


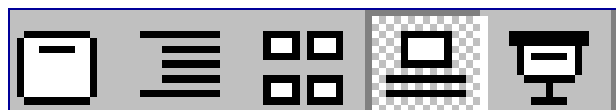
KS4 Speed and Acceleration



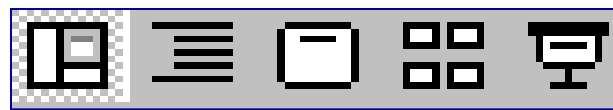
Teacher's Notes

A slide contains teacher's notes wherever this icon is displayed - 

To access these notes go to 'Notes Page View' (PowerPoint 97) or 'Normal View' (PowerPoint 2000).




Notes Page View



Normal View

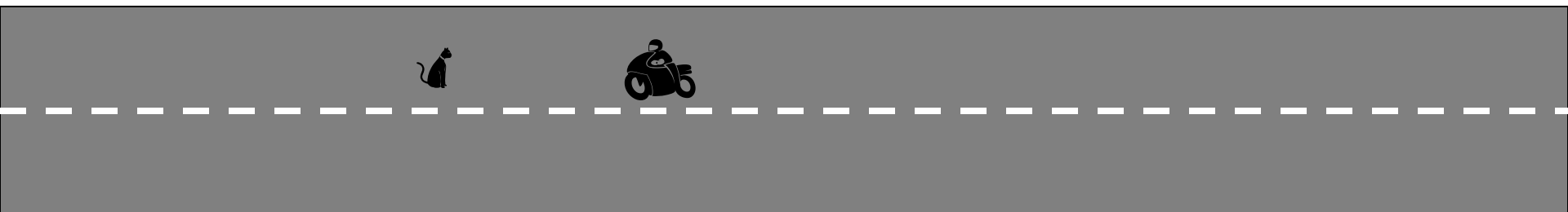
Flash Files

A flash file has been embedded into the PowerPoint slide wherever this icon is displayed - 

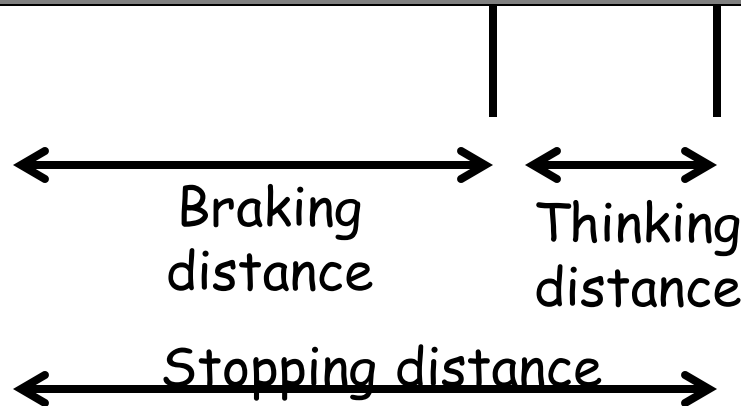
← These files are not editable.



How long does it take a moving vehicle to stop?



The **braking distance** is the distance a car travels before the brakes are applied.



Stopping distance = thinking distance + braking distance



Can you match up the words with their definitions?

Stopping distance

One of forces the road exerts on the tyres as the car is stopping.

Friction

The distance a car travels whilst it is braking.

Thinking distance

The distance a car travels before the brakes are applied.

Braking distance

The sum of thinking distance and the braking distance.



What factors affect braking and thinking distance?

Thinking distance	Braking distance
Speed of car	Speed of car
Drugs and alcohol	Road conditions
Tiredness	Condition of tyres
Medication	Condition of brakes

Medication

Condition of tyres

Speed of car

Drugs and alcohol

Road conditions

Tiredness

Condition of brakes



Braking car question:

A car is moving along an open road. Suddenly, a sheep walks into the road.

- a) What do we call the distance the car travels before the driver puts their foot on the brakes?

Thinking distance

- b) Name one factor that could increase the distance the car travels in this time.

Medication, drugs/alcohol, speed of car, tiredness

- c) The braking distance is 35m for the car. If the stopping distance is 50m, how far did the car travel before the driver put their foot on the brakes?

Thinking distance = Stopping distance – braking distance

= 50m – 35m

= 15m



This graphing experiment shows a movie of a car travelling along a straight road.

Copy the results table shown on the next slide and complete it as the movie is played.

Record the distance the car has travelled every five seconds.

Then graph your results.

Note that there are teacher's notes, in "Notes View" on this slide.



See teacher's notes



Results
table for
Distance /
Time
Graph

Time/Seconds	Distance/Metres
0	
5	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	





Dashboard timer
(seconds) 0:00:00

Distance travelled
(metres) 0

25 50 75 100 125 150 175 200

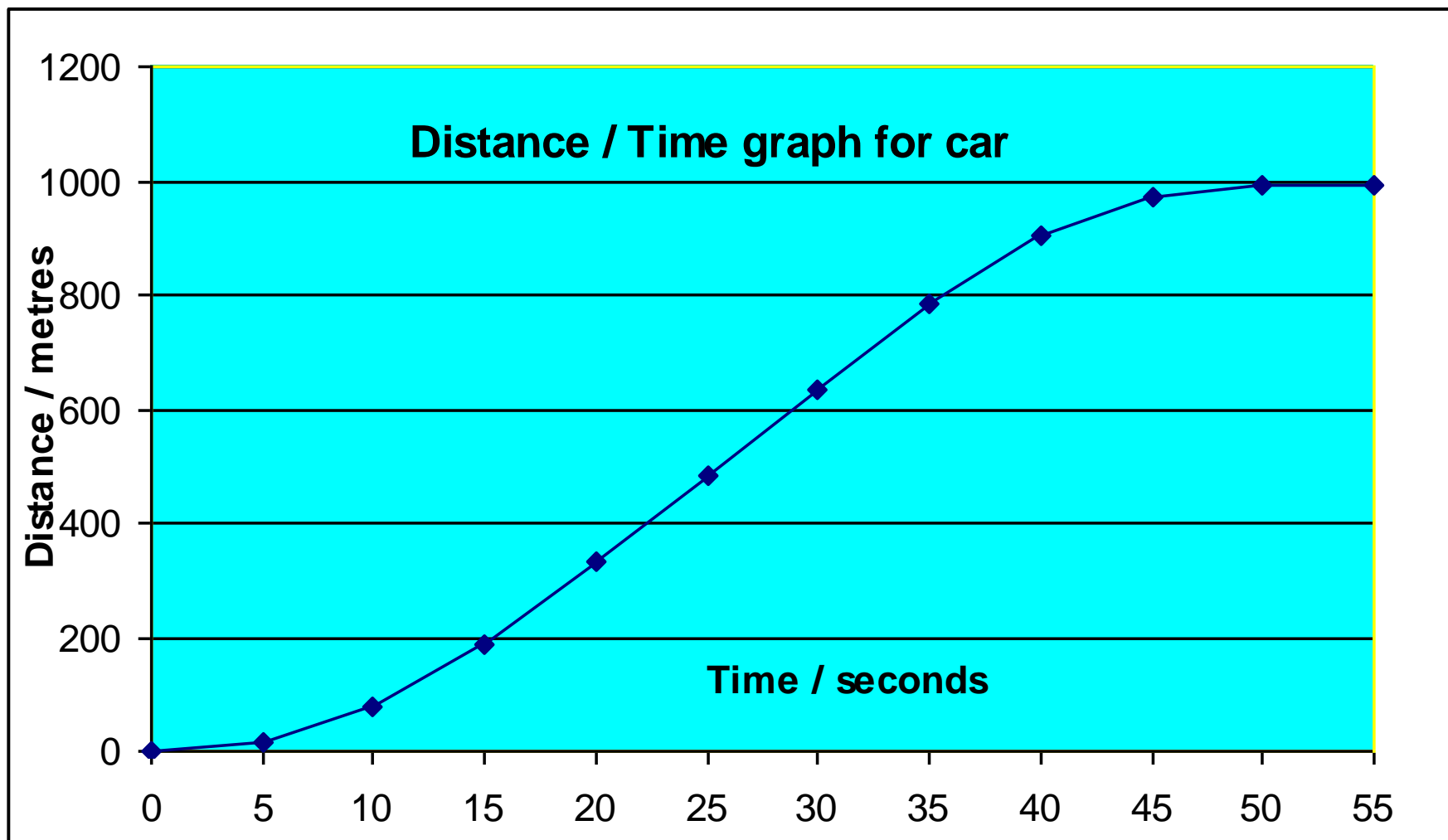
Kilometres per hour

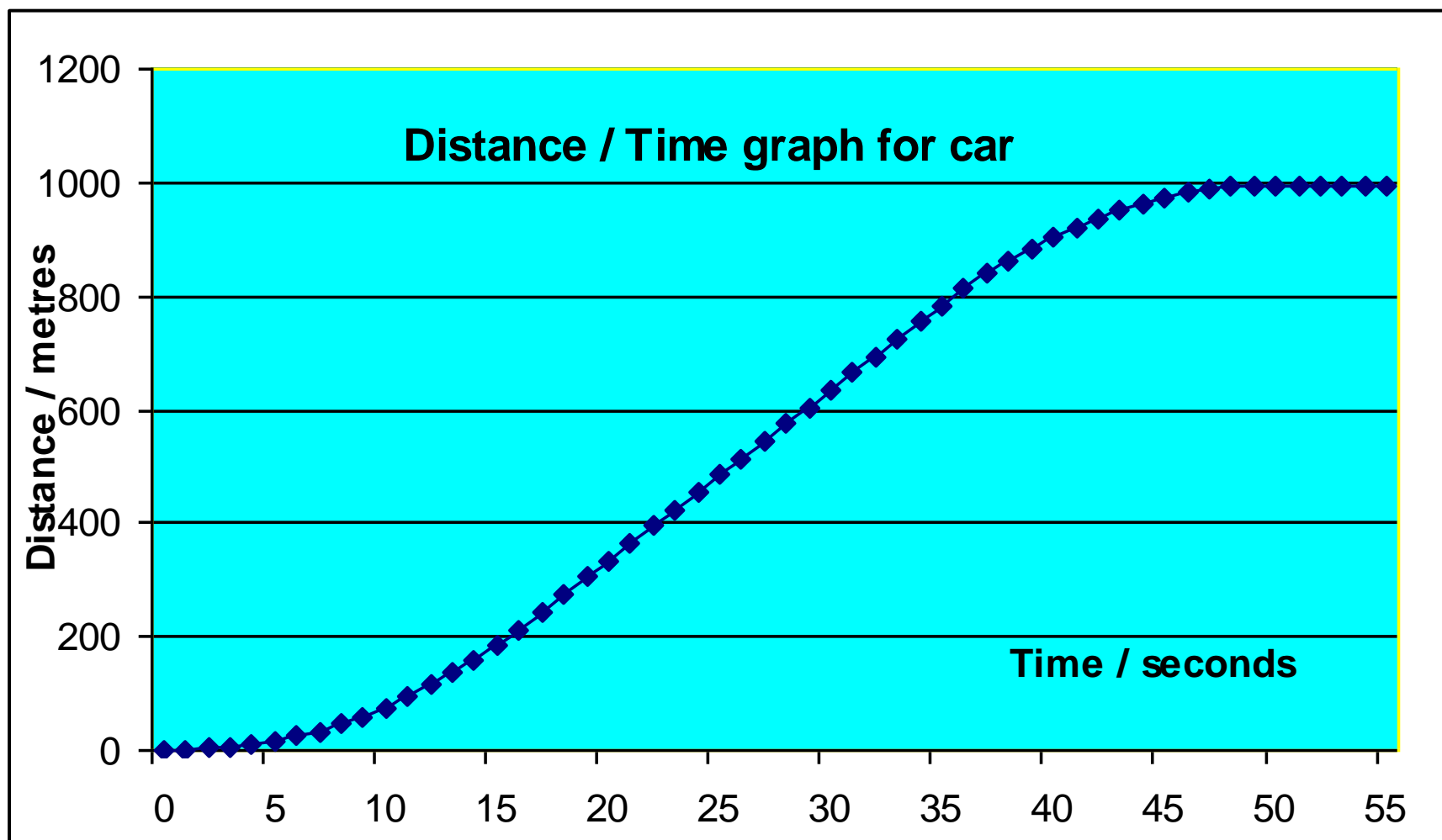
Speed
(metres per second) 0

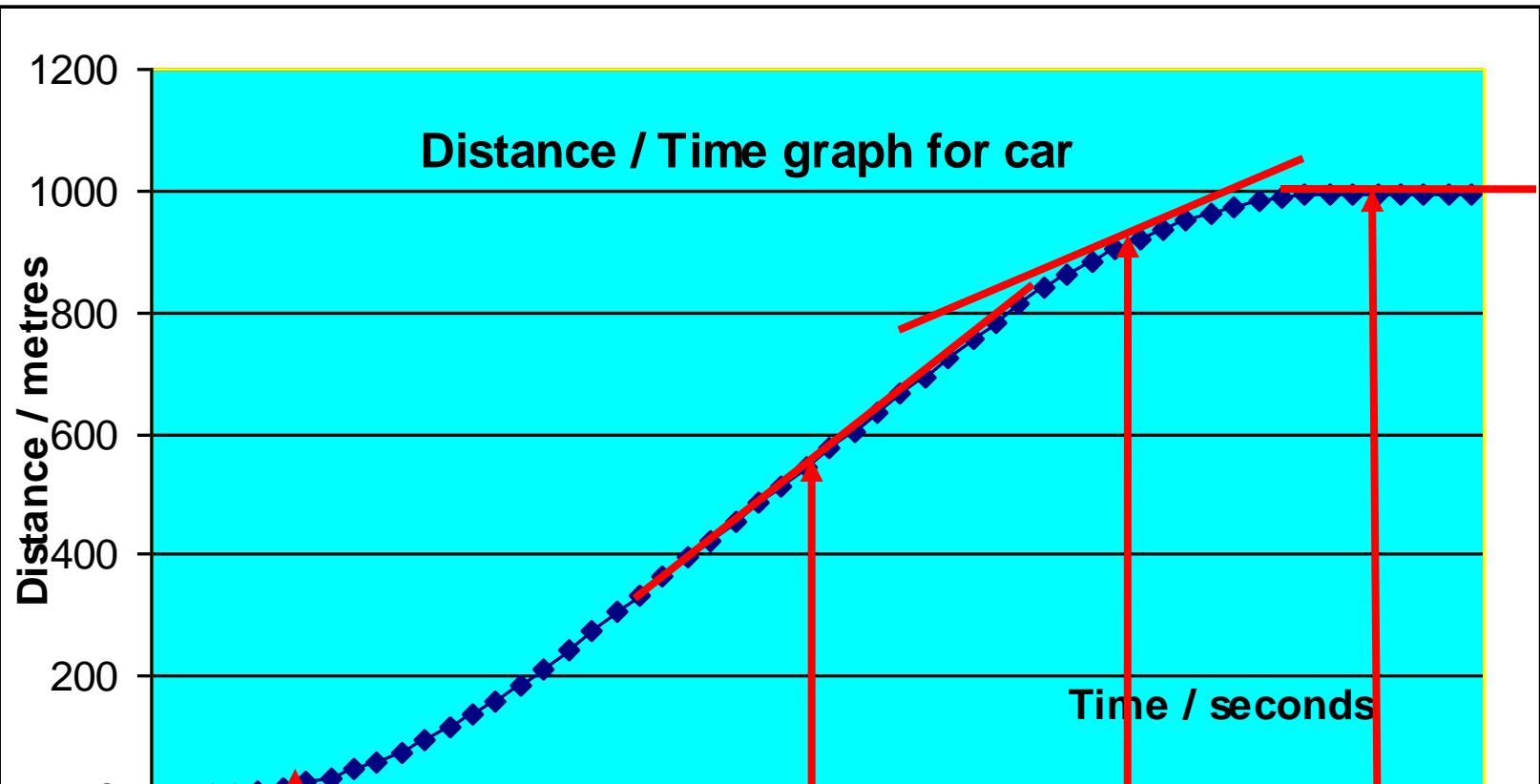
Results
table for
Distance /
Time
Graph

Time/Seconds	Distance/Metres
0	0
5	16
10	76
15	186
20	234
25	484
30	634
35	784
40	904
45	974
50	994
55	994









The car has stopped:
The line is flat, the distance of the car from the start point is constant.

The car is starting to move
The line is curved in this region of the graph.

The car is going fast but at a constant speed.
The line is straight in this region of the graph.

The car has stopped at the end of the movie.
The line is flat in this region of the graph.



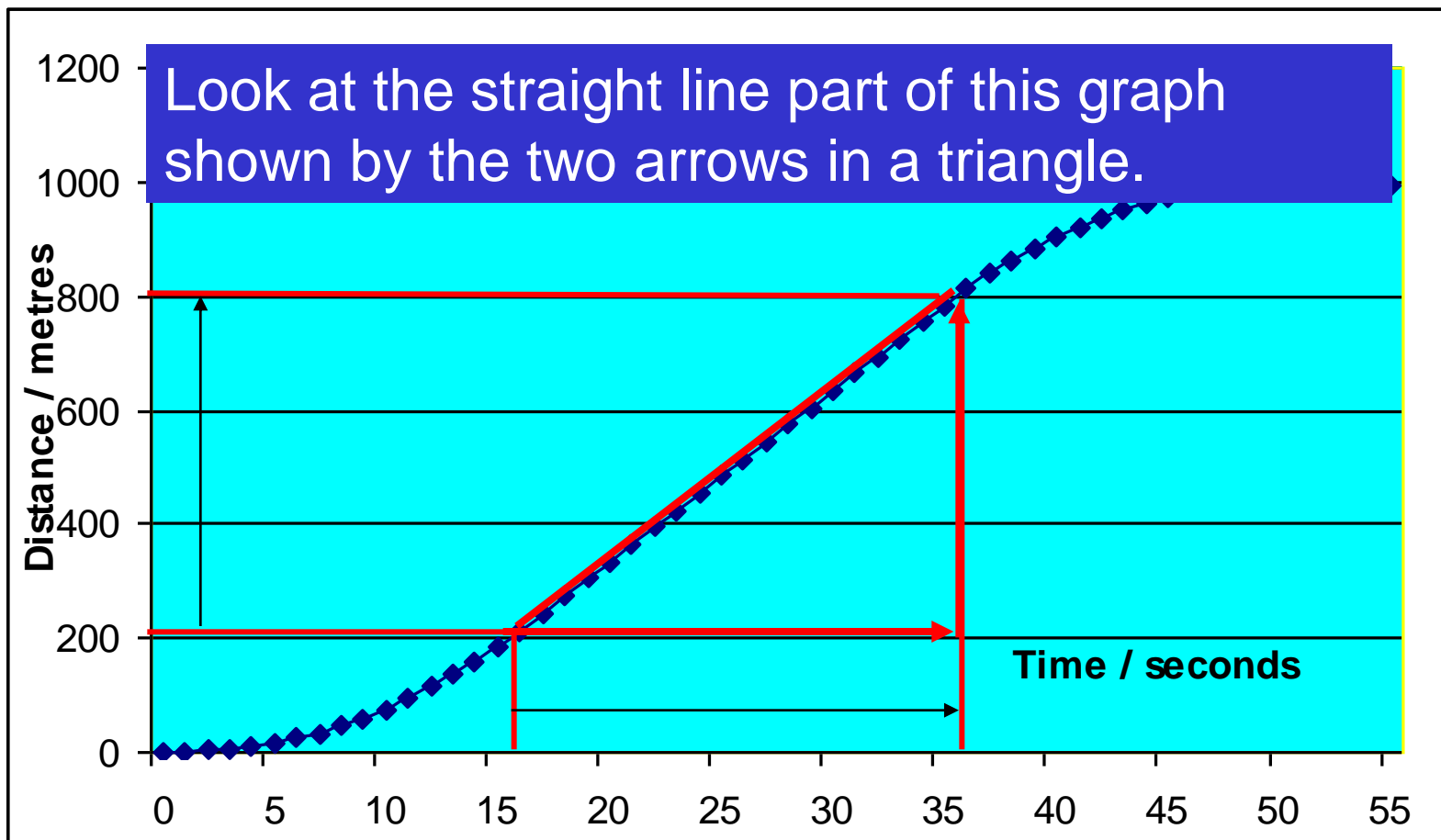
Gradient of a Distance / Time Graph

The speed of the car can be calculated by looking at the gradient of the Distance / Time graph.

Speed is “Distance Travelled divided by Time Taken”

Both these values can be read off the Distance / Time graph, and this is the same as the gradient of the line.





The car has travelled from 200m to 800m, = 600m

The car has taken from 16s to 36s to travel this distance = 20 seconds

Therefore the speed is 600 divided by 20 = 30 m/s

Having looked at the distance-time graph, plot the speed-time graph.

Copy the results table shown on the next slide and complete it as the movie is played.

Record the speed of the car at five second intervals.

Then graph your results.



Results
table for
Speed /
Time
Graph

Time/Seconds	Speed/m/s
0	
5	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	





Dashboard timer
(seconds) 0:00:00

Distance travelled
(metres) 0

25 50 75 100 125 150 175 200

Kilometres per hour

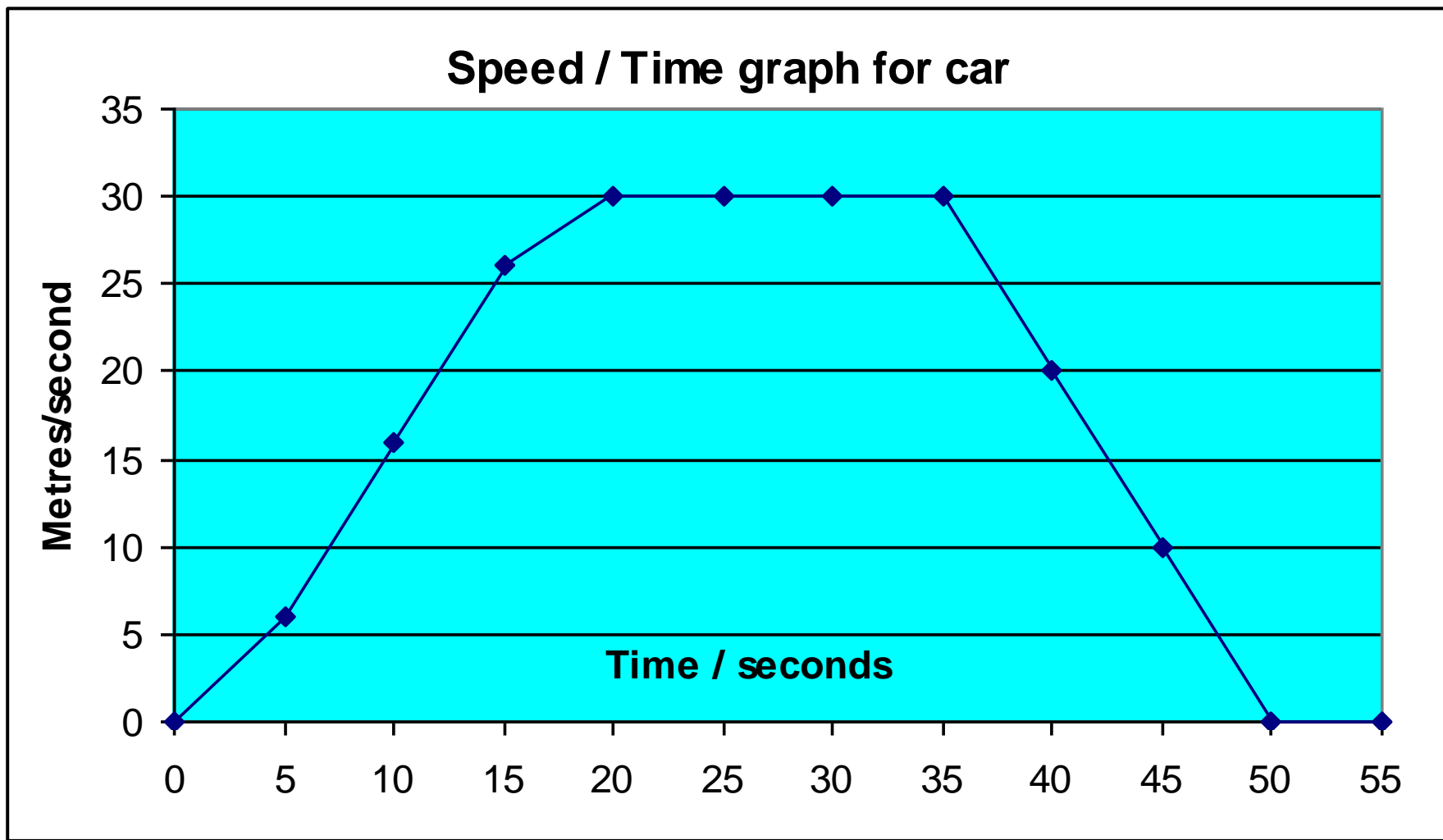
Speed
(metres per second) 0

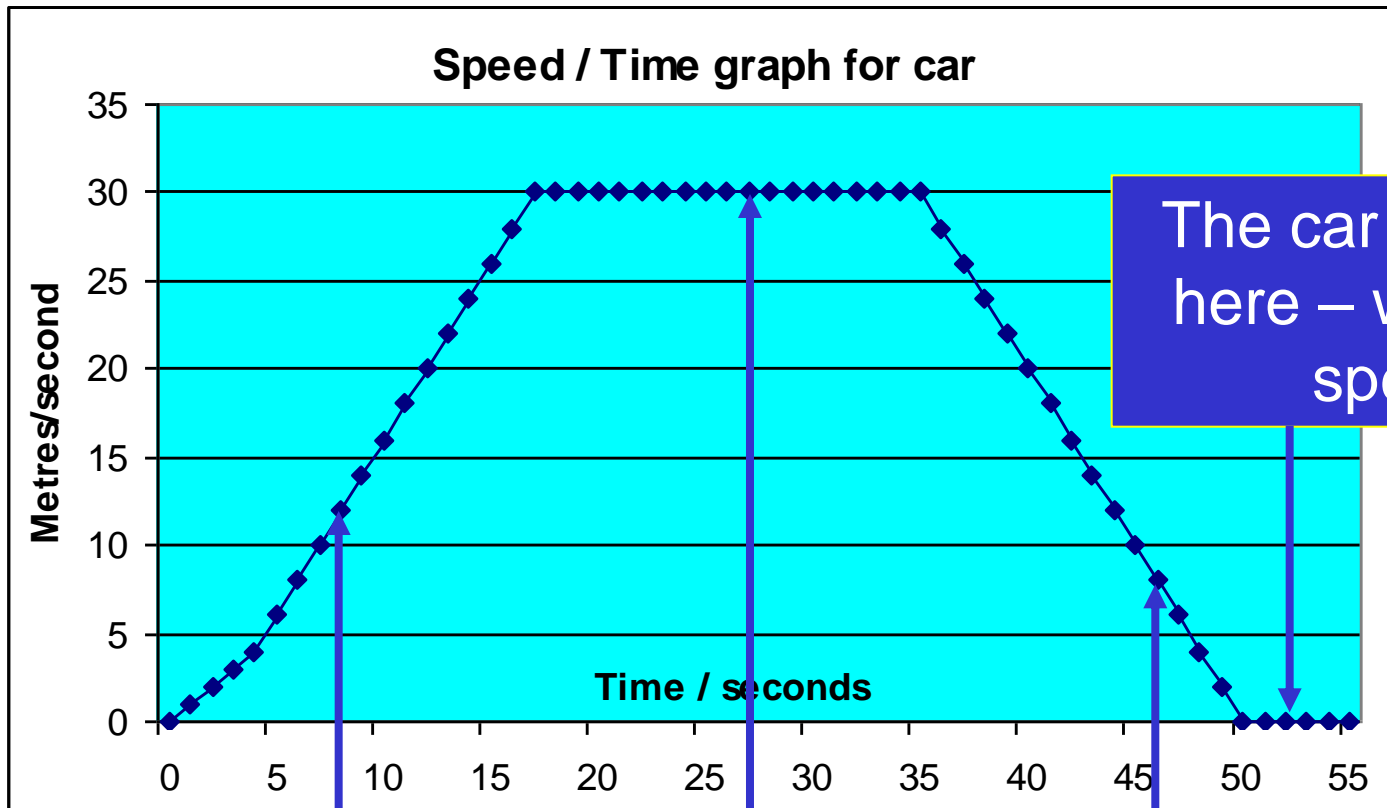
Results
table for
Speed /
Time
Graph

Time/Seconds	Speed/m/s
0	0
5	6
10	16
15	26
20	30
25	30
30	30
35	30
40	20
45	10
50	0
55	0



Speed / Time graph for car





The car is at rest here – with zero speed

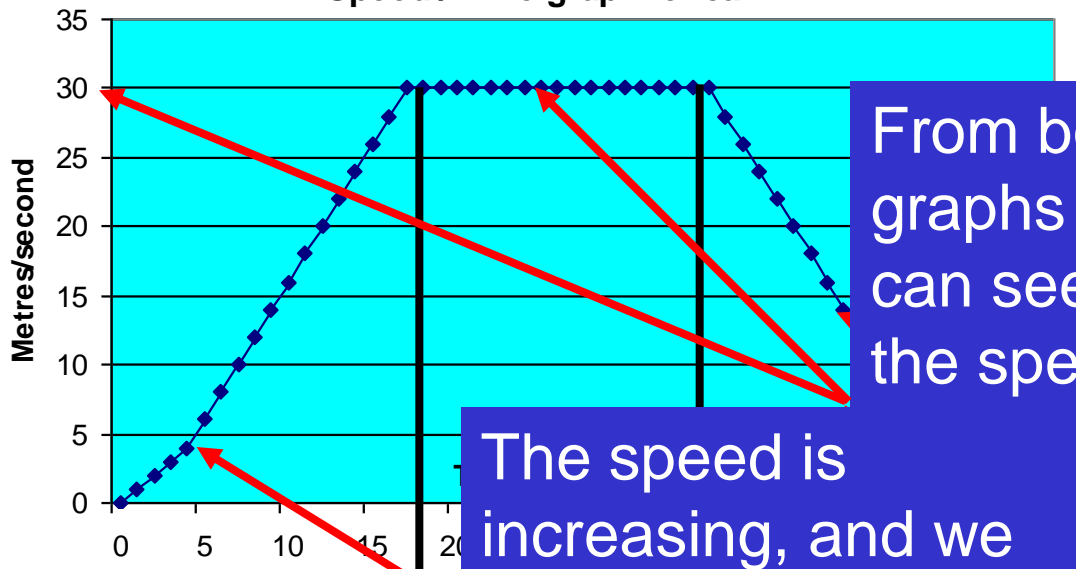
Car is accelerating here – the speed is increasing.

The car is going at constant speed – acceleration is zero.

The car is decelerating here – or slowing down

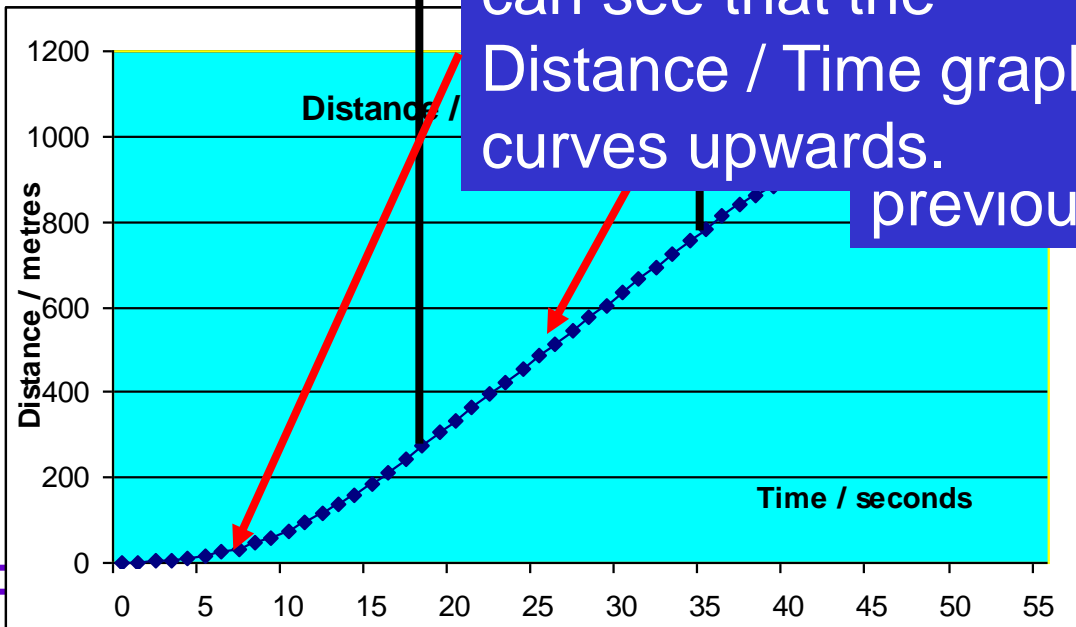


Speed / Time graph for car



From both graphs we can see that the speed is

The speed is increasing, and we can see that the Distance / Time graph curves upwards.



speed is zero – or is not changing (previously) we can see the distance the car has travelled is not changing either.



$$S=d/t$$

We can express the speed formula using the equation:

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

$$S = d/t$$

Speed measured in metres per second (m/s)

Distance measured in metres (m)

Time measured in seconds (s)



Formula triangles help you to rearrange formula, the triangle for the speed formula is shown below:

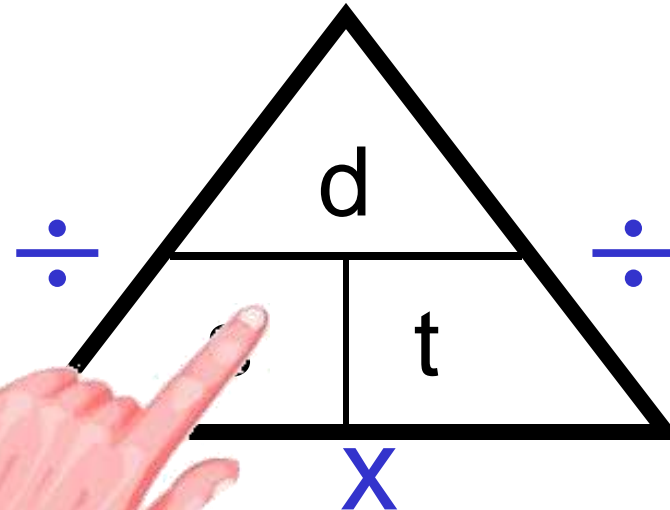
Whatever quantity you are trying to find cover it up and it will leave you with the calculation required.

So if you were trying to find speed, s.....

...you would cover s up...

...and you are left with the sum...

$$s = \frac{d}{t}$$



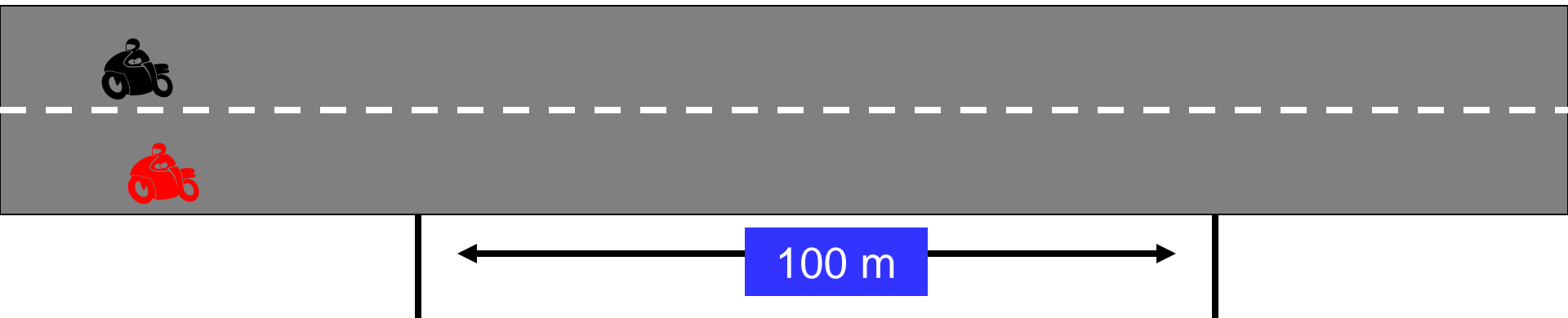


Formula triangle

The diagram shows a red formula triangle with a yellow border. At the top vertex is the letter 'D'. At the bottom-left vertex is the letter 'S', and at the bottom-right vertex is the letter 'T'. A multiplication sign 'x' is located in the center between 'S' and 'T'. Two division signs '÷' are positioned between 'D' and 'S', and between 'D' and 'T'. To the right of the triangle is a large, empty white rectangular area within the same blue border.



Use the speed formula, $s = d/t$, to calculate the speeds of various vehicles, say down the road.
Measure the time it takes vehicles to cover the distance of various vehicles.



Measure the speed of at least 20 vehicles and then represent your data graphically.



We can express the formula for acceleration using the equation:

$$\text{Acceleration} = \text{Change in velocity} \div \text{Time taken}$$

$$a = c/t$$

Acceleration is measured in metres per second per second (m/s^2)

Change in velocity is measured in (m/s)

Time measured is in seconds (s)



Formula triangles help you to rearrange formula, the triangle for the acceleration formula is shown below:

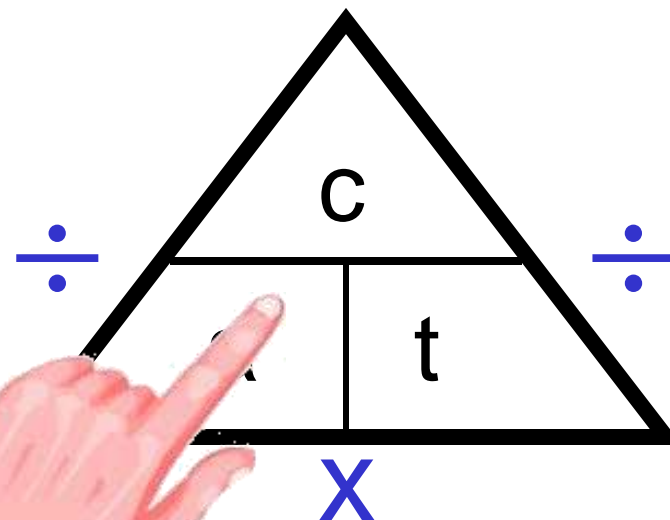
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...and you are left with the sum...

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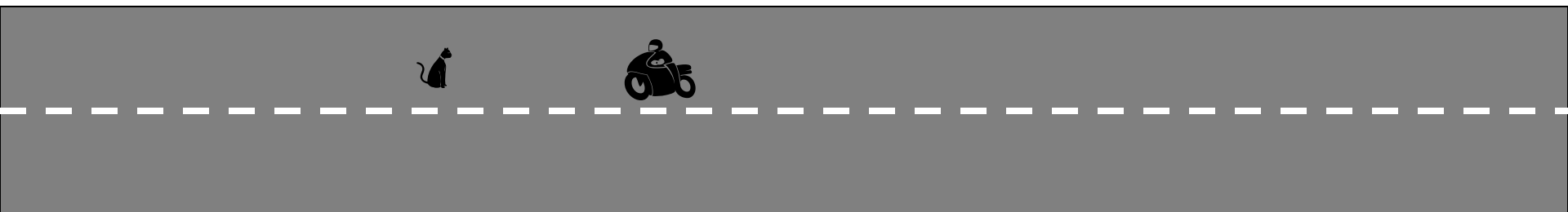
1. A car travels a distance of 100 metres in 20 seconds.
What is the speed of the car? 5 m/s
2. A bike travels at a speed of 20 m/s for 20 seconds.
How far does the bike travel in this time? 400 m
3. A girl runs for a distance of 120 m at a speed of 6 m/s.
How long does it take her to cover this distance? 20 s
4. A car travels at 30 m/s for 2 minutes. How far has it travelled in this time? 3 600 m
5. A car travels at 30 km/hour. How far, in metres, will the car cover in 90 seconds? 750 m



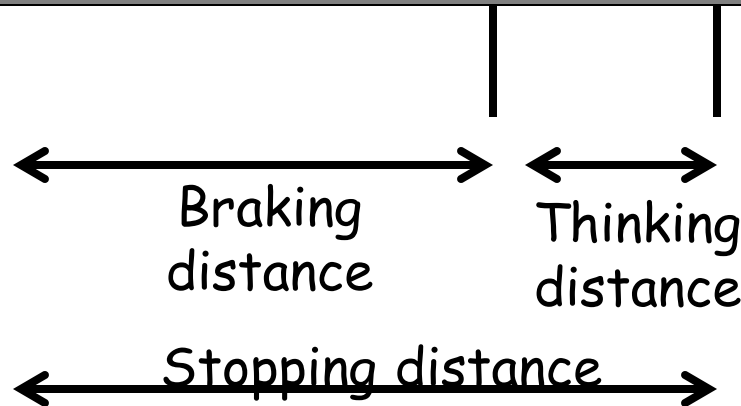
1. A car changes its velocity by 30 m/s in 5 seconds, what is the acceleration of the car? 6 m/s²
2. A bike starts from rest and accelerates to 20 m/s over a period of 6 seconds. What is the acceleration of the car? 3.33 m/s²
3. A man moving at 2 m/s accelerates at a rate of 3 m/s² for 2.5 seconds. What is the new velocity of the man? 9.5 m/s
4. A car decelerates from 60 m/s to 20 m/s at a rate of -5 m/s². How long does this deceleration take the car? 8 seconds



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Condition of tyres

Speed of car

Drugs and alcohol

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