SMILE WORKCARDS

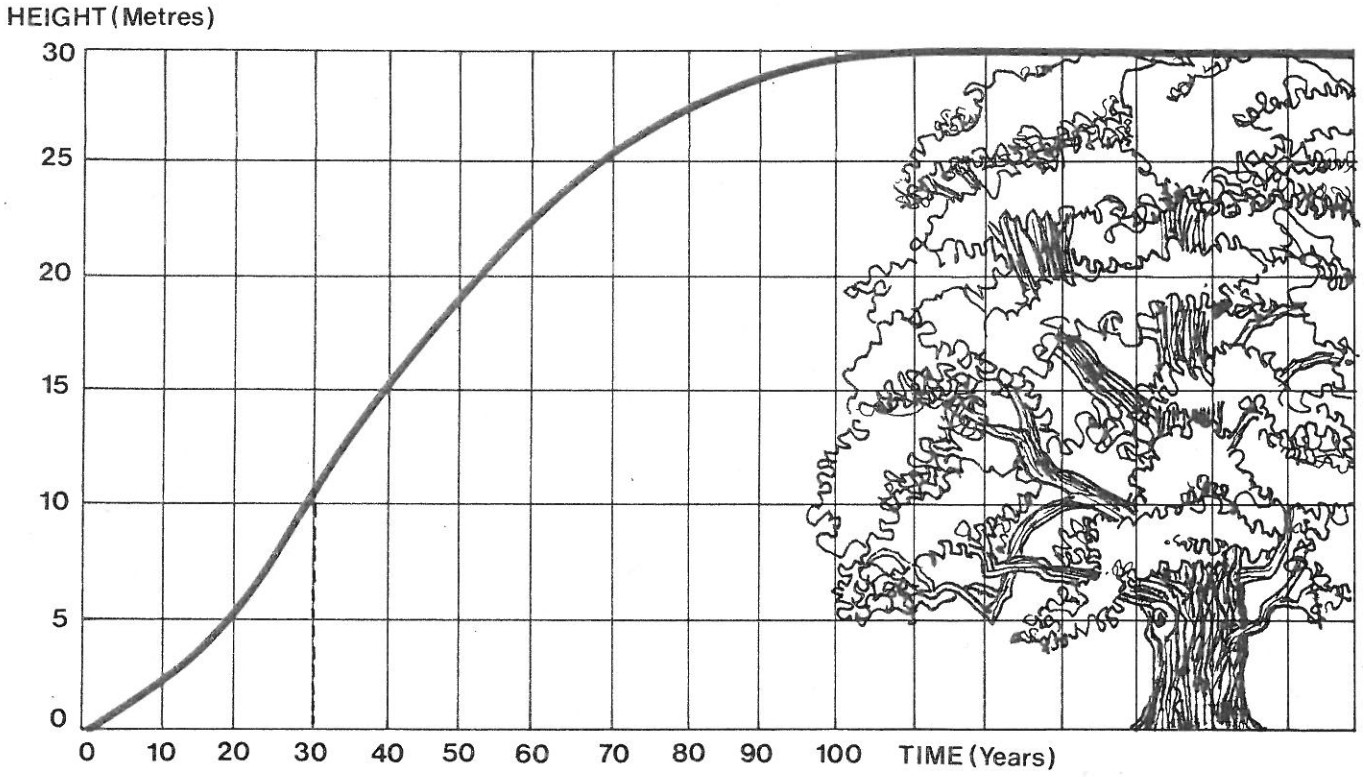
Using Graphs Pack One

Contents

SMILE

0889

Old Oak



The graph shows the growth of an oak tree, from an acorn to a full-grown tree.

1) How tall is the oak tree when full-grown?
Do you know a building which is 30m high?

2) How tall is the oak after 30 years?

3) How tall is the oak after 10 years?

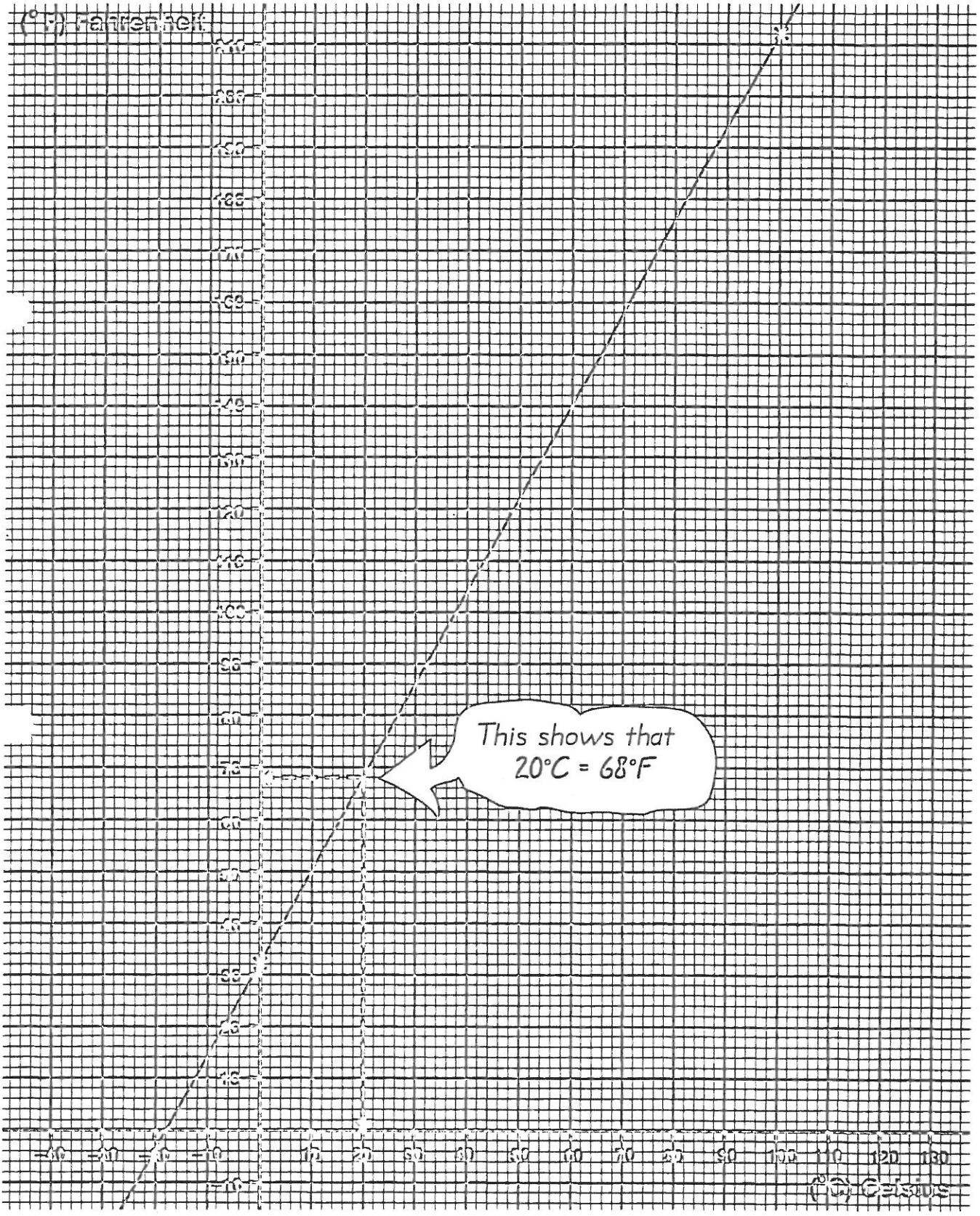
4) How long does the oak take to grow 15m?

5) How long does the oak take to grow 18m?

6) When does the oak become full-grown?
How much does the oak tree change in 10 years?

Graphs

This is a temperature conversion graph. It can be used to convert degrees Celsius (°C) to degrees Fahrenheit (°F) and degrees Fahrenheit to degrees Celsius.



A Make a copy of the **temperature conversion graph** on graph paper.

Check that on your graph

1) 36°F = 2°C 2) −17°C = 2°F

Now use your conversion graph to convert the following temperatures. *Give all your answers to the nearest 2°.*

B Convert these temperatures from degrees Celsius (°C) to degrees Fahrenheit (°F).

1) 70°C 4) 94°C

2) 2°C 5) 38°C

3) 14°C 6) 74°C

C Convert these temperatures from degrees Fahrenheit (°F) to degrees Celsius (°C).

1) 60°F 4) 166°F

2) 116°F 5) 82°F

3) 204°F 6) 152°F

Conversion graphs can also be used for converting:

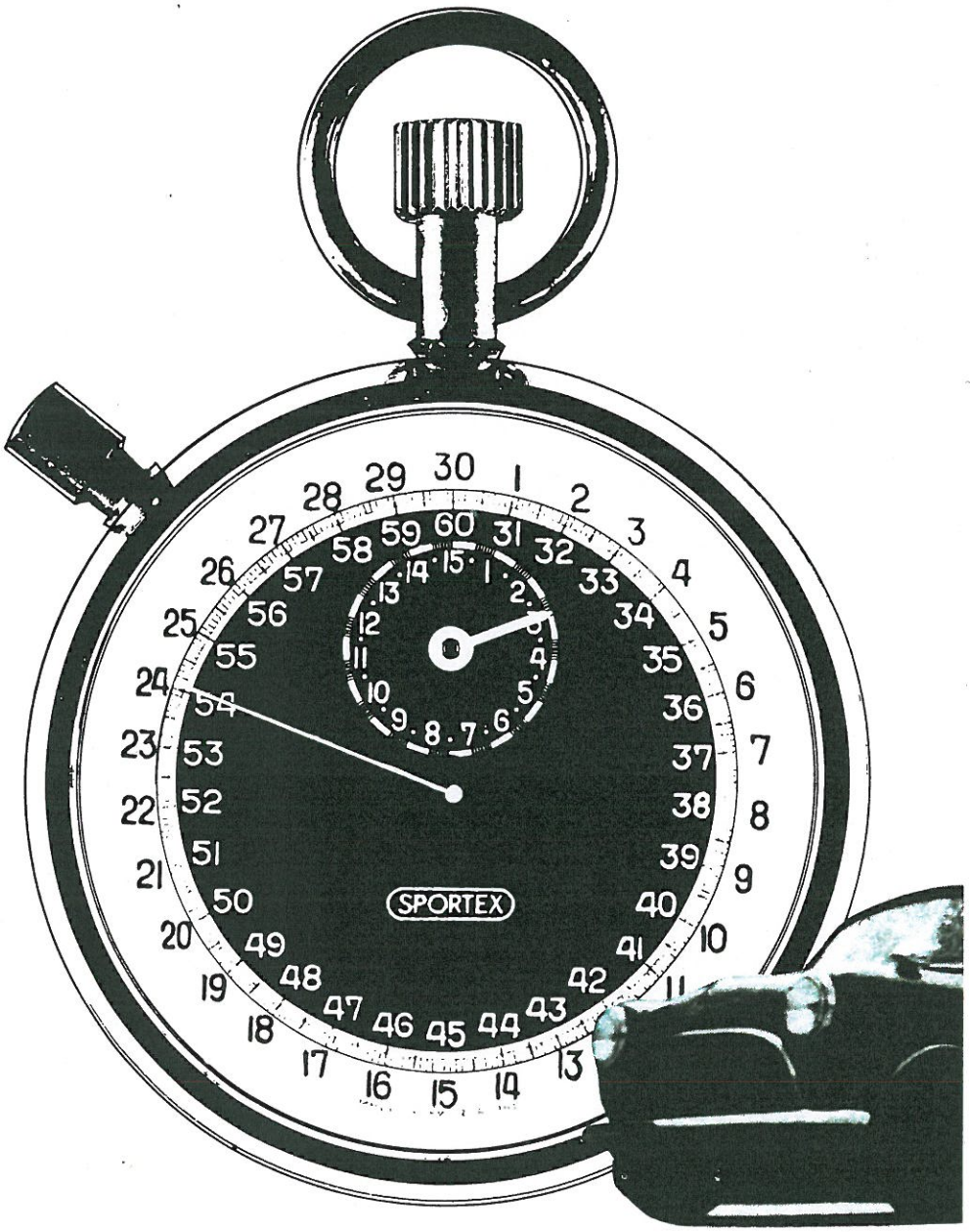
- miles to kilometres
- pounds to kilograms
- foreign currency

You may like to find out more about these.

Smile **0073**

Time/Distance Graph

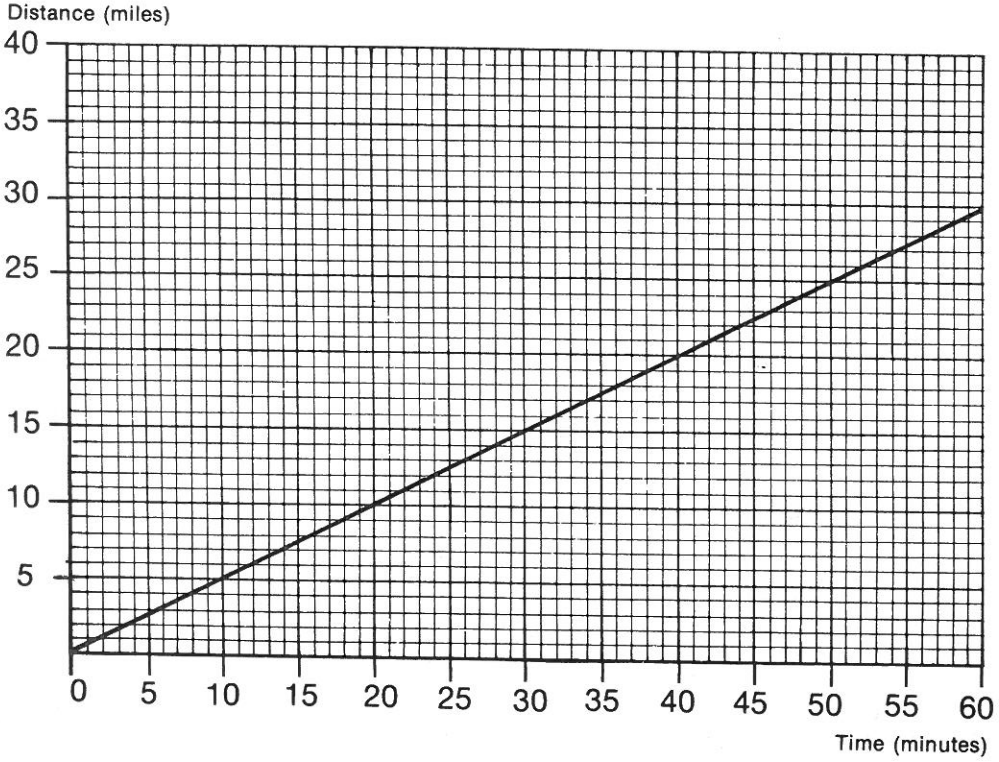
You will need graph paper



Time/Distance Graph

A car is travelling at 30 m.p.h.
In 1 hour it will travel 30 miles.
In $\frac{1}{2}$ hour it will travel 15 miles.

This graph shows the relationship between distance and time.

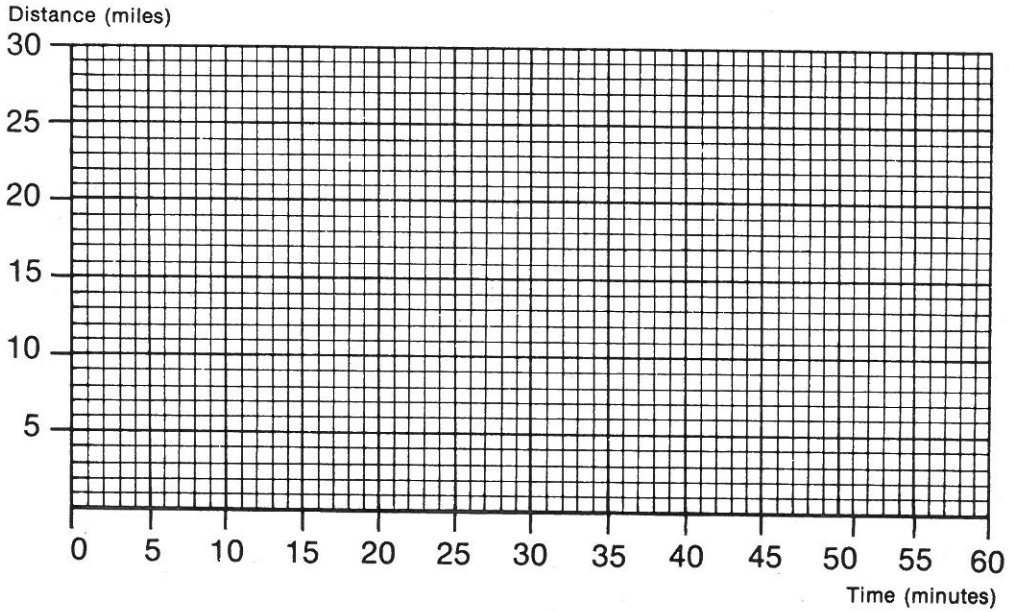


1) Use the graph to find the distance travelled in:
   (a) 10 mins
   (b) 50 mins
   (c) $\frac{1}{4}$ hr
   (d) 30 mins
   (e) $\frac{3}{4}$ hr

2) Use the graph to find the time taken to travel:
   (a) 10 miles
   (b) 20 miles
   (c) 25 miles
   (d) 2.5 miles
   (e) 17.5 miles

A cyclist travels at a steady speed.
After 40 minutes she has gone 10 miles.
Can you draw a time distance graph?

Hint: How far has the cyclist travelled after 40 minutes? How far has she travelled after 20 minutes?



3) What distance has been covered in these times?
   (a) 60 mins
   (b) 50 mins
   (c) 30 mins
   (d) 25 mins

4) What is the cyclist's speed in m.p.h.?

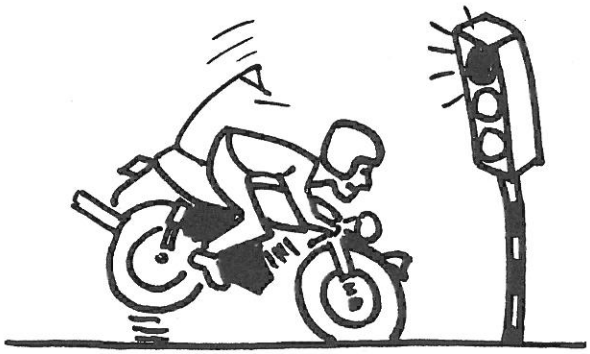
5) Find the time taken to travel:
   (a) 15 miles
   (b) 7.5 miles
   (c) 2.5 miles
   (d) 6.25 miles

6) How far will she travel in $1\frac{1}{2}$ hours?

You will need: graph paper, sharp pencil

No Brakes Bruce

The faster you go, the more space you need to stop.



The highway code says:

for	20	miles an hour you need	40 feet
	30		75
	40		120
	50		175
	60		240
	70		315

(1) Bruce is driving at 45 miles an hour and Brenda is driving at 65 m.p.h. What do you think their stopping distances are?

Draw a graph to show these figures.....

(a) Use the horizontal axis for the speed, up to 80 m.p.h.
Scale: 1 cm to 10 m.p.h.

(b) Use the vertical axis for the distance, up to 500 feet.
Scale: 1 cm to 50 feet.

(c) Plot the 6 points and join them with a smooth curve.

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(2) Use your graph to check your answers to (1).

(3) What is the stopping distance for 52 m.p.h.?

(4) What is the stopping distance for 15 m.p.h.?
(You will need to extend your curve.)

(5) You are driving 200 ft. behind Bruce.
What is your maximum safe speed?

(6) Do you think the curve should go through (0, 0)?
Explain your answer.

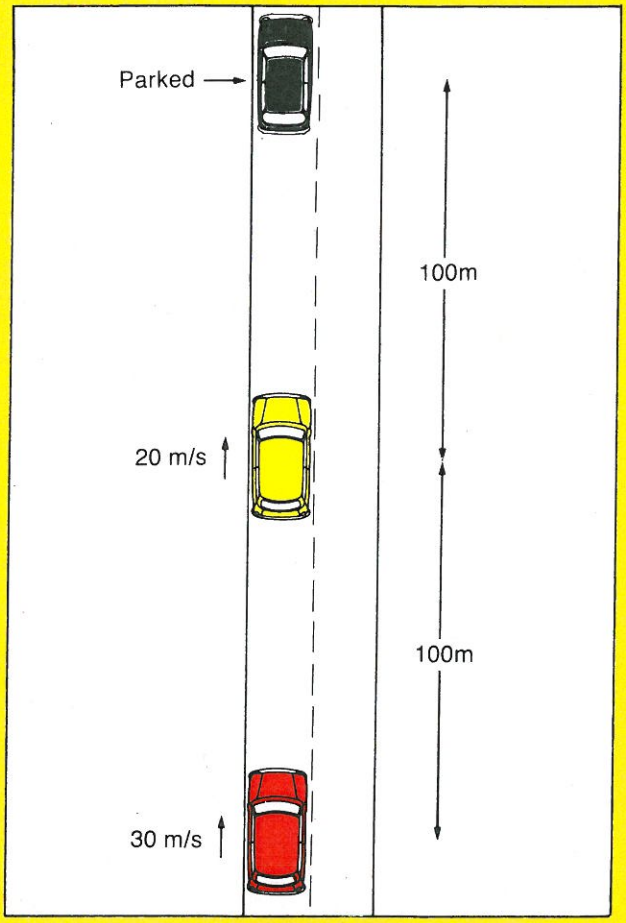
Helicopter photographs

Smile **1818**

You will need several copies of the worksheet 1818A and colours.

A helicopter spots three cars travelling due North along a narrow country lane and takes a photograph of the scene.

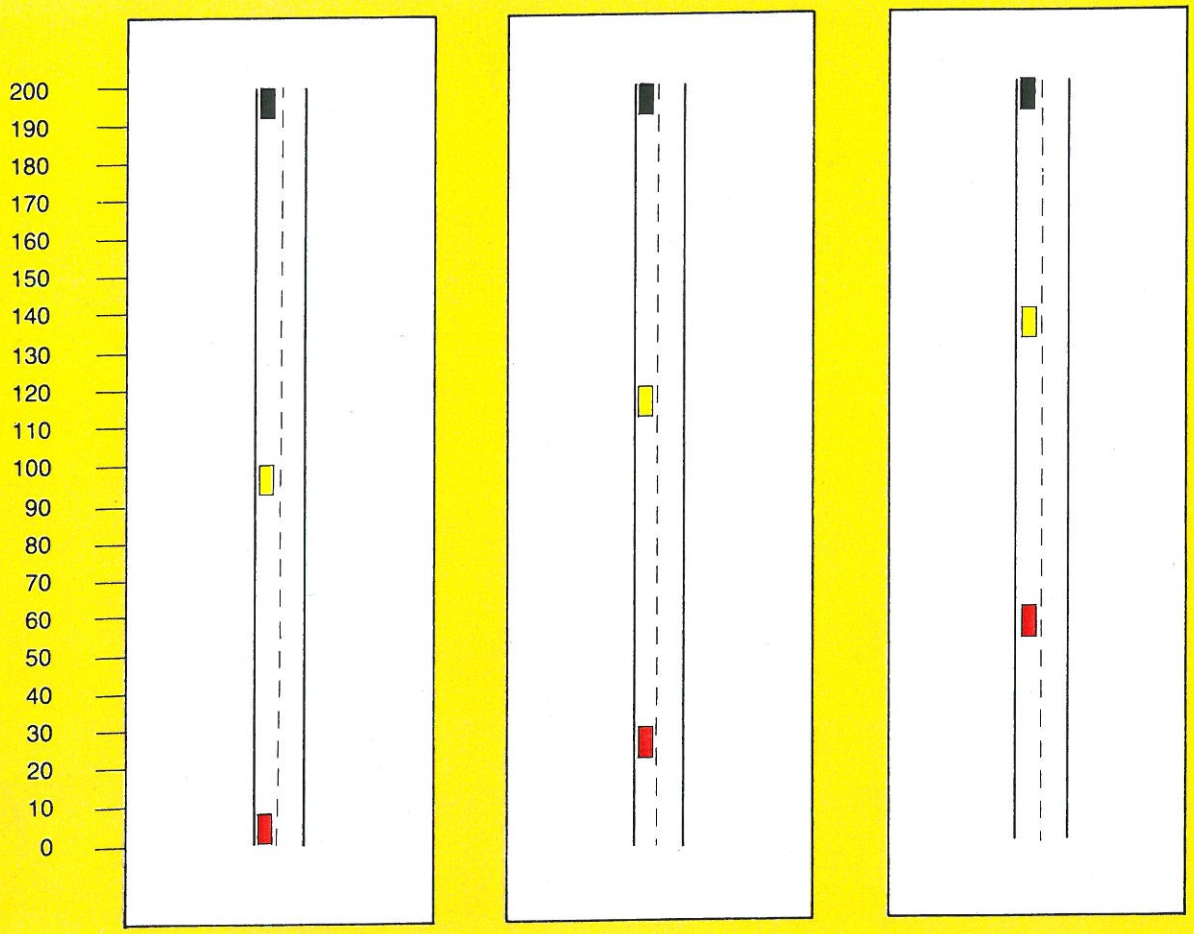
1. If the lane is only wide enough for two cars to pass each other safely, and the cars continue at the same, steady speeds, *what do you think will happen in the next few seconds?*



Note: Speed is sometimes measured in metres per second (m/s) instead of miles per hour (mph). A rough equivalence is 10 m/s to 20 mph.

Imagine that you are sitting in the helicopter. Every second you take a photograph of the scene below.

Your first three photographs will look like this:



2. On a sheet of blanks, complete a series of photographs taken at 1 second intervals. Colours will be useful.

3. Write about what happens.

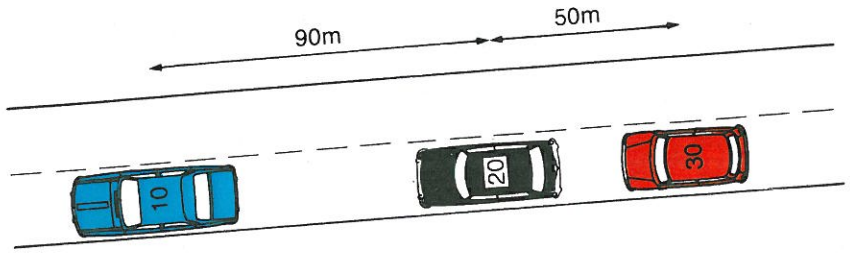
4. Suppose that the black car had been travelling slowly at 10 metres/second. What would happen and when?

Turn over

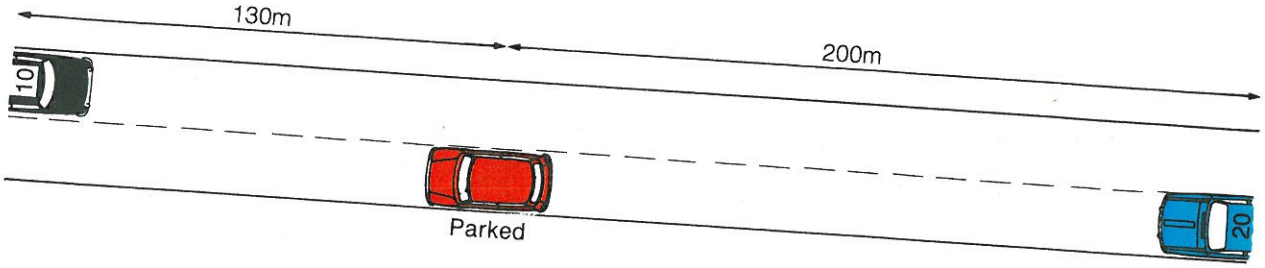
More traffic situations

As you fly northwards you photograph other traffic situations. Some of these are shown below. The speeds (in m/s) are written on the car roofs.

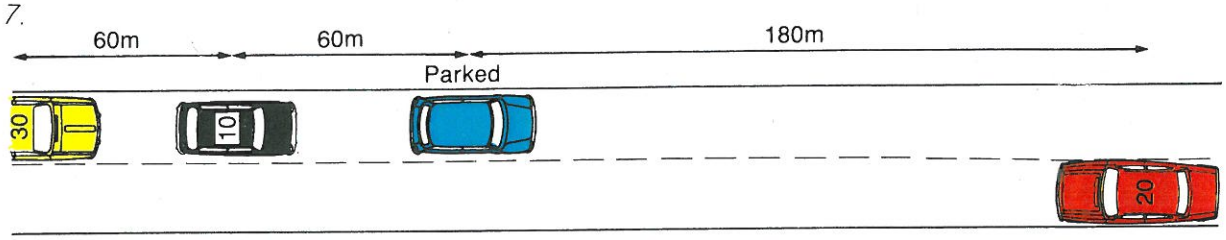
5.



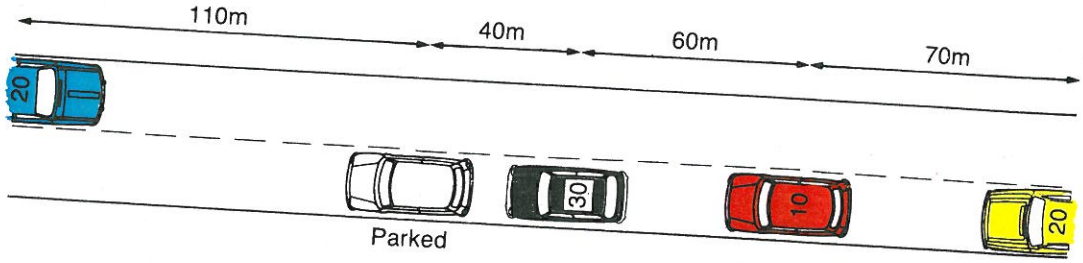
6.



7.



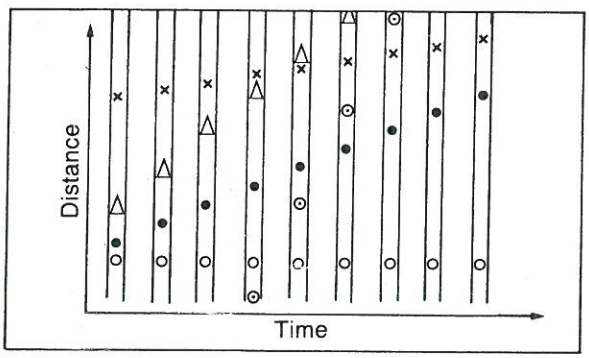
8.



Draw each of these situations in turn, on a separate "snapshot blank". Be careful to give each car its correct speed and starting position.

Write about what happens.

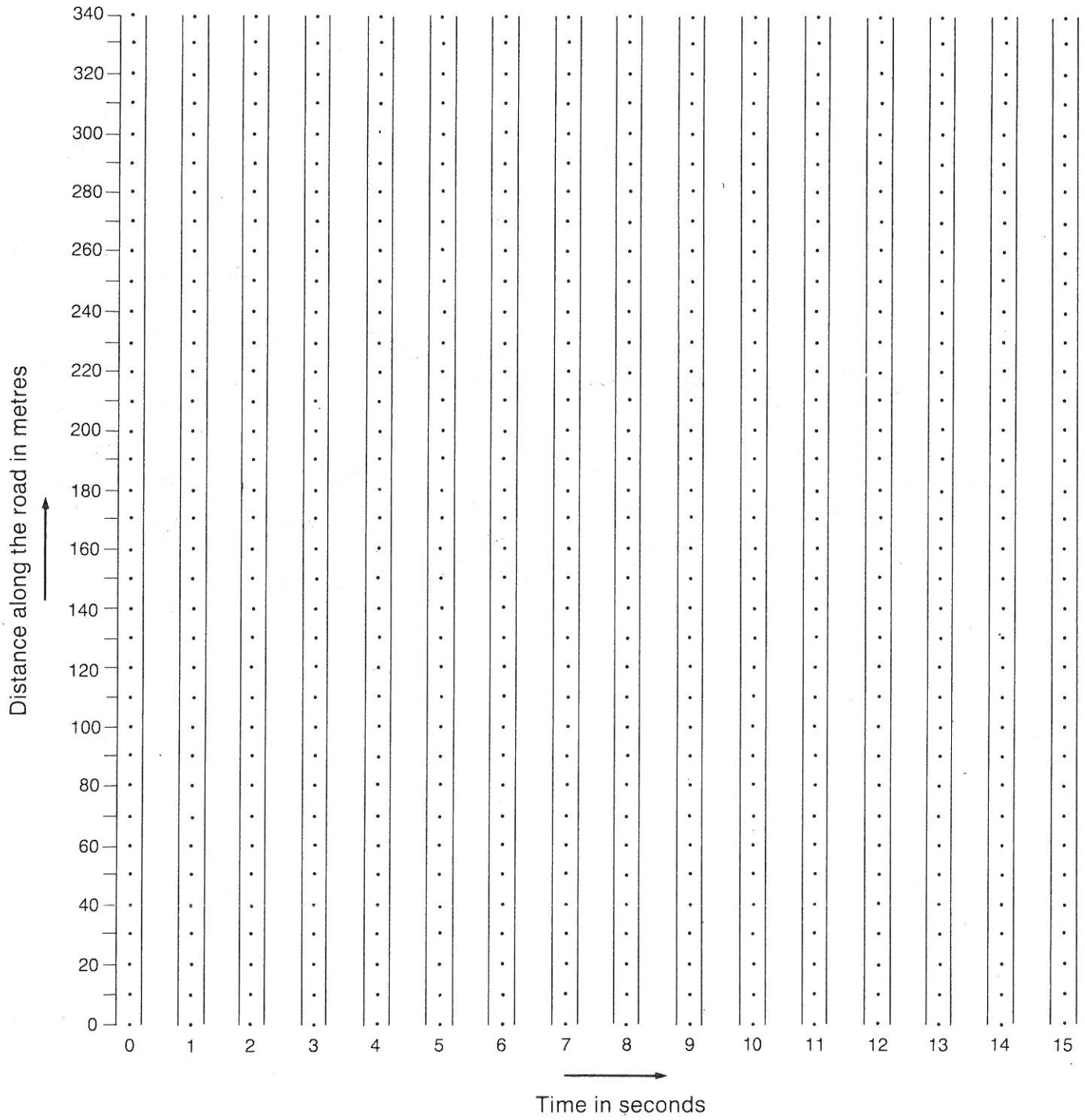
9. The diagram opposite shows a traffic situation involving five cars. Arrange these cars in order of speed. Can you find a quick way to tell which car is going fastest?



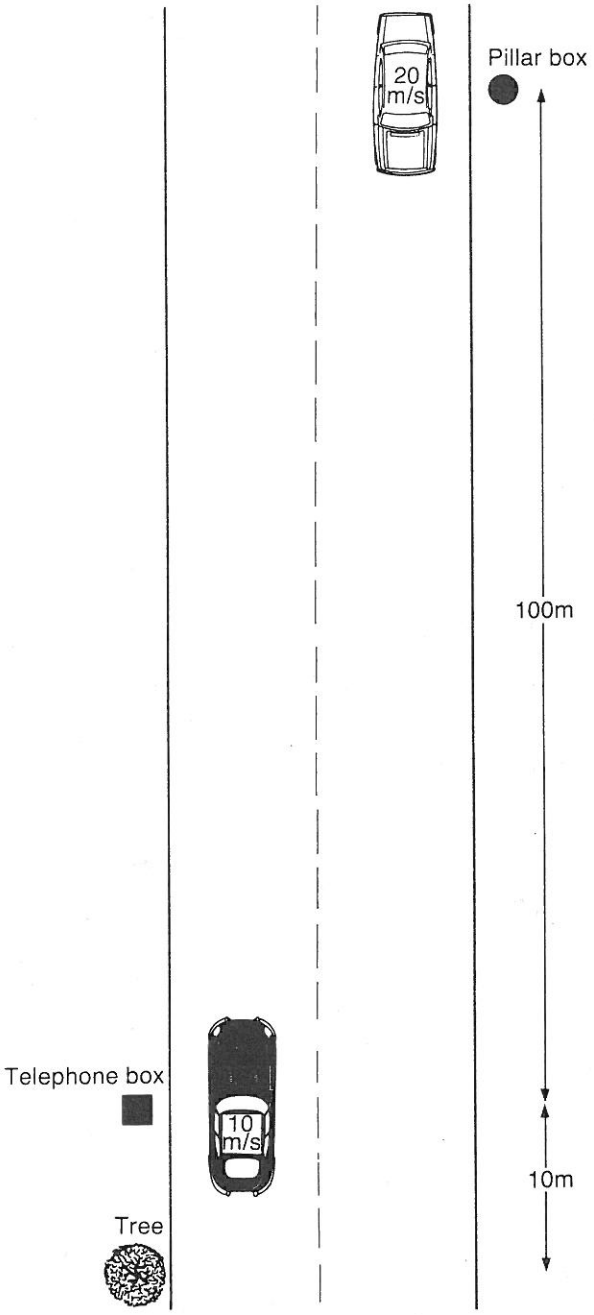
This activity is taken, with kind permission, from *The Language of Graphs*, a collection of teaching materials by Malcolm Swan (ISBN 0906126 11 8).

Snapshot blank

Smile Worksheet **1818A**



Overtaking



The black car is travelling at 10 metres per second and the white car is travelling in the opposite direction at 20 metres per second.

1. How long will it take the black car to reach the pillar box?
2. How long will it take the white car to reach the telephone box?
3. When will these two cars meet each other?
4. How far will they be from the tree at that time?

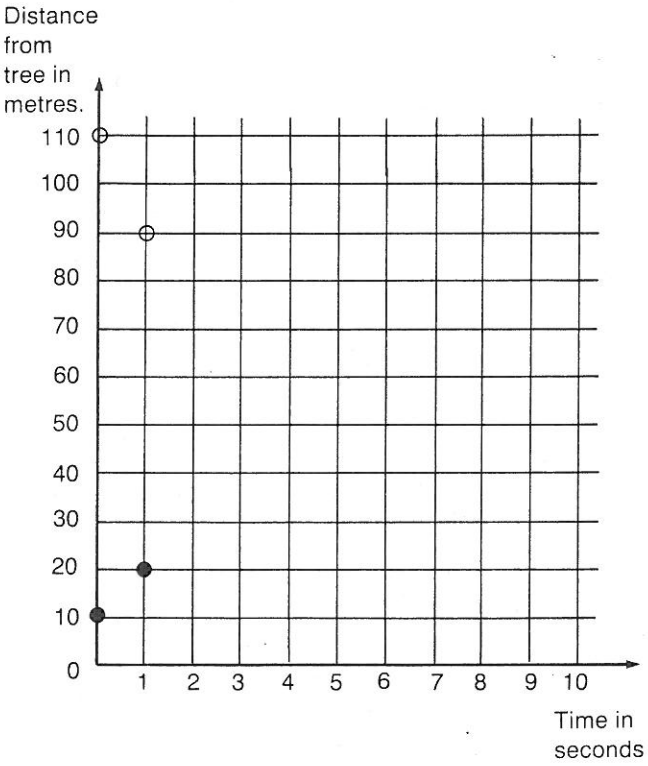
Note: Speed is sometimes measured in metres per second (m/s) instead of miles per hour (mph). A rough equivalence is 10 m/s to 20 mph.

One method for solving this problem involves drawing a graph.

Here a graph has been drawn which shows the distance of each car from the tree at the beginning (0 seconds) and after 1 second.

○ Represents the white car

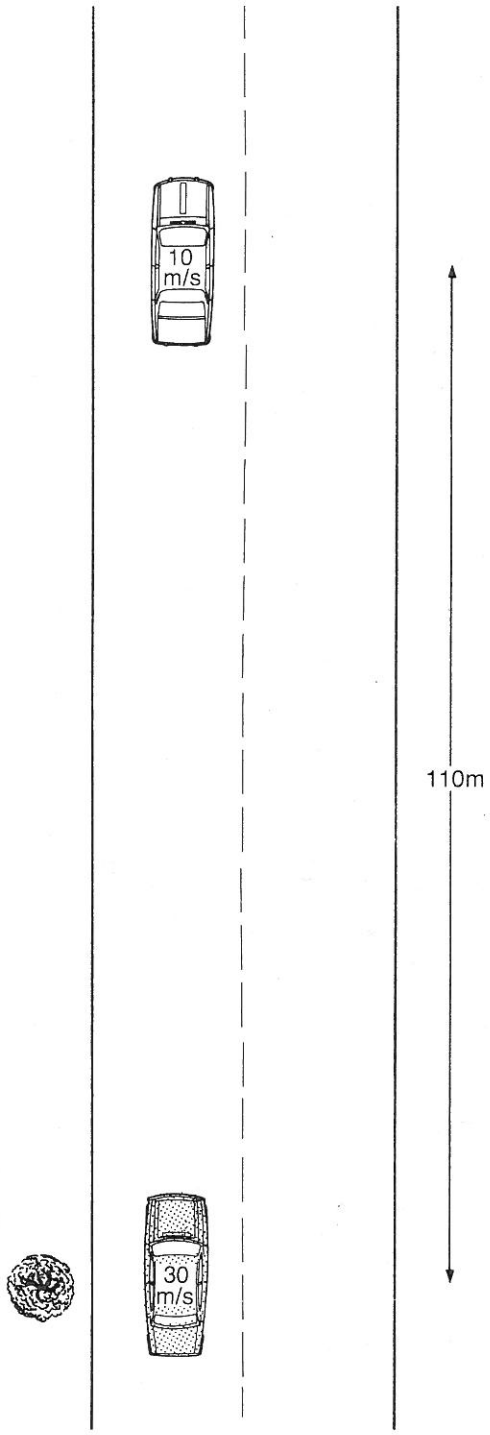
● Represents the black car



5. Copy the above diagram onto graph paper and complete the graph for each car at 1-second intervals.

6. When and where will the two cars meet? Is your answer the same as before?

They grey and the white cars are travelling in the same direction.

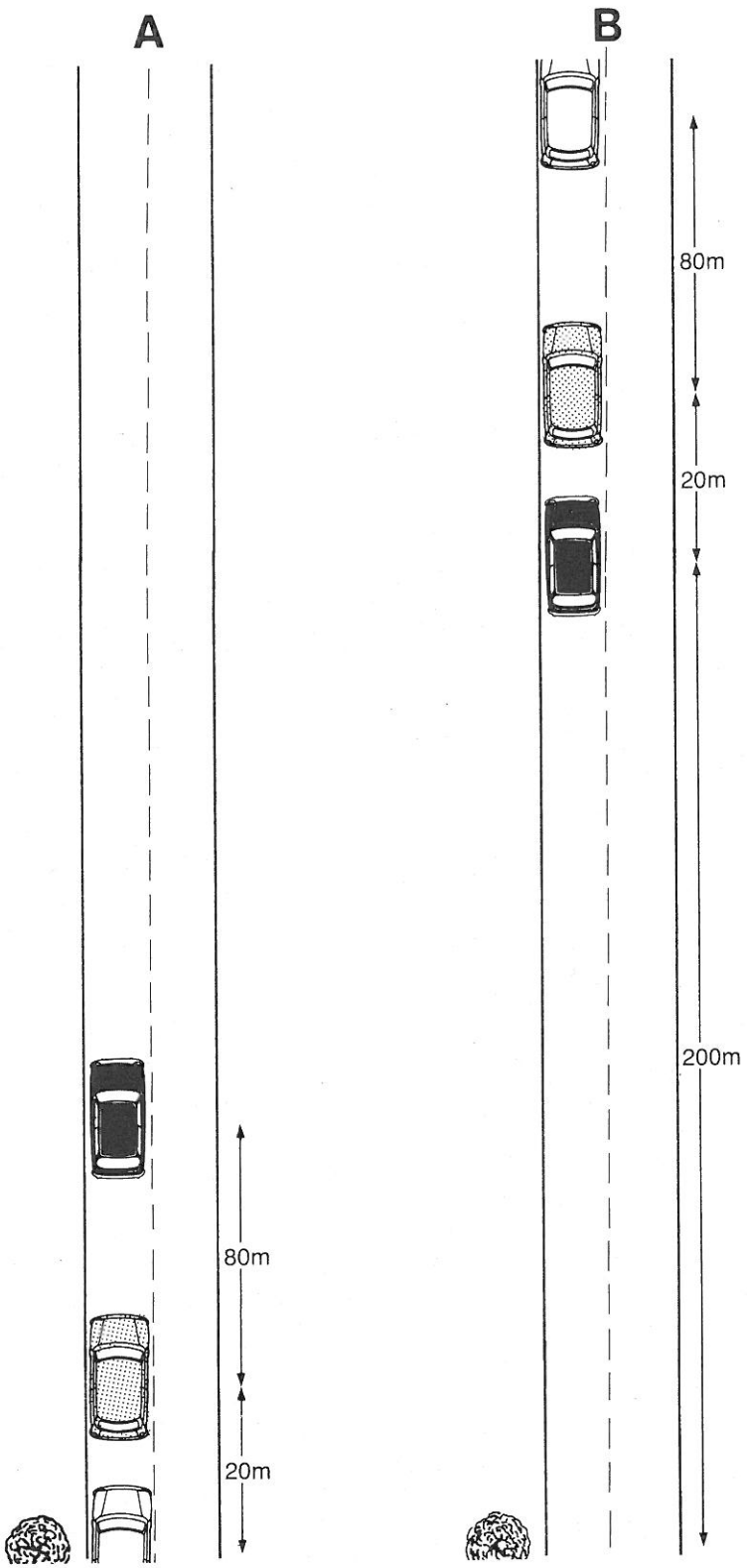


Draw a graph showing distance from the tree (0-200 metres) against time (0-10 seconds) to answer the questions below.

7. When will the grey car overtake the white car?

8. How far will they be from the tree at that time?

Diagram A shows three cars travelling at a constant speed.
Diagram B is a view of the same piece of road 10 seconds later.



9. Draw a graph to show what happened during these 10 seconds.

10. Write an account of what happened.

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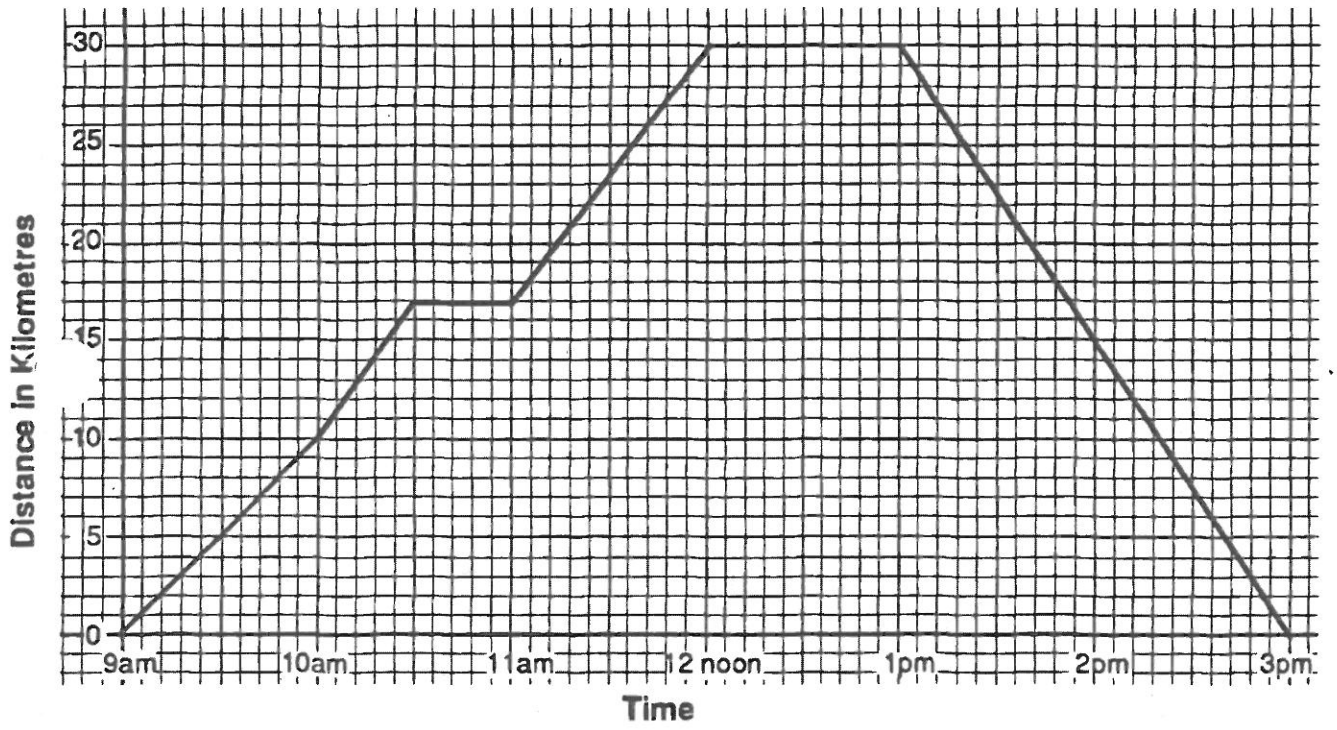
TIME-DISTANCE GRAPHS

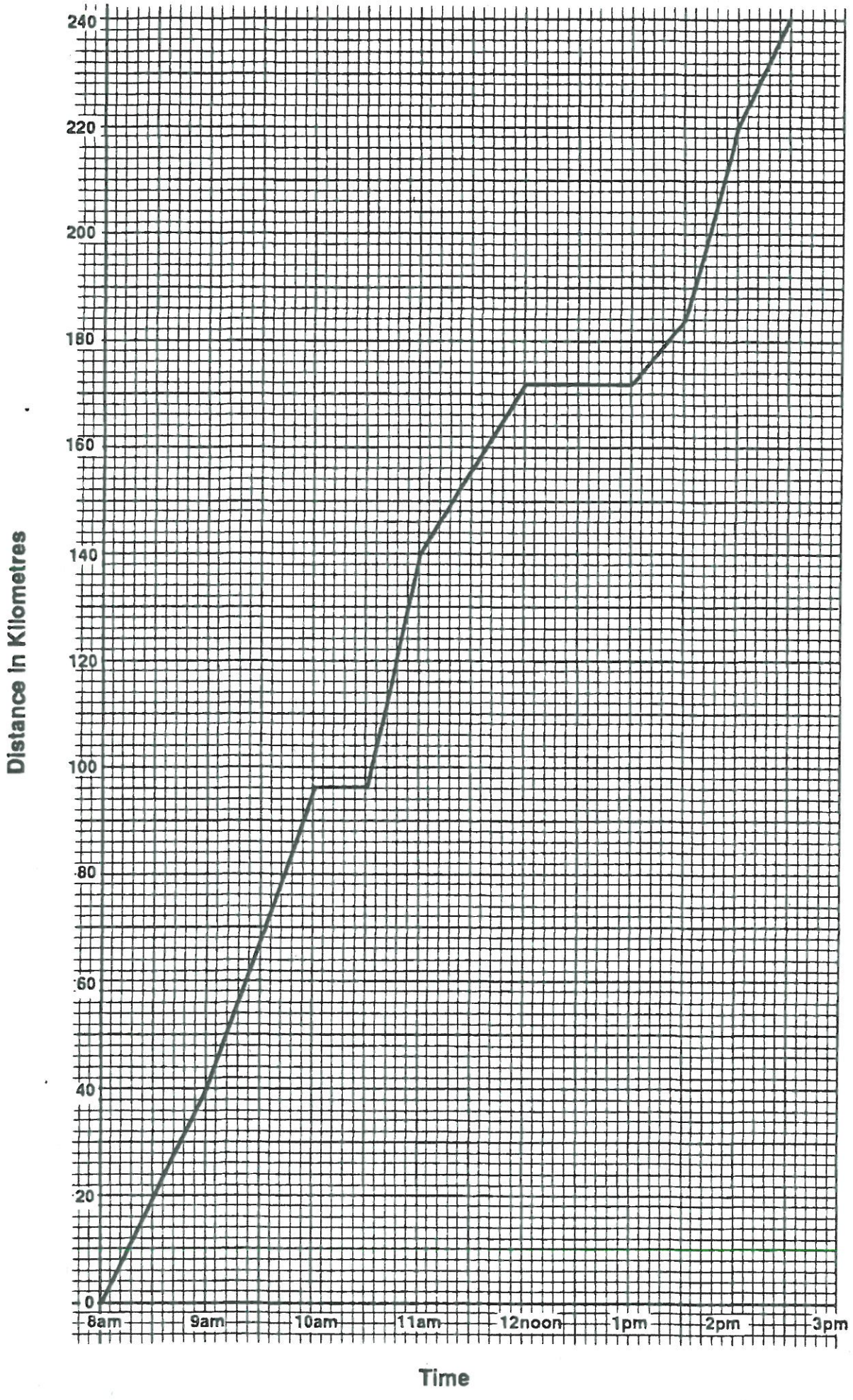
The line on the graph shows the journey made by a cyclist.
She left home at **9 a.m.** and returned home at **3 p.m.**



On ordinary roads it is impossible to travel at a constant speed for any length of time. *Can you think of some reasons for this?* It is only possible to calculate average speeds. Average speeds are used to draw *time-distance graphs.*

1. At what time did the cyclist reach her destination? How far was she from her home?
2. At what time did she take her first rest? For how long did she rest?
3. How far was she from home when she took this rest?
4. How many kilometres did she travel between 11 a.m. and 12 noon?
5. What was her average speed (in kilometres per hour) between (a) 9 a.m. and 10 a.m. (b) between 10 a.m. and 10.30 a.m.?
6. Between what times did she take a break for a meal and a rest?
7. After this break she returned home. How many kilometres did she have to travel?
8. What was her average speed on her return journey?
9. How far was she from home at (a) 11.30 a.m. (b) 1.30 p.m.?
10. At what time on her outward journey was she (a) 13 km (b) 22 km from home?

Turn over.


240
220
200
180
160
140
120
100
80
60
40
20
0
Distance in Kilometres
8am
9am
10am
11am
12noon
1pm
2pm
3pm
Time

← **This line graph shows the journey made by a motorist.**

She left home at 8 a.m.

A

1. How far from her home was the motorist's destination?
   What time did she arrive?

2. Look at the graph to estimate between which times the motorist:

   (a) travelled on a motorway.
   (b) was involved in a traffic delay.

3. At what time did the motorist make her first stop?
   How far was she from her home?

4. How far was the motorist from her home at:

   (a) 9.30 a.m.
   (b) 1.30 p.m.
   (c) 11.30 a.m.
   (d) 1.45 p.m.
   (e) 12.30 p.m.?

5. At what time was the motorist's distance from her home:

   (a) 200 km
   (b) 96 km
   (c) 140 km
   (d) 224 km
   (e) 36 km?

6. What was the motorist's average speed between:

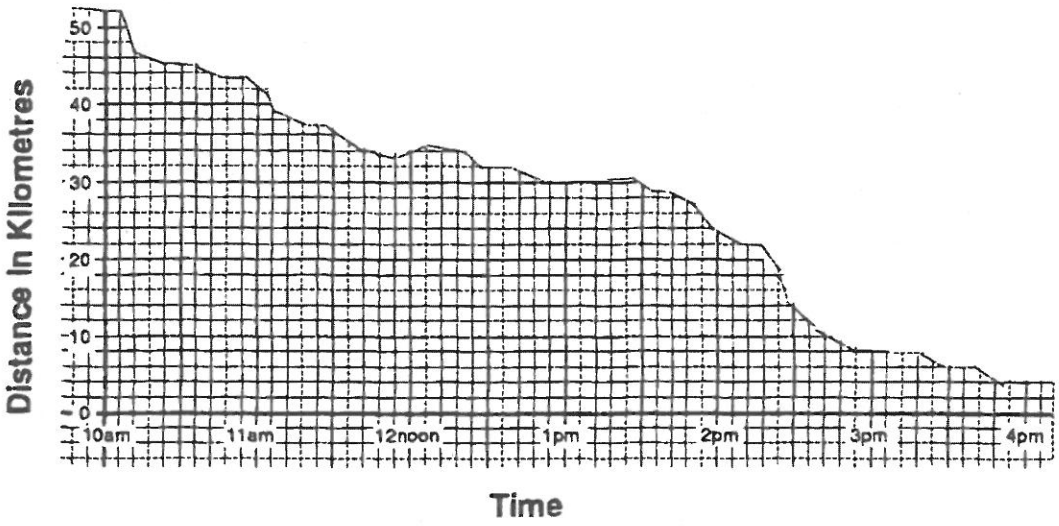
   (a) 9 a.m. and 10 a.m.
   (b) 10.30 a.m. and 11 a.m.
   (c) 1 p.m. and 1.30 p.m.
   (d) 1.30 p.m. and 2 p.m.
   (e) 2 p.m. and 2.30 p.m?

7. Find the average speed for the whole journey considering only the time when the motorist was driving.

B Pedro's Journey

Pedro left his home at 10 a.m. and cycled to a place 7 km away, reaching it at 11 a.m. Here he met some friends and set off again at 11.30 a.m. In the next 1½ hours he covered 15 km. By 3 o'clock Pedro had cycled 38 km from his home. The next part of the journey was through a crowded town and he took ½ hour to travel 3 km. After this the journey was completed at an average speed of 16 km/hr and Pedro reached his destination at 4 p.m.

Draw axes with times from 10 a.m. to 4 p.m. across the x axis and distances from 0 km to 50 km on the y axis. Choose a sensible scale.



Draw a *time-distance graph* for Pedro's journey.

How far was Pedro from his home at 4 p.m.?