Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 1	*Speed*
Activity		***Notes***
1	**Definitions - average and instantaneous speeds** T: In the last unit we dealt with units of length, mass and capacity and also miles per hour. When do we use expressions like 'miles per hour'? Ps: When we want to give the speed of something like a car, a train, etc. T: What do I mean if I say I travel at a speed 50 mph? Ps: You travel a distance of 50 miles in hour. T: And what is my speed if I drive a distance of ... ... 15 miles in 1 hour ...? Ps: 15 mph. T: ... 30 miles in 2 hours ...? Ps: That is 15 miles in one hour, so your speed is 15 mph. T: ... 45 miles in 3 hours ...? Ps: 15 mph again. T: ... 60 miles in 2 hours ...? Ps: That is 30 miles in every hour, so 30 mph. T: What have you done to calculate the speed in mph? P: We've divided the number of miles by the number of hours. T: I drove 15 miles to get to school this-morning and it took me 1 hour. Do you think that I drove at a constant speed of 15 mph? P: You would have varied your speed according to the traffic and other road conditions. Sometimes you would have travelled faster than 15 mph and sometimes slower. T: Yes, ... so the speed that we get by dividing the distance travelled by the time taken is an average speed: $\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$ T: The speed shown by the speedometer in a car at any particular time is called the instantaneous speed. *8 mins*	Whole class activity. T introduces the concept of speed and then the difference between average and instantaneous speed. Questions/ answers interactively. Ps may answer in chorus. T writes on BB, Ps in Ex.Bs.
2	**Mental work** **PB 18.1, Q1** *(40 mph)* **Q2** *(42 mph)* *14 mins*	Mental work. T reads out the questions, asks Ps how they would calculate the answer, and then gets them to do the calculation mentally. Volunteer Ps give their answers; agreement, feedback, praising, for both questions.
3A *(continued)*	**Practice calculating average speeds** **PB 18.1, Q4, 1st, 2nd and 4th rows (no calculator!)** e.g.: P_1 (writes on BB): time = 4 hours distance = 172 miles speed = ?	Whole class activity. T encourages slower Ps to come to BB and show their calculations to find the average speed. T helps them to order the data and asks Ps to do the same in Ex.Bs. Agrees and praises.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 1	*Speed*
Activity		***Notes***
3A *(continued)*	speed $= \frac{\text{distance}}{\text{time}}$ speed $= (172 \div 4)$ mph speed $= 43$ mph etc. with P_2 *(56 mph),* P_3 *(48 mph)*	T may help P_3 convert the time to hours and remind P how to divide by decimals without using a calculator.
3B	**Individual work** **PB 18.1, Q4, 3rd and 5th rows (no calculator!)** *(37.5 mph, 35 mph)*	Individual work, monitored, helped. Verbal checking of results. Agreement, self-correction, feedback. Praising.
	27 mins	
4A	**Units of speed** T: Distance can be given in different units, as we've already seen, and in the imperial and metric systems. Give me some other units of length and the time unit you would use with each one. *Distance* / *Time* / (blank) miles / hours kilometres / hours metres / seconds feet / seconds T: What do you think will be in the third column? ...	Whole class activity. T draws a table on BB, labels the first and second columns, fills in the first row then writes in what Ps dictate. (Ps draw and complete table in Ex.Bs.) Praising. Then discussion about using other units for speed and filling in the third column column (giving abbreviations as well).
4B	**Discussion about units of speed** T: The units of length and time have to be chosen to suit the context. Look at this question ... **PB 18.1, Q3** *(4 m/hr)*	Mental work with discussion $\rightarrow$ any appropriate units can be used to express speed. A P reads out the question; discussion; correct unit of speed is given. Agreement. Praising.
	35 mins	
5A	**Problems in context** **(A)** Mary walks to school every day. Calculate her average speed in mph if she takes half an hour to go 1.5 miles. **(B)** It took us 5 hours to walk 24 km on a moorland walk. Calculate our average speed in km/h. **(C)** A TGV-snail takes 3 seconds to cover 4 metres. Give the average speed of this French snail, in m/s.	T divides Ps into 3 groups by seating and gives a different task to each group. Members of each group solve the same task individually and when T stops the work one of the Ps writes solution on BB (which has been divided into 3 parts by T).
(continued)		

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 1	*Speed*
Activity		***Notes***
5A *(continued)*	*Solutions* (A) Speed $= (1.5 \div 0.5)$ mph $= 3$ mph (B) Speed $= (24 \div 5)$ km/h $= 4.8$ km/h (C) Speed $= (4 \div 3)$ m/s $= \frac{4}{3}$ m/s	The three solutions are written on BB at the same time. Agreement, self-correction, feedback (in each group). Praising.
5B	**Converting units for comparison** T: What would you have to do if you wanted to compare these speeds? Ps: Convert the speeds into the same units. T: Which conversion seems the most straightforward to do? P_1: Since I mile is approximately 1.6 km, 1 mph $\approx$ 1.6 km/h. T: Well done! Now let's convert 3 mph. P_2 (at BB): 3 mph $\approx 3 \times 1.6$ km/h $= 4.8$ km/h T: And what about 1 m/s? What is that in km/h? Ps: ? T: How many seconds are there in one hour? *(* $60 \times 60 = 3600$ *)* T: If you walk 1 m in 1 second, how many metres will you walk at the same speed in 1 hour? *(3600 m)* T: Convert it into kilometres. *(3.6 km)* T: 3.6 km in one hour, that is ... ? *(3.6 km/h)* T: And $\frac{4}{3}$ m/s? P (writes on BB): $\frac{4}{3}$ m/s $= ((3.6 \div 3) \times 4)$ km/h $= 4.8$ km/h Ps: The speeds are all equal!	Further questions and discussion. There will probably be Ps who realise this connection, from work done in the previous unit. T writes on BB, Ps in Ex.Bs. Then volunteer P calculates at BB. Agreement. Praising. Conversion between m/s and km/h is more difficult, so T works through the solution with Ps. T writes on BB, Ps in Ex.Bs. A stronger P will probably volunteer to do the conversion. T praises.
	45 mins	
	Set homework **(1) Change the following speeds into km/h:** **(a) 2 m/s,** **(b) 5 mph,** **(c) 10 m/s,** **(d) 1.5 mph.** **(2) PB 18.1, Q6** **(3) Data for Activity 18.1**	T asks Ps to write down their departure and arrival times when going home from school and calculate their average speed, also suggesting that they all use the same units, e.g. minutes and kilometres.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 2	*Speed, Distance and Time*
Activity		***Notes***
1	**Checking homework**	T should arrive before Ps, draw a table on BB (see Activity 18.1) and ask Ps to fill in the first 4 columns (1 row for each P). Then verbal checking of the other homework questions, with explanations where necessary.
1A	**(3) Data for Activity 18.1**	
1B	**(1)** (a) 2 m/s = 7.2 km/h (b) 5 mph = 8 km/h (c) 10 m/s = 36 km/h (d) 1.5 mph = 2.4 km/h **(2) PB 18.1, Q6** 8 mph	
	7 mins	
2	**Further calculations with speed** **Activity 18.1 (using a calculator!)**	Individual work, monitored, helped. Ps copy the table from BB into Ex.Bs and fill in the final two columns by using their calculators. *Checking*: each P comes out and completes a row in the table (calculation has been done at home). Other Ps agree or suggest correction. Feedback. Praising.
	18 mins	
3A	**Connection between speed, distance and time** T: What do we do if we want to make 'distance' or 'time' the subject of the formula? Who'd like to rearrange it with 'distanc'e as the subject? T (writes on BB): $\text{speed} = \frac{\text{distance}}{\text{time}}$ P_1 (writes on BB): $\times$ time $\Rightarrow$ $\text{distance} = \text{speed} \times \text{time}$ T: Let's make time the subject. P_2 (writes on BB): $\div$ speed $\Rightarrow$ $\text{time} = \frac{\text{distance}}{\text{speed}}$	Whole class activity. T makes Ps discover the other two formulae relating speed, distance and time. Agrees, praises. Ps write in Ex.Bs. ...
3B	**Questions in context** **OS 18.2**	... then asks other volunteer Ps to show at OHP how to use the formulae. Discussion also about units, e.g. with distance in miles and speed in mph we get the time in hours. Agreement. Praising. Ps write in Ex.Bs.
	26 mins	

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 2	*Speed, Distance, Time*
Activity		***Notes***
4A	**Calculating distances** **PB 18.2, Q1 (a)** *(60 miles)* **PB 18.2, Q1 (e)** *(250 miles)* e.g. **(e)**: P (writes on BB): time $= 6\frac{1}{4}$ hours $= 6.25$ hours speed $= 40$ mph distance $= ?$ distance $=$ speed $\times$ time distance $= (40 \times 6.25)$ miles distance $= 250$ miles	Whole class activity first: T encourages slower Ps to come to front and helps them to order data on BB. Other Ps may help and write in Ex.Bs. T agrees and praises. (T decides whether or not Ps may use calculators.)
4B	**PB 18.2, Q1 (b)** *(480 miles)* **PB 18.2, Q1 (c)** *(38 miles)*	Then individual work, monitored, helped. Agreement, self-correction, feedback. Praising.
	34 mins	
5A	**Further practice** **PB 18.2, Q2 (a)** *(3 hours)*	The same activity as before but now using the formula for 'time. Whole class activity for (a) and (d), with slower Ps contributing, then individual work.
	PB 18.2, Q2 (d) *(5 hours 30 minutes or* $5\frac{1}{2}$ *hours)*	
5B	**PB 18.2, Q2 (b)** *(6 hours)*	
	PB 18.2, Q2 (e) *(1 hour 30 minutes or* $1\frac{1}{2}$ *hours)*	
	e.g. **(d)** P (at BB): distance $= 385$ miles speed $= 70$ mph time $= ?$ time $= \frac{\text{distance}}{\text{speed}}$ time $= (385 \div 70)$ hours time $= 5.5$ hours $= 5$ hours 30 minutes	(For questions (d) and (e), T asks Ps to also write the answers as mixed units (in preparation for the next lesson).
	42 mins	
6 *(continued)*	**Mental work summarising the lesson content** T: Let's see if you can use the formulae we've looked at today. (a) How far would you travel if you drove for 4 hours at 50 mph? *(200 miles)* (b) Calculate the average speed of a train which travels 300 km in 2 hours. *(150 km/h)* (c) How long does it take to fly 1600 km at 800 km/h? *(2 hours)*	Mental work to finish the lesson, summarising what has been covered. T writes the three formulae on BB and asks simple questions. Ps decide which formula to use, calculate in their

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 2	*Speed, Distance and Time*
Activity		***Notes***
6 *(continued)*	(d) How long does it take to cycle 350 m at 7 m/s ? *(50 seconds)* (e) Calculate the average speed of a sloth which doesn't move for 10 hours. *(0 m/s)* *45 mins*	heads, volunteer, answer. Then feedback, praising. (T gives (a short) time for Ps to think - warns Ps to take care with units when answering.)
	Set homework **PB 18.2, Q2 (d), (f)** **PB 18.2, Q2 (c), (h)** **PB 18.2, Q7**	

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 3	*Mixed Units*
Activity		***Notes***
1A	**Checking homework** **PB 18.2, Q1 (d)** 63 miles **(f)** 16.5 miles **PB 18.2, Q2 (c)** 4 hours **(h)** $5\frac{1}{2}$ hours	T has asked two Ps to write answers to Q1 and Q2 on BB as soon as they arrive. Agreement/ correction, self-correction, feedback. Praising.
1B	**PB 18.2, Q7 (a)** 8 hours **(b)** 8.75 m **(c)** 24 mins **(d)** 62.5 cm e.g. for **Q7 (a)**: T: In question 7, who calculated the speed of the snail? ... How fast did it move? P_1: 2.5 m/h T: What did you do then? P_2: I used one of the formulae from the last lesson. For part (a), the division $20\text{ m} \div 2.5\text{ m/h}$ gives the answer, which is 8 hours. T: Did anyone use another method? P_3: If the snail moves at a constant speed, the distance it moves is in direct proportion with the time taken. T: That's right, so ...? P_4: Since 20 m is four times 5 m, the snail takes $2\text{ h} \times 4 = 8\text{ h}$ to move that distance. *7 mins*	Then verbal checking of Q7, discussing the different ways of reaching the solution.
2A	**Mixed units for time** T: In Q1 (f) of the homework you converted 30 minutes to half an hour. Now convert the times I'm going to give you into hours. Give your answers as decimals or fractions. **T:** **Ps:** 30 mins 0.5 h, $\frac{1}{2}$ h 15 mins 0.25 h, $\frac{1}{4}$ h 45 mins 0.75 h, $\frac{3}{4}$ h 10 mins $\frac{1}{6}$ h 50 mins $\frac{5}{6}$ h 17 mins ? 1 min $\frac{1}{60}$ h 17 mins $\frac{17}{60}$ h 13 mins $\frac{13}{60}$ h 24 mins $\frac{24}{60}\text{ h} = \frac{2}{5}\text{ h}$ 25 mins $\frac{25}{60}\text{ h} = \frac{5}{12}\text{ h}$	Mental work with simple questions using mixed units. From here on, T writes questions and answers on BB and asks Ps to write them in Ex.Bs. Praising.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 3	*Mixed Units*
Activity		***Notes***
2B	**Further practice with mixed units** **OS 18.3, Q1-4**	The top half of OS 18.3 appears on OHP. Firstly a volunteer and then encouraged slower Ps come to OHP to write and explain solutions. Agreement, Ps write in Ex.Bs. Praising.
2C	**Mental work** T: How did you calculate the time in hours from the time in minutes? Ps: We divided the number of minutes by 60. T: And inversely? ... **T:** / **Ps:** 1 h / 60 mins 3 h / 180 mins 0.2 h / $0.2 \times 60 = 12$ mins $\frac{1}{12}$ h / $\frac{1}{12} \times 60 = 5$ mins $\frac{3}{5}$ h / $\frac{3}{5} \times 60 = 36$ mins	Mental work, but ... ... Ps (who need to) are allowed to write in Ex.Bs.
2D	**OS 18.3, Q5-7, extended with** **Q8** $2\frac{2}{3}$ hours = ? minutes *(160 minutes)*	Whole class activity continues with the bottom half of OS 18.3 now shown on OHP. T asks volunteer Ps to calculate at BB and give answers in minutes as well. Agreement, writing on OS and in Ex.Bs. Praising.
	17 mins	
3	**Further practice with mixed units** **PB 18.3, Q1 (b)** *3.17 hrs* **(d)** *2.3 hrs* **(g)** *1.12 hrs* **Give answers in hours and minutes and also in minutes:** **PB 18.3, Q2 (a)** *1 hr 15 mins; 75 minutes,* **(c)** *3 hrs 42 mins; 222 minutes* **(e)** *1 hr 27 mins; 87 minutes*	Individual work, monitored, helped. Checking in detail at BB. Agreement, self-correction, feedback. Praising.
	24 mins	
4	**Mixed units in context** **OS 18.5**	Whole class activity, working with mixed units for speeds. T encourages and helps a slower P to give solution for Q1 at OHP, then chooses a volunteer P to answer Q2. T agrees (and praises) then all Ps write solution in Ex.Bs.
	30 mins	

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 3	*Mixed Units*
Activity		***Notes***
5A	**Revision of connection between units of speed** T: Can you still remember how to convert between km/h and m/s ? Ps: 1 m/s = 3.6 km/h. 1 mph ≈ 1.6 km/h T: So how would you convert 90 mph to m/s ? P_1: I would first convert 90 mph to km/h, then convert the answer to m/s. T: Let's do that ... P_2 (aloud, writing on BB): $90 \text{ mph} = 90 \times 1.6 \text{ km/h}$ $= 144 \text{ km/h}$ P_3 (aloud, writing on BB): $144 \text{ km/h} = 144 \div 3.6 \text{ m/s}$ $= 40 \text{ m/s}$ T: Well done. You'll need to use these connections for the next question.	Short review of connection between units of speed (T writes them on BB), followed by some calculations by volunteer Ps on BB ...
5B	**Using speed and time in context** **PB 18.3, Q7** P_1: Distance = 162 km Time = 2 hours 12 mins = $2\frac{12}{60}$ hours = 2.2 hours Speed = ? $\text{Speed} = \frac{\text{distance}}{\text{time}}$ $\text{Speed} = \frac{162}{2.2} = 73.64 \text{ km/h}$ (to 2 d.p.) P_2: $73.64 \text{ km/h} = 73.64 \div 3.6 \text{ m/s}$ $= 20.46 \text{ m/s}$ (to 2 d.p.) P_3: $73.64 \text{ km/h} = 73.64 \div 1.6 \text{ mph}$ $= 46.03 \text{ mph}$ (to 2 d.p.)	... then individual work. Ps can use calculators. T monitors Ps' work and helps where necessary. Checking in detail at BB, with 3 volunteers showing the solutions. Note that in (b) it is more accurate to use original values, i.e. $\text{speed} = \left(\frac{162}{2.2}\right) \div 3.6$ $\approx 20.45 \text{ m/s}$ (to 2 d.p.), etc. Agreement, self-correction, feedback. Praising.
	38 mins	
6 *(continued)*	**Individual work** **Activity 18.2, Q1 (a), Q2** T: You've read the text and question 1 (a), now what should you do? P_1: Nothing difficult - just use the calculator to divide the distance by the time. T: If you divide 100 m by 9.79 seconds, what unit will the answer be? P_2: It will be m/s.	Individual work with discussion. Each P has a copy of the Activity. T makes Ps read the text and Q1 (a) and then a short discussion takes place, followed by individual work.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 3	*Mixed Units*
Activity **6** *(continued)*	T: Look at the 4th row. What do we do here? P_3: We have to convert the time to seconds. T: What is the key to this? P_4: 1 minute = 60 seconds T: What is 3 minutes 26 seconds in seconds? P_5: Since $3 \times 60 = 180$, it will be 206 seconds. T: Good. Let's start. *Solutions* *Activity 18.2, Q1 (a)* *Distance* / *Speed* (m/s) 100 — 10.21 200 — 10.35 400 — 9.26 800 — 7.91 1500 — 7.28 3000 — 6.81 5000 — 6.58 10 000 — 6.32	***Notes*** T monitors Ps' work and helps them. Also corrects wherever necessary. T suggests that Ps work on the sheet by adding a sixth column for 'Speed'. After 3 minutes, T writes solution on BB (self-correction, feedback, praising). Then T asks Ps to read Q2. Short discussion about what to do (e.g. agreeing on units to be used for the axes) then individual work monitored and helped by T, until the end of the lesson.
	45 mins **Set homework** **(1) Completing Activity 18.2, Q2** **(2) Activity 18.2, Q1 (b)** **(3) PB 18.3, Q6 (b), (c), (a)** **PB 18.3, Q8**	

Y8 UNIT 18 *Speed, Distance and Time* Lesson Plan 4 — *Distance-Time Graphs 1*

Activity		*Notes*
1	**Checking homework**	
1A	**(2) Activity 18.2, Q1 (b)**	T has asked a P to write the conversions for Activity 18.2 and PB 18.3, Q6 on BB as soon as P arrives. T agrees (or not), makes Ps repeat the connection.

Distance	*Speed* (km/h)
100	36.76
200	37.27
400	33.35
800	28.48
1500	26.21
3000	24.51
5000	23.70
10 000	22.75

(3) PB 18.3, Q6 (b), (c), (a)

T: What is the connection between m/s and km/h ?

Ps: 1 m/s = 3.6 km/h

T: Between km/h and mph ?

Ps: 1 mph ≈ 1.6 km/h

T: What have you done in Q6 (a)?

P_1: First I multiplied by 3.6, then divided by 1.6.

T: So 16 m/s = 36 mph. Reduce this connection.

P_2: 4 m/s = 9 mph

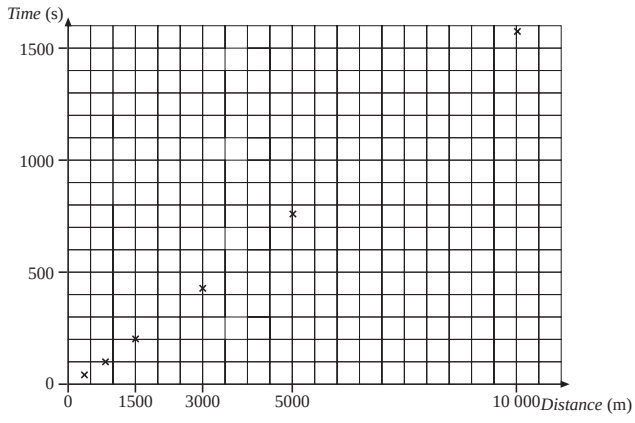
P_3: 2 m/s = 4.5 mph

P_4: 1 m/s = 2.25 mph

T: Good!

Solutions: **PB 18.3, Q6 (b)** *51.25 mph* **(c)** *30 mph* **(a)** *36 mph*

1B **(1) Activity 18.2, Q2**



T puts the graph on OHP. Self-correction, feedback, praising and a short discussion about long distance runners.

Data is close to a straight line.

1C **(3) PB 18.3, Q8** **(a)** *55 mph* **(b)** *377.67 miles*

Finally a detailed discussion of Q8 (working with mixed units) at BB.

7 mins

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 4	*Distance-Time Graphs 1*

Activity

2

Introducing distance-time graphs

T: Kevin travels to school by bus every day. There is a bus stop 45 m from his house. Look at the following table and see what happened yesterday morning.

T (s)	1	2	4	6	7	8	10	14	15
D (m)	1.5	3	6	9	13	17	25	41	45

P_1: Kevin went to school by bus.

T: Right. What else can you say?

P_2: First he walked.

T: For how long?

P_3: For 6 seconds.

T: Why do you say that?

P_4: In the first second he walked 1.5 m and ...

T: And from the second until the fourth second?

P_5: He walked 3 m in 2 seconds, that is the same speed.

T: What happened then?

P_6: Perhaps he saw the bus coming.

T: What did he do?

P_7: He started to run.

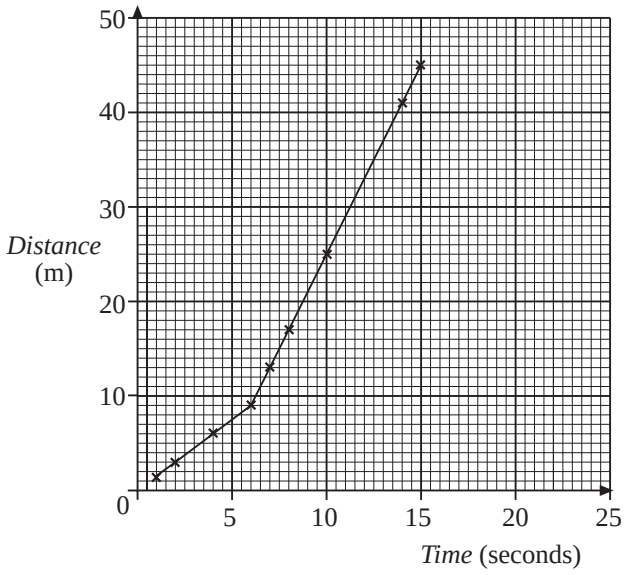
T: How fast?

P_8: He ran 4 m in 1 second.

T: And then ? ... for example, from the 10th second until the 14th second?

P_9: He ran 16 m in 4 seconds, so his speed remained the same, 4 m/s.

T: We can show this data on a graph of time against distance. It might show more clearly what has happened.



17 mins

Notes

Whole class activity.

T gets Ps to look at the table (on OHP) ...

... then whole class discussion follows. (Questions/answers interactively.)

T draws a graph on BB, Ps in Ex.Bs, with:

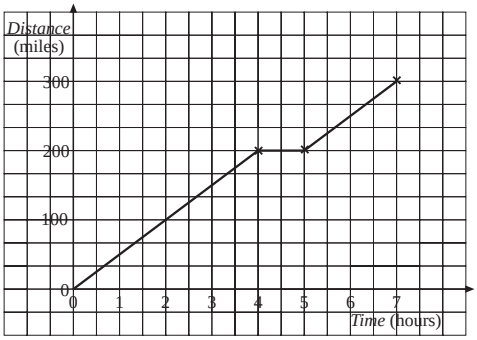
- time on the horizontal axis, 2 divisions = 1 second,
- distance on the vertical axis, 1 division = 1 m

Then T points to Ps to come and plot the data on the graph; Ps come to realise that:

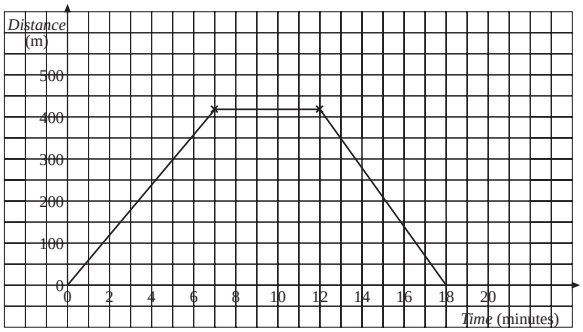
- a larger gradient indicates a faster speed,
- in all cases, the gradient of the distance-time graph gives the speed,
- a straight line means constant speed.

Praising.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 4	*Distance-Time Graphs 1*
Activity		***Notes***
3	**Using a distance-time graph** **OS 18.6** T: What does the graph show? P_1: A child travelling away from home. P_2: The speed is constant, represented by the straight line. P_3: The gradient of this line gives the speed ... P_4: ... that is $(1000 \div 80)$ m/s. T: Try to work this out in your head. P_5: 12.5 m/s P_6: Then the child stopped for 20 minutes. ... etc. *25 mins*	Whole class activity. T puts OS on OHP, then lets Ps say anything relevant about the graph. T points to volunteer Ps, agrees, writes on BB (if necessary), Ps write in Ex.Bs. T will need to help Ps interpret the negative gradient for the return journey. Praising.
4	**Further practice with distance-time graphs** **PB 18.4, Q1 (a)** *150 secs* $= 2\frac{1}{2}$ *mins* **(b)** *450 m* **(c)** *180 m/min = 3 m/s* **(d)** *90 secs* $= 1\frac{1}{2}$ *min* **(e)** *3.75 m/s* *33 mins*	Individual work, monitored, helped. *Checking*: T puts graph on BB, chooses a slower P to come to front to show calculations for the speed on the way to the shop (answering questions (a) - (c)). Agreement, self-correction, feedback. Praising. Then the same with another slower P when checking questions (d) and (e).
5	**Further example of distance-time graphs** T: In the first task today we plotted a graph using information from a distance-time table. Let's see if we can draw Rebecca's distance-time graph from the speed and time of her journey. **OS 18.7** T: How many different parts does Rebecca's journey have? Ps: Three. T: What can you say about the first part? P_1: She is moving at a constant speed. T: So? ... P_2: It will be represented by a straight line. T: Starting from? ... P_3: Starting from the origin. T: And finishing where? P_4: Driving at 50 mph for 2 hours means travelling 100 miles, so the end of the straight section is at (2, 100). T: Let's draw it. T: Now I think you can finish the graph for yourselves.	Whole class activity. T puts OS on OHP and each P has a copy. Discussion about the first stage of Rebecca's journey ... (T should allow Ps to contribute, rather than make suggestions.) ... then a volunteer P comes to front and draws the line. (All Ps draw it on their copy.) Agreement. Praising.
(continued)		

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 4	*Distance-Time Graphs 1*
Activity		***Notes***
5 *(continued)*		Finally, T asks Ps to complete Rebecca's graph on their own. T monitors and helps them. *Checking*: a volunteer P complete the graph at OS. Agreement, self-correction, feedback. Praising.
	39 mins	
6	**Individual practice drawing distance-time graphs** **PB 18.4, Q2** Distance-time graph showing Vera's journey  	Individual work, monitored, helped. Checking at BB. Agreement, self-correction, feedback. Praising
	45 mins	
	Set homework **PB 18.4, Q3 (also calculating the speed for each part of the journey)** **PB 18.4, Q4**	

Y8 UNIT 18 *Speed, Distance and Time* Lesson Plan 5 — *Distance-Time Graphs 2*

Activity		*Notes*
1	**Checking homework and further discussion**	T puts the graph of Q3 on OHP, asks Ps to describe the parts of the journey with reference to the steepness of the graph and the speed, remembering that the speeds had to be calculated, and checking these.
1A	**PB 18.4, Q3 (a)** Constant speed 100 km/h for 3 hrs **(b)** Rest for $\frac{1}{2}$ hr **(c)** Constant speed 100 km/h for 1 hr **(d)** Rest for $\frac{1}{2}$ hr **(e)** Constant speed 37.5 km/h for 4 hrs.	
1B	**PB 18.4, Q4 (a)** Graph for Ray's shopping trip  **(b)** Ray walks to the shop at 60 m/minute and walks home at 70 m/minute. (Answers to 2 d.p.)	Then a volunteer P shows how to sketch a distance-time graph using this information, stressing that travelling at a constant speed is represented by a straight line. Agreement, self-correction, feedback. Praising.
	6 mins	
2	**Revision of work covered so far in this unit** T: We've come a long way since we started this topic! Let's see if you can still remember what we learnt at the beginning.	Mental work, with all Ps contributing.
	1. How many seconds are there in 2.5 minutes? *(150 seconds)* 2. How many minutes are there in $\frac{1}{5}$ hours? *(12 mins)* 3. How many minutes are there in $1\frac{1}{6}$ hours? *(70 mins)* 4. Convert 6 minutes to hours. *(0.1 hour)* 5. Convert 1 hour 20 minutes to hours. *($1\frac{1}{3}$ hours)* 6. Convert 1 m/s to km/h. *(3.6 km/h)* 7. How many m/s is 36 km/h ? *(10 m/s)* 8. How many mph is 1.6 km/h ? *(1 mph)* 9. How many km/h is 2 mph ? *(3.2 km/h)*	T reads out questions, which also appear on OHP to give slower Ps time to think. T allows some time, then points to a volunteer P to answer a question and give the explanation. (T encourages slower Ps and allows them to use their Ex.Bs, if necessary.) **Note:** here the main point is not the actual calculations, but revision of the connections that Ps should know, and checking that they realise how to use them.
(continued)		

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 5	*Distance-Time Graphs 2*
Activity		***Notes***
2 *(continued)*	10. Bridget drives 150 km in 3 hours. Calculate her average speed. *(50 km/h)* 11. Ingrid drove at 50 mph. How far did she drive in 2.5 hours? *(125 miles)* 12. Sophia drives for 20 minutes at 90 km/h. How far does she drive? *(30 km)* 13. How long does it take Hannah to run 60 m at 5 m/s ? *(12 seconds)* 14. Cathy travelled 20 miles at 160 km/h. How long did her journey take? *($\frac{20}{100}$ h $= \frac{1}{5}$ h $= 12$ mins)*	Agreement, praising after each question.
	16 mins	
3	**Using data to draw a distance-time graph** T: Let's use what we've leant so far to draw another distance-time graph.	Whole class activity.
	Travelling from the loading area to the take-off runway, an aeroplane taxied at 7.5 m/s for $\frac{1}{3}$ of a minute and then stopped on the runway for half a minute. When taking off, the plane moved as shown in the following table: *T* (s) 0 5 10 15 20 25 30 35 40 *D* (m) 0 50 100 200 350 550 800 1100 1450 On a distance-time graph, plot the data of the moving plane as it travelled from the loading area until it left the runway. Describe the movement of the plane on the runway.	Task appears on OHP.
	T: Let's look at the first set of data. P_1: The plane moved to the runway at a constant speed of 7.5 m/s. P_2: We can find the distance by multiplying the speed by the time. P_3: Before doing this we should convert the time in minutes to seconds: $\frac{1}{3}$ minute $= 20$ seconds. P_4 (writes on BB): Distance $= (7.5 \times 20)$ m $= 150$ m T: Then? P_5: The plane was stationary for 30 seconds. T: How far and for how long did the plane move on the ground? P_6: The plane taxied for 20 seconds, stopped for 30 seconds and was on the runway for 40 seconds, a total of 90 seconds. P_7: And the distance travelled on the ground is 1600 m. T: Who would like to draw a suitable distance-time graph? ... What units would you choose for the axes?	T lets Ps think, then suggest the steps. Ps volunteer to come to front to work and explain at BB. T agrees, praises, Ps write in Ex.Bs. (T can ask extra questions if Ps need more guidance.)
(continued)		

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 5	*Distance-Time Graphs 2*
Activity		***Notes***
3 *(continued)*	P_8: I would choose 5 seconds and 100 m as the units on the axes. T: OK. Please show us ...	P_8 draws a graph, then T chooses volunteer Ps to represent the movement of the plane on it, remembering that 0 seconds on the runway will be the 50th second of movement of the plane overall, during which time it has travelled 150 m. After plotting the points of the runway part of the journey, T asks Ps to join the points and describe the plane's movements.
	T: What can you say about the movement of the plane from the 50th second? P_1: It moved at a constant speed for 10 seconds but then ... T: Calculate this speed. P_1: It moved 100 m in 10 seconds, so its speed is $(100 \div 10)$ m/s, that is 10 m/s. But then the steepness of the graph increases. T: So? P_2: The speed is not constant. T: What happens? P_3: The aircraft must have been accelerating in order to take off. T: Clever! How many metres did the plane move on the land in the last 5 seconds before it took off? P_4: 350 metres. T: Can you calculate its speed? P_5: $(350 \div 5)$ m/s = 70 m/s T: In km/h ? P_5 (at BB): 70×3.6 km/h = 252 km/h T: What kind of speed must this be? P_6: It must be an average speed. T: What can you say about the speed of the plane just before take-off, in the 90th second? P_7: It was greater than 252 km/h. *30 mins*	T should consider the stronger Ps and continue putting questions to challenge them to think about this for as long as they are capable and interested. Praising.
4	**Interpreting distance-time graphs** T: Let's look at another type of problem. What can you see from this graph? **PB 18.4, Q6** *Solutions* **(a)** *1500 m* **(b)** *15 mins* **(c)** $1\frac{2}{3}$ m/s $\approx$ *1.67 m/s (2 d.p.)* **(d)** *35 mins* **(e)** $1\frac{1}{4}$ *m/s = 1.25 m/s* *38 mins*	Whole class activity to start. T puts the graph on OHP and asks Ps to describe what has happened. (Encourages them to make up a story.) Praising. Then T asks Ps to open their PBs on p124 and read the task for Q6. Short discussion, then individual work, monitored, helped. Verbal checking, agreement, self-correction, feedback. Praising.

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 5	*Distance-Time Graphs 2*
Activity		***Notes***
5	**Individual work with graphs** **Activity 18.3, Q2, Q3, Q5** <u>*Solutions*</u> 2. Increasing speed for a while, then reducing to zero speed; turning round and returning in the same way to the start position. 3. Starting away from the origin, increasing speed for a while, but then reducing to zero speed (still some distance from the origin), turning back and returning to the starting point. 5. Starting away from the origin and going at a constant speed until the origin is reached; then returning to the start point at a constant, but slower, speed. *45 mins*	Individual work. Task appears on OHP. When checking, T asks for descriptions and also encourages Ps to make comparisons, e.g.: - the movement in '2.' is the same as that in '3.', but seen from the opposite side; - note that in Q5 the object stops/starts without slowing down or accelerating! Praising.
	Set homework **(1) Mental Test M 18.2 (each P is given a copy)** **(2) PB 18.4, Q11 (a) and (c)**	Perhaps only interested Ps should be given Task (2).

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 6	*Other Compound Measures*
Activity		***Notes***
1	**Checking homework**	Very detailed discussion of the first part of the homework. Since M 18.2 covers all the essential facts and information from this unit, it's very important that all Ps understand it.
1A	**(1) M 18.2**	If several Ps have difficulties with any topic here, T must explain again clearly at BB until they are familiar with it.
1B	**(2) PB 18.4, Q11 (a)** Speed increasing from zero; then slowing down; stationary at destination. **(c)** Speed increasing from point away from starting position; back to start; speed rapidly increasing, back to original distance from start.	Volunteer (probably stronger) Ps describe the journeys.
	10 mins	
2	**Units of speed in different contexts** T: What different units of speed have we met? Ps: mph, km/h, m/s, ... T: For example, what do we mean by '26 m/s' ? P_1: We mean that something, perhaps a car, moves 26 metres every second. P_2: Or it does on average. T: And as the seconds/minutes/hours pass, can you imagine any other activities we could use as examples? Look at the next problem ... read it out. **PB 18.1, Q7** P_1: $(50 \div 2)$ words/minute = $(25$ words/min$)$ P_2: $(300 \div 15)$ words/minute = $(20$ words/min$)$ P_3: 25 words/min = (60×25) words/hour = 1500 words/hour P_4: 20 words/min = (60×20) words/hour = 1200 words/hour	Whole class activity. T gets one of Ps to read the question aloud. Discussion about typing speed, then two volunteer Ps come to BB to show calculations (at the same time). Agreement, praising, Ps write in Ex.Bs.
	16 mins	
3	**Finding averages by dividing** T: We don't always need to see how long an activity takes. For example, look at this question about a football match. **PB 18.5, Q1**	Whole class activity. When Ps have read the question, T asks them to determine the solution. Agreement, and then slower Ps are called (one after the other) to calculate the rates, without a calculator, at the same time reviewing how to change fractions into decimals. Praising. Ps write in Ex.Bs.
(continued)	*Solutions*:	

	No. of Goals Scored	*No. of Matches Played*	*Goals per Match*
Ian	16	32	0.5
Ben	22	40	0.55
Sergio	9	20	0.45

Y8	**UNIT 18** ***Speed, Distance and Time*** Lesson Plan 6	*Other Compound Measures*
Activity		***Notes***
3 *(continued)*	**(a)** *Most goals/match = 0.55 (Ben)* **(b)** *Least goals/match = 0.45 (Sergio)* *23 mins*	
4	**Working out averages** So we can interpret averages by dividing, using many different units. Let's look at an example of how to convert them. **OS 18.9** *28 mins*	Whole class activity. OS appears on OHP. The same activity as before: Ps work through solution at BB/ OHP, others in Ex.Bs. T agrees and praises.
5	**Individual work with averages** **PB 18.5, Q2 (c)** *(0.9),* **(a)** *(0.6),* **(b)** *(0.01)* *33 mins*	Individual work, monitored, helped. Verbal checking. Agreement, self-correction, feedback. Praising.
6	**Lesson using computers** **Activity 18.4, Q1** *45 mins*	T should arrange to give this lesson in a computer room. Each P is given a copy of the Activity and asked to read Q1. Ps then use the internet to find information needed to answer the question. (T helps by walking among them.) After collecting data, T makes Ps read questions 2-5 and prepare to discuss what columns will be needed to answer the questions. Discussion leading to agreement, then T sketches the table on BB, labels the columns (see *Notes and Solutions* sheet), Ps prepare table on computers. Finally, Ps print a table to be filled in at home. (T has done this in advance and gives a copy to any Ps who have not succeeded in preparing their own.) Praising.
	Set homework **(1) Activity 18.4, Q2 - Q5** **(2) Activity 18.4, Q6, for stronger Ps**	