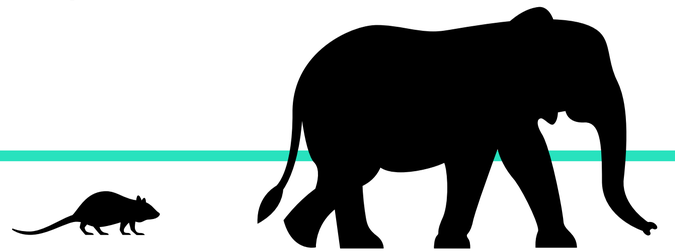
Know and use the relationship between momentum, mass and velocity:
momentum = mass × velocity $p = m \times v$
Use the conservation of momentum to calculate the mass, velocity or momentum of objects

**Starter question:** An elephant and a mouse charge towards you at a velocity of 5 meters per second.

**1)** Which one is going to hurt more?

**2)** Give a reason for your answer to 1)

**3)** Is anything wrong with my Starter Question, based on previous lessons?



# Momentum = Mass x Velocity

## Do!

A car with a mass of 1000kg travels at a constant 30 m/s. What is its momentum?

A cat running at 3m/s has momentum of 6 kg m/s. What is its mass?

## Do if time!

What's the momentum of a car with a mass of 2000kg travelling at 5 km/s?

A ball weighing 20N falls at 5 m/s. What is its momentum?

**Extra challenge:** Why is it mass not weight?!

# Momentum is always conserved

Momentum = Mass x Velocity

Momentum before = momentum after

A car of mass 500 kg travelling at 10m/s hits a stationary car of mass 2000 kg. They stick together but keep moving. What is their velocity after the collision?

500kg

2000kg

**Before**

**After**

**Before**

# Theatre of Science IGCSE Physics
# Forces and Motion 11: Impulse!

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**Bring: Calculator, few sheets scrap paper.**

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This lesson will cover the following points:

## Edexcel Specification

- use the relationship between force, change in momentum and time taken: change in momentum force time taken = F = (mv - mu) / t

## Cambridge Specification

- Define resultant force as the change in momentum per unit time; recall and use the equation $F = \Delta p / \Delta t$

- Define impulse as force × time for which force acts; recall and use the equation impulse = $F\Delta t = \Delta(mv)$

**First Question:** Your friend loves physics (WHO DOESN'T?!) They see these equations and say "Ooh, what do those letters mean?". Give your best explanation*! Out loud! Include their units!

$$v^2 = u^2 + 2as$$

$$v = u + at$$

$$p = mv$$

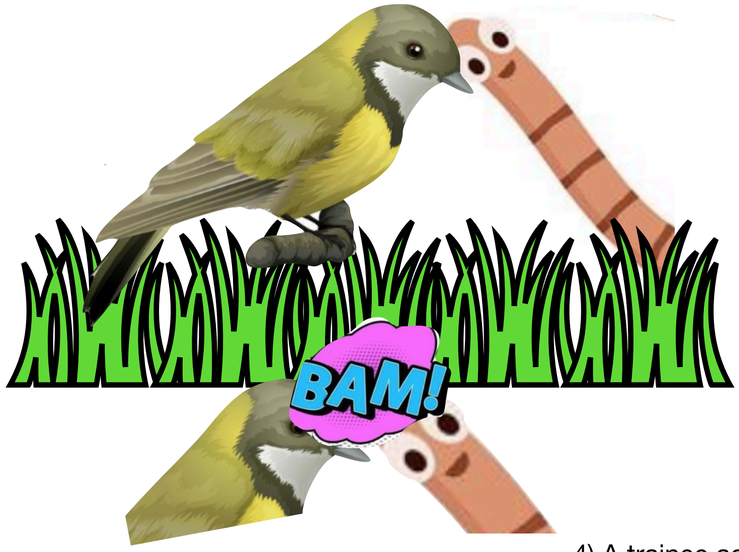
$$F = ma$$

*Not THE best, YOUR best! It might be terrible. That doesn't matter. This is just to make you aware of what you know/don't know and fuse a few neurons together before we start.

# Try these!

$$Ft = m\triangle v$$

$$p = mv$$




A bird is at rest, thinking about eating Wormy. She whacks it on the head.

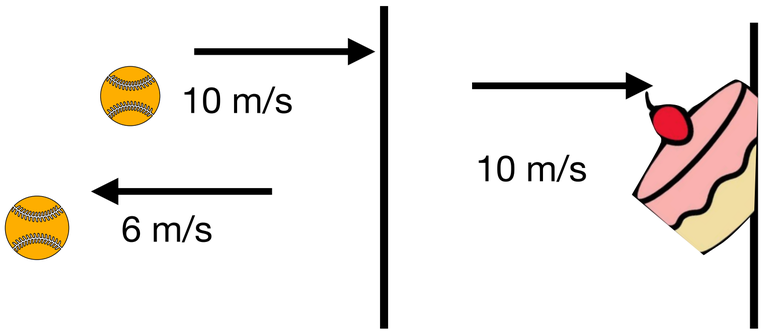
1) If the bird's head has a mass of 0.5kg, and moves away from Wormy at 6m/s, what was its change in momentum?

2) What impulse was delivered to the bird's head?

3) If Wormy was in contact with the bird's head for 3 seconds, how much force did she hit it with?

4) A trainee acrobat has a mass of 60kg and travels at 3m/s. What is his momentum?

5) He splats into a padded wall with a force of 45N. How long does it take him to stop?







6) A ball hits a wall at 10 m/s and bounces off at 6 m/s. A cake hits a wall at 10 m/s and sticks to it. Which one has the biggest change in velocity? Careful!

# Theatre of Science IGCSE Physics
# Forces and Motion 12: Moments!

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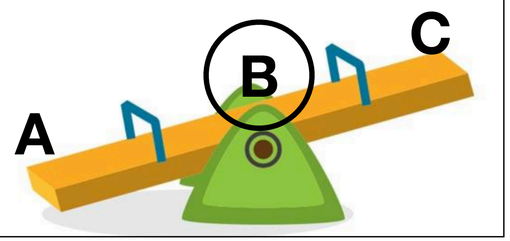
Both the Edexcel and Cambridge specifications need you to know what a ‘moment’ is in physics, and for you to be able to use and explain the equation. I’m not saying anything else because I want you to do a lot of working out today!

**Bring: Calculator, tablespoon.**

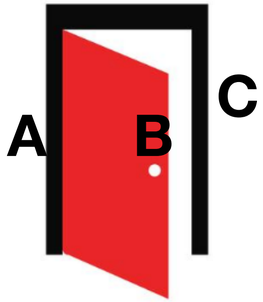
# Where's the pivot?

**Write down or circle the letter nearest the pivot.**

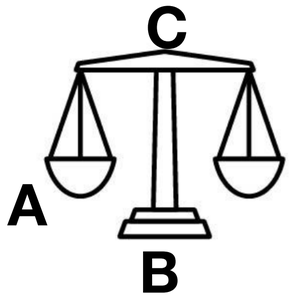
**Example: See-saw**



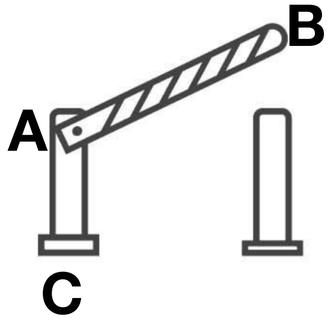

**1. Door**



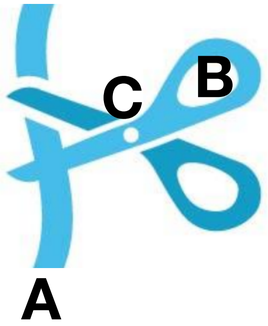

**2. A balance**



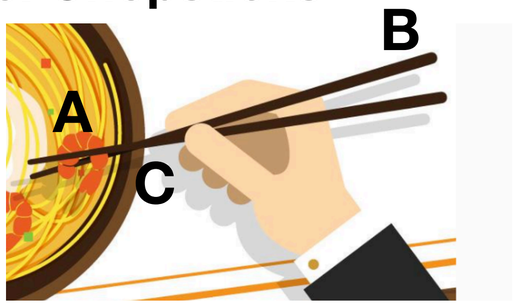

**3. This thing**



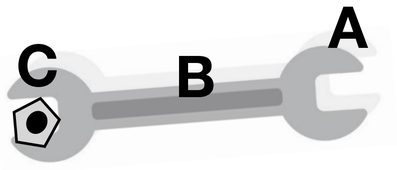

**4. Scissors**




**5. Chopsticks**




**6. Spanner**




**Finished?**

1) What words might complete this sentence?

"A seesaw is still when the turning forces are _____ and _____".

Small, large, adjacent, equal, opposite, pushing, pulling, squirrel?

2) Explain your answer above with reference to Newton's Law.

3) Equation for how strong a turning force is:

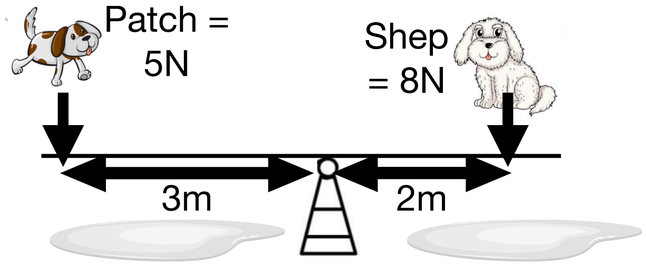
Turning force = _____ x _____

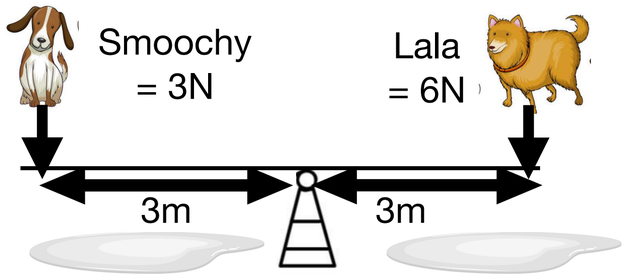
Think about what might go in the gaps. Imagine putting a weight on a seesaw. What two things would affect whether it turned?

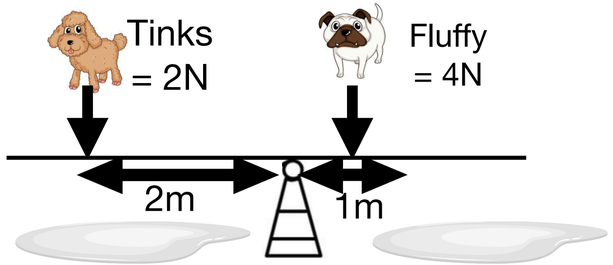
# Calculate the moments

Dogs fall onto seesaws. Who gets dunked?

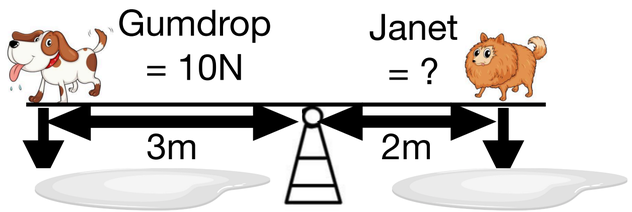
Moment = force x distance

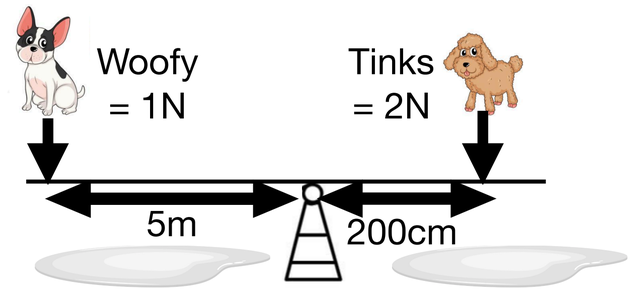


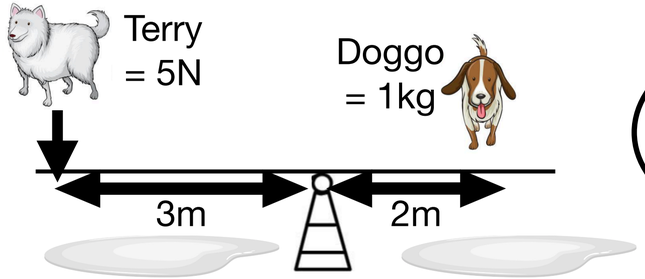




These dogs are balanced. How much does Janet weigh?

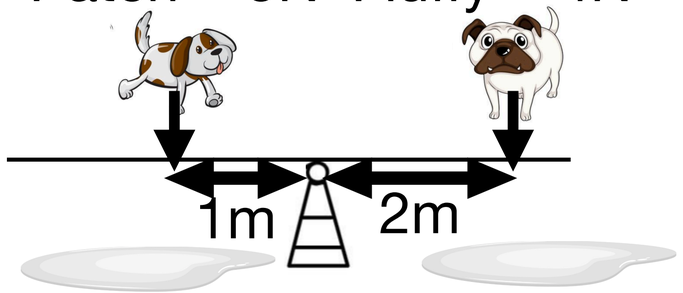



## Example

Patch = 5N  Fluffy = 4N




Anticlockwise moment = force x distance

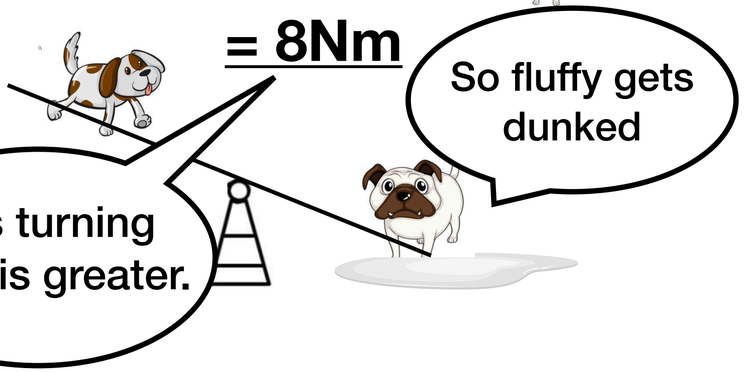
= 5N x 1m

= **5Nm**

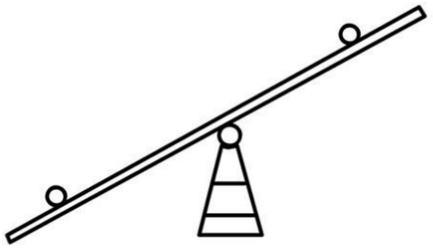
Clockwise moment = force x distance

= 4N x 2m

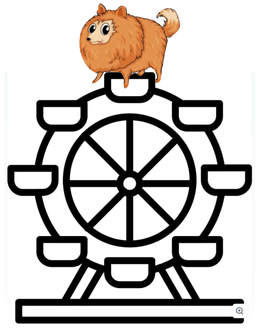
= **8Nm**

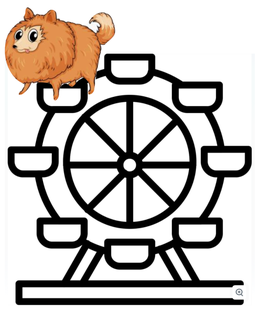


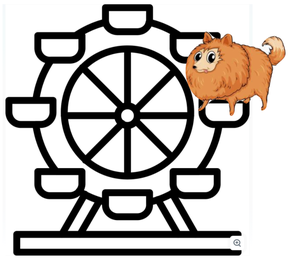
The balls are the same distance from the pivot, and the same size. Explain how one can have caused the seesaw to turn.



**Which wheel experiences the greatest moment if the dogs are identical?**







# Theatre of Science IGCSE Physics
# Forces and Motion 13: Centre of Mass

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The following will be covered in today's lesson:

**Bring: cereal box or similar size box, paper, scissors, pin, sellotape, cotton thread, blob of blue tack / play dough**

## Edexcel

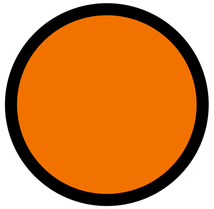
know that the weight of a body acts through its centre of gravity

## Cambridge

State what is meant by centre of gravity
Describe an experiment to determine the position of the centre of gravity of an irregularly shaped plane lamina
Describe, qualitatively, the effect of the position of the centre of gravity on the stability of simple objects

1. Spanner

2. Ball



3. Janet

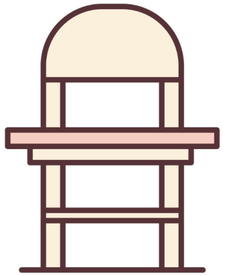
4. Donut

5. Balance

6. A book

7. Double decker bus

8. Highchair



**B. Draw a NON symmetrical shape on a piece of paper and cut it out.** How could you find the centre of mass of it using the materials you've brought to this lesson?

**C. How does the centre of mass of the highchair change when a baby sits in it?**
**And the bus when there are people on it?**
**Does this present any problems?**

# Finding the centre of mass of an irregular object

1. Put these steps in the right order.

1 Place the needle in any other part of the card.

2 Place a needle through any part of the card.

5 Repeat the above steps again

7 Make sure that the card “hangs loose”

3 Mark dots along the plumb line.

4 Wait until the card has stopped moving

6 Hang a plumb line on the needle

2. Sketch a diagram of the completed activity.

3. How might you get a candle to balance on a Christmas tree branch?! Sketch some ideas!

# Theatre of Science IGCSE Physics
# Forces and Motion 14: Resolving Vectors

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The following will be covered in today's lesson:

**Bring: Paper, ruler, pencil, calculator with sin, cos and tan on it**

## Edexcel

- describe the factors affecting vehicle stopping distance, including speed, mass, road condition and reaction time

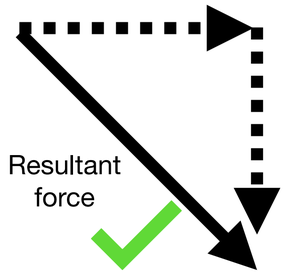
- know that the stopping distance of a vehicle is made up of the sum of the thinking distance and the braking distance

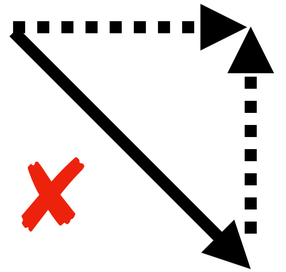
- understand that force is a vector quantity

## Cambridge

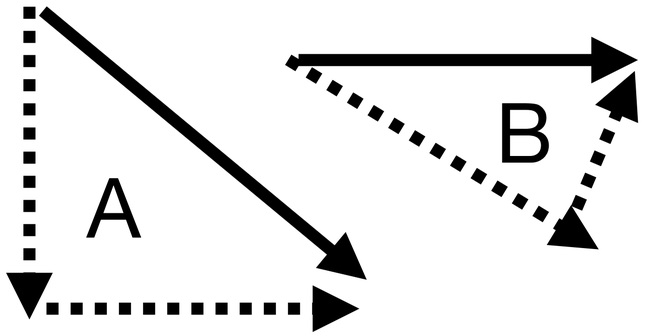
Determine, by calculation or graphically, the resultant of two vectors at right angles, limited to forces or velocities only

Eg



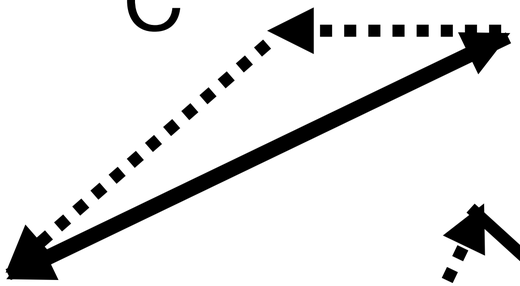



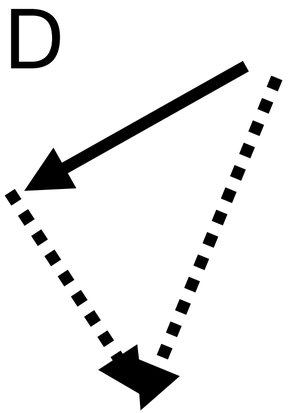
1. Which diagrams show a correct resultant force?

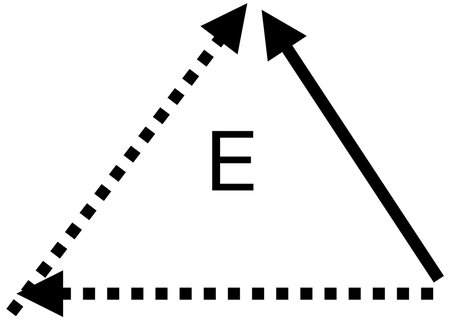


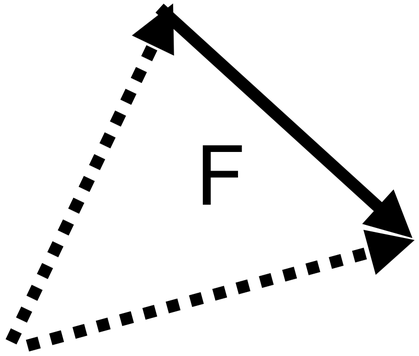







2. For those that are wrong, rearrange the vectors to correct them.

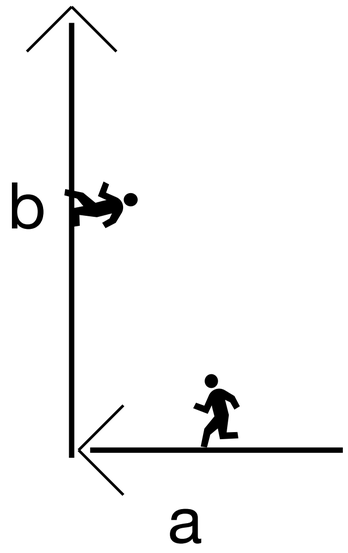
**Try these**

1. A girl runs 4 miles west, then 6 miles north.

What is her displacement?

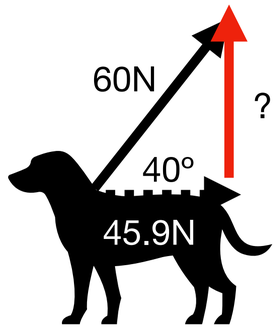
- Calculate your answer by drawing a diagram on your paper. (Use a scale of 1cm = 1 mile)

- Then work out the answer using $a^2 + b^2 = c^2$




2. If she runs at 4 m/s west, then 6 m/s north, what's her resultant velocity?

3. A dog's lead is pulled with a force of 60N at an angle of 40°. If the horizontal component of the force is 45.9N, what is the vertical component?

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https://www.physicsclassroom.com/class/vectors/Lesson-1/Vector-Resolution