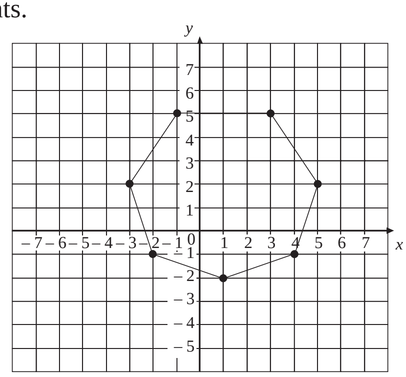
Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 1	*Coordinates*

Activity		***Notes***
1	**Revising the use of grids** T: Can you remember how to plot and read points on a grid? We'll be working on grids in this unit, so we'll start by revising them. **OS 14.1 with the following points added in:** I (–4, 0) J (2, 0) K (0, 3) L (0, –5)	
1A	**Using grids** *First column:* A (4, 7), C (5, –3), E (–5, –3), G (4, –7), I (–4, 0), K (0, 3)	Whole class activity. Task appears on OHP. T points to Ps to read the coordinates of the points on the grid and then to write them on OS. Each point is read by a different P. The first few Ps are also asked to explain how to read the coordinates, stressing the importance of the order in which the coordinates are given. Slower Ps are then asked to read points. If many find this difficult, T can plot further points (including points on the axes) for them to practise. Agreement. Praising.
1B	**Individual practice** *Second column:* B (6, 2), D (–5, 6), F (–6, –7), H (–3, 8), J (2, 0), L (0, –5) *8 mins*	Individual work. T monitors Ps' work, if necessary giving a copy of OS 14.1 to any struggling Ps and helping them to read the coordinates by pointing to the points with their fingers/pens. Verbal checking. Agreement, feedback, self-correction. Praising.
2	**Revision - plotting points** T: Now we'll do the process inversely. We have the coordinates; now we have to plot the points. **OS 14.2**  *15 mins*	Whole class activity. Task appears on OHP. Mainly slower Ps are asked to plot points on OS. Ps watch and may help. Each P is given a copy of OS 14.2 and, after agreement, plots the correct points on it. Praising, joining the points in order, including the first to the last one, and naming the shape (heptagon).

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 1	*Coordinates*
Activity		***Notes***
3A	**Plotting points from coordinates** **PB 14.1, Q5** *((–1, –5))*	Whole class activity. Ps prepare a grid in their Ex.Bs, T monitors, helps and sketches a grid on BB. T asks Ps to plot the three points on their grids and then plots them on grid on BB. Discussion about position of fourth corner of rectangle. Ps show at BB and plot in Ex.Bs, giving coordinates individually; checking, agreement, feedback, self-correction. Praising.
3B	**Individual practice - plotting points from coordinates** **For slower Ps: PB 14.1, Q4** *((–1, –3))* **For stronger Ps: PB 14.1, Q4 changed, giving only two corners: (3, 1) and (–1, 1)**	Individual work, monitored, helped if necessary. *Checking*: firstly the task for slower Ps. T puts a pre-prepared grid on OHP and asks a slower P to plot the three corners given, complete the square and read the coordinates of the missing point. (1, –3)
	T: Some of you were given only two points: (3, 1) and (–1, 1). Have you all found the square shown on the OHP? *(Yes)* T: Could you complete it in another way? *((3, 5); (–1, 5))* T: Is that the only alternative? Imagine that the two corners are placed diagonally ... Who can show it on the OHP? ... Did anyone have this solution? ...Please give us the coordinates. *((1, 3); (1, –1))*	Then the stronger Ps' task is checked. Volunteer P shows the third possible solution at OHP. Agreement, completing work. Praising.
	27 mins	
4	**Function machines** T: Pairs of numbers can also be given from function machines. T: Let's use a number machine that multiplies the number that you put into it by 5. What will you get if you put in:	Mental work to enthuse Ps and prepare them for the next section. T asks, points to a P to answer, agrees/waits for correction and then praises, question by question.

T:	Ps:
3	15
10	50
100	500
1	5
0	0
4	20
–4	–20
–1.5	–7.5

(continued)

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 1	*Coordinates*

Activity | | ***Notes***

4 *(continued)*

T: Another machine divides the number put into it by – 2. Can you say what pairs of numbers it will produce?

T:	Ps:
4	–2
6	–3
20	–10
–2	1
0	0
–100	50
1	–0.5
–3	1.5

33 mins

5

Individual work - completing grids for pairs of numbers

T: We can also illustrate the pairs of numbers produced by a number machine on a grid. Let's look at two examples.

(A) T: The first number machine multiplies the number put in by 2. Copy and complete the table on the BB.

x	–2	–1	0	1	2	3
$2x$						

Solution: *–4 –2 0 2 4 6*

T: So we have some pairs of numbers: (–2, – 4); (–1, –2); (0, 0), etc. Let's use them as coordinates and put them on a grid.

T: How do these points seem to be relating to each other on the grid? *(They seem to be on a straight line)*

T: Do all number machines produce points that are on the same straight line? ... Let's look at another one.

(B) T: This number machine squares the number put into it.

x	0	1	2	3	4
x^2					

Solution: *0 1 4 9 16*

Notes:

Individual work, monitored, and helped if necessary.

Checking: Ps dictate, T agrees and writes correct answers in the table. Feedback, self-correction. Praising.

Then T prepares a grid on BB (Ps in Ex.Bs) or shows a pre-prepared OS, and asks Ps to come and plot the points at BB/ OHP. Agreement, praising; all Ps plot the points on their grids.

Whole class activity.

T may quickly remind Ps about 'squaring' (i.e. $x^2 = x \times x$), then asks, agrees, praises and writes correct answers in the table (Ps in Ex.Bs).

Then the points are plotted on BB and in Ex.Bs as before and a short discussion takes place: these points do *not* seem to be on a straight line.

45 mins

Set homework

(1) PB 14.1, Q3

PB 14.1, Q9

(2) Copy and complete the table, then, on a grid, plot the points given by the pairs of numbers. What do you notice?

x	–3	–2	–1	0	1	2	3
$3x$							

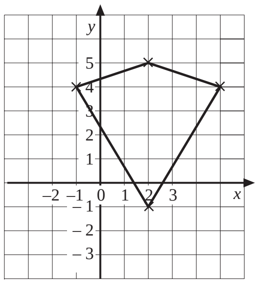
Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 2	*Straight Lines Passing Through the Origin*

Activity | ***Notes***

1

Checking homework

(1) PB 14.1, Q3 (a), (b)

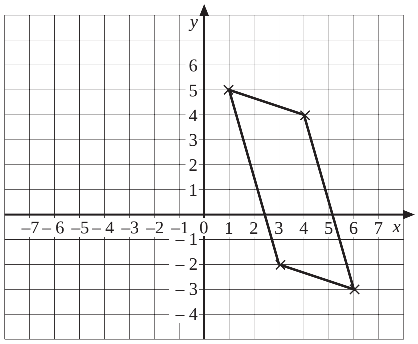


(c) kite

T has asked two Ps to draw a grids showing the solutions of part (1) of homework on BB as soon as Ps arrive. Other Ps agree/ correct.

Feedback, self-correction. Praising.

PB 14.1, Q9 (a)



(b) $(3, -2)$

(2) Completing the table and plotting the points

x	–3	–2	–1	0	1	2	3
$3x$	– 9	– 6	– 3	0	3	6	9

Then detailed discussion of task (2). T sketches table on BB, points to slower Ps to dictate the missing numbers, agrees, writes correct answers in the table.

Then T draws a grid on BB and points to slower Ps to plot the points on the grid.

Agreement or correction for each point. Feedback at end. Praising.

Agreement that these points are again all on a straight line (see previous lesson).

7 mins

2

Number machines for remainders

T: So the points of the rule $x \to 3x$ are again all on a straight line. Why are the points in the second table at the end of the last lesson not in a straight line?

Let's look at another type of equation, a number machine that gives remainders. You put in a whole number, the machine divides it by 2 and gives you the remainder.

Are all these points on a straight line?

x	1	2	3	4	5	6	7
r	*1*	*0*	*1*	*0*	*1*	*0*	*1*

Table appears on BB. Whole class activity when completing the table. Volunteer Ps count aloud and write their answers on the table on BB, ...

T: Can you predict whether these points will be on a straight line?

(They won't be on a straight line)

T: Let's check.

... then individual work, drawing a grid and plotting the points on it. *Checking*: T sketches solution on BB. Agreement, feedback, self-correction. Praising

14 mins

Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 2	*Straight Lines Passing Through the Origin*

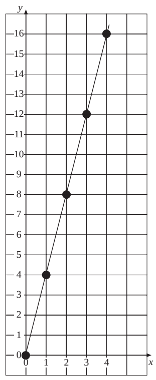
Activity		***Notes***

3

Plotting straight lines

T: So now we need to answer the question:
"What type of rules will give points that are all on a straight line?"
So far we've used different rules and got different graphs, now we'll look at graphs of straight lines and then find their rules.

OS 14.4



Notes: Task appears on OHP and each P is given a copy of OS 14.4.
Ps plot the points individually, checking (T plots them on OS quickly after stopping Ps work), then finding the rule followed by a short discussion.

T: What do you notice here?
(The points are all on a straight line)

T: Draw the line on your set of axes.

T: Look at the coordinates of the points.
Can you see a relationship between them?
(For each point, the y-coordinate is 4 times the x-coordinate)

T: Write it down.

P: $y = 4x$

T: So what is the rule that gives us these points?

Ps: $x \to 4x$

Notes: Volunteer P writes the relationship/ rule on BB.

T: We were given only 5 points, but you've drawn a straight line on the grid. What's happened?

Ps: We got lots of points.

Notes: Then further discussion, questions/ answers interactively.

T: Do the coordinates of these points fit the same equation? ...
Let's read the point which has 0.5 as its *x*-coordinate.

P: (0.5, 2)

T: So?

Ps: $0.5 \times 4 = 2$, so that's OK.

T: What is the *x*-coordinate of the point which has 10 as its *y*-coordinate?

Ps: About 2.5.

T: And?

Ps: And $2.5 \times 4 = 10$.

T: Can we take it that all the points on this line fit this equation?

Ps: Yes

22 mins

4A

Finding the rule

Notes: Individual work, monitored, helped.

T: Now I'll give you some points. Your task is to plot and draw them on your grid and then find the rule. You can use the grid from OS 14.4.

T (writes on BB): (0, 0), (1, 0.5), (2, 1), (4, 2)

Notes: T write the coordinates of the points on BB; Ps work on sheet from previous Activity.

P_1: The relationship I've found is $x = 2y$.

T: And put another way? Can you change the subject of this formula?

Notes: Checking at OHP, then discussion.

P_2: $y = \frac{1}{2}x$ or $y = 0.5x$

T: So what can we write as the rule?

P_3: $x \to 0.5x$

Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 2	*Straight Lines Passing Through the Origin*
Activity		***Notes***
4B	**A question in context** T: Now we'll look at a problem in context. Listen to the problem, answer it and find the connection between the text and the straight line in the previous section. On a market stall, 1 kg of bananas costs £0.50. Calculate the cost of T: 2 kg — Ps: £1 4 kg — £2 0 kg — £0 x kg — £$(0.50 \times x)$ T: What can we say about the answers? *(Each answer corresponds to a point on the graph of $x \to 0.5x$)* T: Can you read from the graph the cost of 3 kg of bananas? *(3 kg $\to$ £1.50)* *32 mins*	Mental work. T asks, gives time for Ps to think, points to slower Ps to answer, agrees and points to the actual point on the graph. Volunteer P shows at OHP how to read the answer from the graph. Agreement. Praising.
5	**Revision of linear proportion** T: What can you say about the relationship between the bananas and their cost? *(If the mass of bananas is doubled, the cost will be doubled)* T: What do we call this type of connection? *(We say they are in direct or linear proportion to each other)* T: Why are they 'linear'? *(Because their graph is in a straight line)* T: Is the inverse (opposite) true as well? Do all the straight lines correspond to a direct/linear proportion? We'll look at this now. There is another graph on your grid. What can you say about the coordinates of these points? $\to$ (1, 4), (2, 8), (3, 12), ... *(They are all in linear proportion (except the point (0, 0))* T: Turn back to your homework graph: (1, 3), (2, 6), (3, 9), ... *(These points are also in linear proportion)* T: Let's plot some of these points, e.g. (writes on BB): (0, 0), (1, 3), (2, 6), (3, 9) on this grid and draw the straight line and then compare the three graphs. T: Is there any common property? *(They all pass through the point (0, 0), the origin of the graph)* T: Any differences? *(The steepness of the lines is different)* T: Write the rules of the graph next to each one. Which line is the steepest? *($y = 4x$, then $y = 3x$, finally $y = 0.5x$, so the greater the number x is multiplied by, the steeper the graph)* T: Good. We'll find out more about this in our next lesson. *38 mins*	Whole class activity. Short reminder of the concept of linear proportion followed by a discussion with interactive questions/answers.

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 2	*Straight Lines Passing Through the Origin*

Activity

Notes

6

Individual work

T: Let's look at our final task for this lesson:

(a) Plot the points given in the table:

x	–3	–2	–1	0	1	2	3	4
y	6		2	0	– 2	– 4		

(b) Draw a straight line through the points.

(c) Give the rule of the graph.

(d) Fill in the missing coordinates by reading them from the graph and checking the rule.

Individual work, monitored, helped.

Task appears on OHP.

T give Ps 5 minutes, then stops the work, draws a grid on BB with the graph for Ps to check.

Feedback, self-correction. Praising.

Then T asks for the relationship between the x and y coordinates ($y = -2x$), comparing it with the graphs in the previous examples (increasing-decreasing).

Part (d) can be given as homework.

45 mins

Set homework

(1) Complete Activity 6 from the lesson.

(2) PB 14.2, Q4

(3) Use the same grid to draw straight lines between the following points and write down the rule of each graph:

(a) (– 1, – 2), (0, 0), (1, 2), (3, 6)

(b) (– 3, – 1), (0, 0), $\left(1, \frac{1}{3}\right)$, (6, 2)

(c) (– 2, 6), (– 1, 3), (1, – 3), (3, – 9)

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 3	*Gradient*
Activity		***Notes***
1	**Checking homework (and further discussion)**	
1A	**(1) Completing the final activity of the last lesson** The missing coordinates: $(-2, 4)$ and $(-2) \times (-2) = 4$ $(3, -6)$ and $3 \times (-2) = -6$ $(4, -8)$ and $4 \times (-2) = -8$ so the rule is $y = -2x$.	Short verbal checking of homework exercise (1), giving the missing coordinate and checking the rule at each point by a different P. Agreement, feedback, self-correction. Praising.
1B	**(2) and (3) PB 14.2, Q4 and more about the graph** $(1, 1)$, $(2, 2)$, $(4, 4)$, $(5, 5)$ $\rightarrow$ $y = x$ $(-1, -2)$, $(0, 0)$, $(1, 2)$, $(3, 6)$ $\rightarrow$ $y = 2x$ $(-3, -1)$, $(0, 0)$, $(1, \frac{1}{3})$, $(6, 2)$ $\rightarrow$ $y = \frac{1}{3}x$ $(-2, 6)$, $(-1, 3)$, $(1, -3)$, $(3, -9)$ $\rightarrow$ $y = -3x$	Then T puts a pre-prepared OS on OHP showing the four graphs of homework exercises (2) and (3). Ps check/correct their graphs; then T asks for the rules. Agreement, feedback, self-correction. Praising.
1C	**Introducing 'gradient'** T: What do you notice when you look at all the graphs? P_1: All four graphs are straight lines. P_2: The all pass through the point (0, 0), the origin. T: From now on we'll refer to the rules as equations. Is there any similarity in their equations? P_3: All the equations follow the pattern $y =$ something $\times\ x$ T: What is the 'something'? P_4: For the first example the 'something' is 1, so $y = 1 \times x$ can be written here. T: What about the other lines? Ps: 2, $\frac{1}{3}$, -3 are the 'somethings'. T: How are the graphs different? Ps: In their steepness. T: And what do we mean by steepness? P_5: How fast the graph rises. T: Do all of them rise? Ps: All except $y = -2x$. T: Right. Let's look at the first three graphs and their equations. What else do they have in common? Try to give it as a statement. P_6: If the multiplier in the equation is positive, the graph will rise/increase. T: What is the difference in the rate of increase? P_7: The larger multiplier gives a steeper rise. T: Has anyone noticed *how* the multiplier in the equation changes the steepness? P_8: When x increases by 1, the graph of $y = 2x$ rises 2 units, while the graph of $y = 1 \times x$ rises 1 unit.. T: And the graph of $y = \frac{1}{3}x$?	Discussion leading to the topic for the lesson. T praises Ps for correct answers. It is not important that all Ps understand this at this stage; if a stronger P does give the answer, T should wait for some slower Ps to understand as well. Further detailed explanation might be helpful, perhaps with other graphs shown. As the lesson progresses, it will become clear to slower Ps after they have seen several examples.
(continued)		

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 3	*Gradient*
Activity		***Notes***
1C *(continued)*	Ps: It rises by $\frac{1}{3}$ unit. T: Can you explain that - I'm not sure what you mean. P_9: We can see that while x increases by 3, the graph rises 1 ... T: That's right. The number, which multiplies x in the equation of the line and tells us the steepness of the rise of the line after one step in the direction of x, is called the gradient. The gradient is used for measuring and describing the steepness of the line on the graph. T: Let's see how we read it from the graph ... *13 mins*	The first figure from p41 of PB appears on OHP; a short discussion about gradient comes next.
2	**Reading gradients** **OS 14.5** T: Let's look at question (b) first. P_1: The line rises 4 units over 2 steps, so gradient $= \frac{4}{2} = \frac{2}{1} = 2$ T: What is the other way we can read this? P_2: We can read the gradient from a smaller triangle as well: 1 step, 2 rises, gives the same gradient. T: Now, for question (a), use any appropriate triangle to determine the gradient. P_3: $\frac{1}{1} = 1$ p_4: $\frac{2}{2} = 1$ P_5: $\frac{3}{3} = 1$ etc. with (c) and (d). T: We haven't yet looked at the fourth graph from the homework. Have a look at it now - how is it different from the previous ones? Ps: It decreases. The decrease is 3 over 1 step. T: So what is its rise? Ps: ? ... (-3) ? T: Look at its equation. Ps; $y = -3x$ T: So, is it likely that (-3) is the gradient? Ps: Yes. T: OK. Now on to the last question on the OS. Who can explain it? P: This is also a graph which decreases, so its gradient will be negative. Over 3 steps the rise is -4, so the gradient is $-\frac{4}{3}$. *23 mins*	Whole class activity. Task appears on OHP. T asks, volunteer Ps answer first, then T encourages slower ones. T agrees, praises, writes correct answers on OS. T asks Ps to turn back to the fourth homework graph and then they calculate the negative gradients together.

Y8	UNIT 14 ***Straight Line Graphs*** Lesson Plan 3	*Gradient*
Activity		***Notes***
3	**Individual practice** **PB 14.3, Q2** (a) 4, (b) 1, (e) $1\frac{1}{2}$ **PB 14.3, Q3** (a) – 1, (d) – 2 *30 mins*	Individual work, monitored, helped. *Checking*: Figures appear on OHP, volunteer Ps show and explain solutions. Agreement, feedback, self-correction. Praising.
4	**Plotting points and drawing straight line graphs** T: All the straight lines we've seen so far have been drawn through the origin (the point (0, 0)). What type of rule/equation describes them? Ps: y = something $\times\ x$. T: What is the 'something' ? Ps: A number showing the gradient or steepness of the line. T: So would you be able to give the equation of a straight line drawn through the origin if you were asked to? Ps: Yes. T: How would you do this? Ps: By finding the gradient of the line. T: Good. We'll use the letter '*m*' to represent the gradient, so the equation of these lines will be written as ... (writes on BB)) $y = m \times x$	Whole class activity. Discussion led by T; questions/ answers interactively before starting the task. Ps may call out answers without being chosen by T. Ps write in Ex.Bs.
	(a) T: Draw a grid in your Ex.Bs and then I'll give you a line. The point which defines the line is (2, 6). Plot the point and draw the straight line fitted on it. Ps: ? T: What's the problem? ... OK, I'll give you one more point ... Will this be enough, or should I give you more points? Why? Ps: Two points uniquely define a straight line. T: So now you can draw your line on BB. T: Is this similar to what we've dealt with so far? Ps: Yes. T: Why? Ps: It has passed through the point (0, 0), the origin. T: So what is its equation? Ps: $y = m \times x$ T: What does '*m*' represent? Ps: The gradient of the line. T: Who'd like to determine the equation at BB? P (counts at BB): Between the two points we have been given, step $= 3$, rise $= 9$ so the gradient is $\frac{9}{3} = 3$. The equation of this straight line is $y = 3x$.	Each P draws a grid in Ex.B, T on BB. T plots (2, 6) on the grid on BB, Ps in Ex.Bs. Ps can protest. T plots (– 1, – 3) on BB, Ps in Ex.Bs. Volunteer draws the straight line on BB, others in Ex.Bs.
(continued)		

Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 3	*Gradient*
Activity		***Notes***
4 *(continued)*	T: How can we check this? P: $(-1)\times 3 = -3$ and $2\times 3 = 6$ T: Good. T: Now give the equation of the straight line drawn through these points ... (b) ... $(-3, -2)$ and $(6, 4)$ ... $\left(y = \frac{2}{3}x\right)$ (c) ... $(-3, 12)$ and $(-1, 4)$ ... $(y = -4x)$ (d) ... $(-5, 1)$ and $(10, -2)$ ... $\left(y = -\frac{1}{5}x\right)$ *39 mins*	After finding the first equation, T gives more and more straight lines (with two of their points) for Ps to determine the equation of the lines. T lets Ps work quietly without asking them further questions. Ps come to BB to explain solutions. T agrees and praises.
5	**Individual practice drawing straight line graphs** T: I think it's time for you all to try some on your own. Give the equation of the straight line fitted on the points: (a) $(-1, (-5))$ and $(2, 10)$ $(y = 5x)$ (b) $(-2, 1)$ and $(4, -2)$ $\left(y = -\frac{1}{2}x\right)$ (c) $(0, 0)$ and $(4, 6)$ $\left(y = \frac{3}{2}x\right)$ *45 mins*	Individual work, monitored, helped. T draws the three lines on BB (or puts them on OHP when they are to be checked) while Ps work. *Checking*: volunteer Ps come out and show solutions. T agrees, praises (self-correction) and stresses at the end that all these lines pass through the origin, so their equation can be written in the form $y = m \times x$.
	Set homework **(1) PB 14.3, Q2, (d), (f), (g), (h)** **PB 14.3, Q3 (b), (c)** **(2) Give the equation of the straight line fitted on the points:** **(a)** $(-3, -6)$ and $(-1, -2)$ **(b)** $(-1, 3)$ and $(3, -9)$ **(c)** $(0, 0)$ and $(8, 6)$ **(d)** $(4, -1)$ and $(12, -3)$	

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 4	*Straight Lines*
Activity		***Notes***
1	**Checking homework** **(1) PB 14.3, Q2** (d) 2 (f) 1 (g) $2\frac{1}{2}$ (h) 0 **PB 14.3, Q3** (b) -4 (c) -3 **(2) Giving equations** (a) (–3, –6) and (–1, –2) $\rightarrow y = 2x$ (b) (–1, 3) and (3, –9) $\rightarrow y = -3x$ (c) (0, 0) and (8, 6) $\rightarrow y = \frac{3}{4}x$ (d) (4, –1) and (12, –3) $\rightarrow y = -\frac{1}{4}x$ *5 mins*	Verbal checking of part (1) of homework. Figures appear on OHP, volunteer Ps give Step and Rise, T shows it on OHP, P gives Gradient, other Ps agree or suggest correction. (Short discussion at Q2 (h) - how to imagine a straight line with 0 as gradient.) Part (2): checking the equations verbally with further explanation (including drawing at BB) if there is any problem. Agreement, feedback, self-correction. Praising.
2A **2B** *(continued)*	**Whole class review** T: What have we covered so far in this unit? Ps: Straight lines and their equations. T: What type of straight lines? P_1: Lines drawn through the origin. T: What do the equations of these lines look like? P_2: $y = m \times x$ T: What is meant by 'm' ? P_3: The gradient of the line. P_4: It shows the steepness of the straight line. T: How do we calculate it? P_5: Gradient $= \frac{\text{rise}}{\text{step}}$ T: What kind of gradients have you met? P_6: If a gradient is positive, the steepness of the line increases; if it's negative, the steepness of the line decreases. T: And? ... remember your homework! P_7: If the gradient is 0, the steepness of the line doesn't increase or decrease. T: What is meant by 'the equation of a line' ? P_8: The relationship between the x- and y-coordinates of a line. **Drawing lines from equations** T: So what does the graph of $y = 2x$ look like? P: It passes through the origin and rises 2 units during 1 step. T: What does the graph of $y = 3x$ look like? ... $y = -2x$ ... ... $y = \frac{1}{3}x$ ...	Whole class activity. A short summary/review of what has been covered so far in this unit ... ... followed by Ps using their knowledge to draw a line (passing through the origin without actually finding any of the points. T draws a grid, asks, volunteer P comes out, draws the line (starts from (0, 0) and plots other points step by step) and explains.

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 4	*Straight Lines*
Activity		*Notes*
2B (continued)	What does the graph of $y = \frac{3}{5}x$ look like? ... $y = -\frac{3}{2}x$ ...	T agrees, praises, other Ps listen and draw in their Ex.Bs. Then T encourages other (and slower) Ps to do the same. (In some case, T may suggest that Ps check one or two points if they 'know' the rule/equation of the particular line.) Agreement. Praising.
	14 mins	

3

Finding equations

T: Let's look again at number machines. Find the rule for the numbers in this table.

Whole class activity.

(A)

x	–3	–1	0	1	4
y	2	4	5	6	9

T draws the table on BB; Ps find the rule.

P: $y = x + 5$

T: Is this rule similar to those we've met so far?

Ps: No!

T: What is the difference?

Ps: The $+5$.

T: Let's see what kind of points are given by this rule in a grid ...

T draws a grid on BB, slower Ps are asked to plot the points on it and all Ps do it in their Ex.Bs. Then questions/answers interactively to examine the graph.

T: Can you draw a straight line through the points? Do it ...

T: What can you say about this line?

P_1: It does not pass through the origin.

P_2: We can determine its gradient ... It is 1.

P_3: And this is also the multiplier of x in the rule for a straight line passing through (0, 0).

Praising wherever possible.

(B)

T: Let's take another number machine and do the same as before: find the rule of the pairs of numbers, plot them in a grid and then examine what we get.

Whole class activity continues at a faster pace.

x	–2	0	1	2	4
y	5	3	2	1	–1

P_1: $x + y = 3$

T writes equation on BB, Ps in Ex.Bs.

(after plotting on BB):

P_2: We got a straight line again.

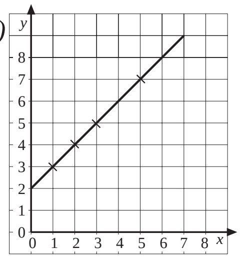
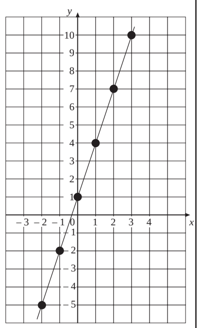
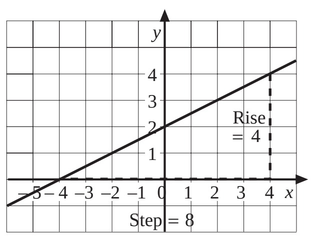
P_3: It doesn't pass through the point (0, 0) either.

P_4: Its gradient is –1.

T: Where can you see –1 in its equation? Can you find y from it?

(continued)

Y8 UNIT 14 *Straight Line Graphs* Lesson Plan 4 *Straight Lines*

Activity		Notes
3 *(continued)*	P_5: $y = 3 - x$ T: Or we can write: $y = -x + 3$ or $y = -1 \times x + 3$. P_6: And – 1 is the multiplier of *x*. *24 mins*	T writes equation on BB, Ps in Ex.Bs. Agreement. Praising.
4	**Individual work** **PB 14.2, Q5 extended with the question:** *(a)* **(d) Determine the gradient of the line.** *(b) For example, (0, 2), (4, 6), (6, 8)* *(c) The y-coordinate is always 2 more than the x-coordinate, i.e.* $y = x + 2$. *(d) Gradient* $= 1$  <u>*Properties:*</u> - equation $y = x + 2$ or $y = 1 \times x + 2$ - straight line - does not pass through the origin - gradient $= 1$ - the gradient can be read from the equation of the line; it is the multiplier of *x*. *32 mins*	Individual work, monitored, helped. *Checking*: T draws line on OHP or on BB (Ps check/correct their work) and discusses its properties of the line with Ps. Agreement. Praising.
5	**Plotting points from an equation** T: Now we'll do something easier. Let's look at the inverse of the procedures we've just covered. I'll give you an equation and you have to find points to draw the line, then give the properties of the line. **OS 14.6** <table><tr><td>x</td><td>–2</td><td>–1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>–5</td><td>–2</td><td>1</td><td>4</td><td>7</td><td>10</td></tr></table> <u>*Properties:*</u> - straight line - does not pass through the origin - gradient $= 3$ - the gradient is the multiplier of *x* in the equation. *37 mins*	Whole class activity. Task appears on OHP and each P is given a copy. Slower Ps are encouraged to come out to fill in the table and plot the points (one point per P) on OS. All Ps plot the points on their copies. Then Ps give properties of the line. Agreement. Praising.
6	**Individual work** **PB 14.3, Q7 (also writing down properties, as before)** <table><tr><td>x</td><td>–2</td><td>0</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td></td><td></td><td></td><td></td><td></td></tr></table>*Solution*: *1 2 3* $3\frac{1}{2}$ *4*  <u>*Properties*</u>: - straight line - does not pass through the origin - gradient $\frac{4}{8} = \frac{1}{2}$ - the gradient is the multiplier of *x* in the equation *43 mins*	Individual work, monitored, helped. T may give a table to fill in, to help Ps when drawing the line. T checks and corrects the graphs when monitoring Ps' work. Verbal checking of the properties. Agreement, feedback, self-correction. Praising.

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 4	*Straight Lines*
Activity		***Notes***
7	**Summarising** T: What kind of lines have we dealt with today? P_1: Straight lines, not passing through the origin (point (0, 0)). T: What do the equations of these lines look like? P_2: y = something $\times$ x + something T: What can you say about the first 'something' ? P_3: It is the gradient of the straight line. T: So? P_4: We can read the gradient of a line from its equation without drawing it. T: In the same way as ... ? P_5: In the same way as we could for straight lines passing through the origin. T: For example, what is the gradient of the line of $y = 5x + 3$? P_6: Gradient $= 5$ T: $y = \frac{1}{4}x + 2$? Ps (perhaps in chorus): $\frac{1}{4}$ T: Very good! But what is the other 'something' in the equations of these lines? We'll look at this in our next lesson. *45 mins*	T makes Ps review what they have covered in this lesson. Quick questions/answers ... ... praising at the end.
	Set homework **PB 14.2, Q1, (and determine the gradient)** **PB 14.3, Q8**	

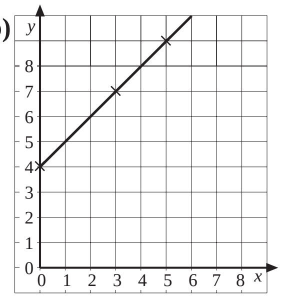
Y8	UNIT 14 ***Straight Line Graphs*** Lesson Plan 5	*Equations of Straight Lines 1*

Activity | ***Notes***

1A

Checking homework

PB 14.2, Q1 (a), (b)



(c) (2, 6), (4, 8), (6, 10)

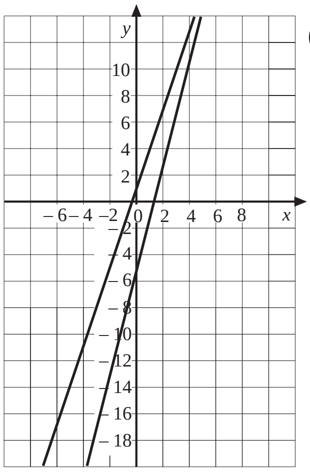
(d) Gradient $= 1$

T has asked three Ps to draw 1-1 grid on BB and one of the lines of the homework each.

Agreement, feedback, self-correction. Praising.

Then T asks Ps to list the properties of each line and, finally, a volunteer to summarise what has been covered so far.

PB 14.3, Q8 (a)



(b) $y = 3x + 1$

Gradient $= 3$

$y = 4x - 5$

Gradient $= 4$

P: In the last lesson and in the homework we dealt with lines with equations (writes on BB):

$$y = \square \times x + \square$$

Their graphs are straight lines not passing through the origin, and the multiplier of x in their equations gives their gradient.

T: This is the same for a straight line passing through the origin. That's why we can use the letter m again to represent the gradient.

1B

Mental work

T: Fine. Look at the following equations and give their gradients.

PB 14.3, Q9

T: $y = 2x + 4$	Ps: the gradient	$m = 2$
$y = 3x - 9$		$m = 3$
$y = 10x + 1$		$m = 10$
$y = 5x + 3$		$m = 5$

T: But what is the other number? We'll find out soon.

Mental work to finish the review, with slower Ps contributing.

T asks and Ps can also look at the equations in their PB. Answering, agreeing, praising.

8 mins

2A

Plotting points and comparing graphs

T: Plot the following two sets of points on the same grid, draw 1-1 line through both sets and compare them. Also write down their rules.

Set A:	$(-2, -4)$, $(0, 0)$, $(2, 4)$, $(4, 8)$
Set B:	$(0, 1)$, $(1, 3)$, $(2, 5)$, $(4, 9)$

Individual work.

T writes the points of both sets on BB, then monitors Ps' work and helps them (particularly with finding the rule/equation of $y = 2x + 1$).

(continued)

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 5	*Equations of Straight Lines 1*

Activity

2A *(continued)*

Properties

Set A	Set B
- equation $y = 2x$	- equation $y = 2x + 1$
- straight line	- straight line
- passing through the origin	- not passing through the origin
- $m = 2$	- $m = 2$

2B **Introducing 'the intercept'**

T: Look at the two graphs. What happens because the two gradients are the same?

Ps: The graphs are parallel.

T: What is the only difference between the two graphs?

P: The graph of $y = 2x$ passes through the origin while the graph of $y = 2x + 1$ does not.

T: The graph of $y = 2x + 1$ doesn't pass through the origin, so what point does it pass through? Look at the two graphs and read the y-coordinates of both of them at the x positions I give you.

T:	P_1s:	P_2s:
$x = -2$	$y = -4$	$y = -3$
$x = -1$	$y = -2$	$y = -1$
$x = 0$	$y = 0$	$y = 1$
$x = 1$	$y = 2$	$y = 3$
$x = 2$	$y = 4$	$y = 5$

T: What do you notice?

P_1: The points of the graph of $y = 2x + 1$, at each x position, are higher by 1 (unit) than the points of the graph of $y = 2x$.

T: The graph of $y = 2x$ passes through the origin. What does that tell us?

P_2: The value of $y = 2x$ is 0 at 0.

T: And ... ?

P_3: And, at $y = 2x + 1$, that is higher by 1. The value is 1 at 0.

T: We can say that $y = 2x$, passing through the origin, crosses the x-axis at 0. So ... ?

P_4: ... $y = 2x + 1$ crosses the y-axis at 1.

2C **Further work with the intercept**

T: Let's add a fourth row to the table.

x	-2	-1	0	1	2
$y = 2x$	-4	-2	0	2	4
$y = 2x + 1$	-3	-1	1	3	5
$y = 2x + 4$					

T: Use the rule of $y = 2x + 4$ and find its values at $-2, -1$, ...

T: -2 Ps: $2 \times (-2) + 4 = -4 + 4 = 0$

... etc.

T: What do you notice?

(continued)

Notes

Detailed discussion at checking. Just before stopping the work, T draws a grid on BB, plots the points and draws the lines on it. Checking/correcting, then T asks Ps to say aloud the properties they have listed. Agrees (praises), writes them on BB, ...

... then further questions are asked to lead Ps to the concept of the 'intercept' - questions/ answers interactively.

T gives the x-coordinates, Ps read the y-coordinates from the graphs, volunteer, answer. Other Ps agree, T praises and writes them in a table on BB.

x					
$y = 2x$					
$y = 2x + 1$					

T complete the table on BB with a fourth row.

Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 5	*Equations of Straight Lines 1*

Activity | ***Notes***

2C *(continued)*

P$_5$: The values of $y = 2x + 4$ are higher by 4 (units) than the values of $y = 2x$.

T: And at $x = 0$?

P$_6$: $y = 4$ ... The $y = 2x + 4$ crosses the *y*-axis at 4.

T: What can you state about the other 'something' in the equation of a straight line?

P$_7$: It shows where the line crosses the *y*-axis.

T: How could you draw this line without knowing any of its points? Where would you start the line

P$_8$: Since it crosses the *y*-axis at 4, we can start from there, then, because of its gradient, the line rises 2 (units) as we draw it from left to right, step by step.

T: Who would like to draw the line of $y = 2x - 1$ on BB?

Notes: Mental work.
T asks, Ps count, answer, T fills in the fourth row of the table.
Praises.

T draws a grid on BB, a volunteer P comes out, explains and draws the line.

2D

General formula of a straight line

P$_9$ (at BB, describing while drawing on BB):

This graph is lower by 1 than the graph of $y = 2x$, so it crosses the *y*-axis at -1. We can start from this point. The next point will be one step from left to right with a rise of 2.

T: Let's check and see if this is correct.

T: Now we can summarise what we know about a line with equation

$$y = mx + c$$

Ps:
- its graph is a straight line
- its gradient is *m*, which gives the steepness of the line
- the line crosses the *y*-axis at *c*.

T: Good. We're going to call the intercept '*c*'.

Notes: Finally T asks some Ps to come out, read the coordinates of a point and check if $y = 2x - 1$.

T writes the general formula of a straight line on BB and Ps list what they know about it.

32 mins

3

Practice - equations of straight lines

OS 14.7 *1. (a) gradient line A* $= 2$, *(b) gradient line B* $= -3$

2. (a) $c = 2$, *(b)* $c = 7$

3. (a) line A : $y = 2x + 2$, *line B* : $y = -3x + 7$

Notes: Whole class activity with slower Ps contributing.
Task appears on OHP.
T encourages slower Ps to come out, read the graph and fill in the OS. T may help them.
Agreement. Praising.

37 mins

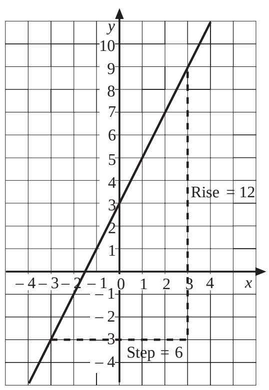
4

Individual practice

PB 14.4, Q1 *Solution: (a) graph*

(b) $m = 2$

(c) $c = 3$



PB 14.4, Q4 (a)

($m = 1$, $c = -3$, $y = x - 3$)

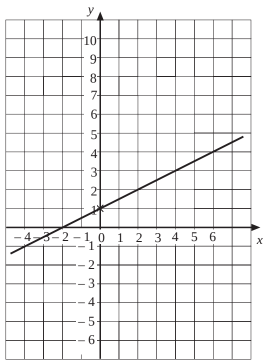
Notes: Individual work, monitored, helped.
Detailed discussion during checking:
- what do we know about a line with equation $y = mx + c$?
- how can the line be drawn if we do not have some of the points but do have the equation?
- how can we write the equation if we have the graph?

Agreement, feedback, self-correction. Praising.

45 mins

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 5	*Equations of Straight Lines 1*
Activity		*Notes*
	Set homework **PB 14.4, Q4 (b), (c)** **PB 14.4, Q5, also drawing the lines for rows 1 and 5.**	

Y8	**UNIT 14** ***Straight Line Graphs*** Lesson Plan 6	*Equations of Straight Lines 2*
Activity		***Notes***
1	**Checking homework** **PB 14.4, Q4 (b), (c)** **PB 14.4, Q5, also drawing the lines for rows 1 and 5.** P_1: $y = 2x + 2$ P_2: $y = -x + 4$ (or $y = 4 - x$) P_3: $y = 2x + 7$ P_4: $y = -3x + 2$ *7 mins*	T has asked four Ps to draw grids on BB, each with one of the straight lines of the homework, and to write their equations close to the graphs, as soon as they arrive. Correction/self-correction. Feedback. Praising. Then T points to four Ps (one at a time) from those who failed at homework, asks them to come to BB and explain the solutions, showing that they now understand. T helps them, using the graph and equation.
2	**Straight lines in context** T: Let's see how our understanding of straight lines can be useful in real life. **Activity 14.2** **Q2**	Whole class activity. Task appears on OHP. After discussing the problem (relationship between length of foot and adult shoe size), T draws a suitable grid on BB and asks a slower P to draw the graph of $y = 3x - 25$ on it. T also asks Ps to explain the concepts of gradient and intercept. T may help; agrees, praises.
	Q1, with: **Use the formula to determine the suitable shoe size then check if the graph is correct.** P_1: If $x = 9$ inches, (writes on BB): $y = 3 \times 9 - 25$ $y = 2$ The value of the graph ... (reads the graph) ... is 2 at 9, so it is correct.	Then three other Ps are asked to count and check (by reading the graph) at BB.
	Similarly P_2 and P_3 for Q1, parts (b) and (c).	Agreement. Praising.
	Q3 T: So our graph is correct. We can use it to determine shoe size instead of counting. Use it inversely: read the shoe size from the graph then check it by using the formula. *17 mins*	Another 3 Ps (slower ones are encouraged) come out and answer Q3. All Ps listen, suggest correction if necessary, and work in their Ex.Bs. Agreement. Praising.
3 *(continued)*	**Revision questions** **(1) M 14.2** **(2) PB 14.4, Q4 (d)** ($y = -3x + 2$ or $y = 2 - 3x$)	Individual work. Each P has a copy of M 14.2 (without answers) and Data Sheet.

Y8	UNIT 14 *Straight Line Graphs* Lesson Plan 6	*Equations of Straight Lines 2*
Activity		***Notes***
3 *(continued)*	**(3) PB 14.4, Q8 (b)** 	T tests whether or not Ps have enough knowledge to undertake the Revision Test in order to see (and help) where there are still weaknesses. Detailed checking, agreement, self-correction. Feedback will show which Ps need further practice in certain topics. Praising.
	30 mins	
4 (slower)	**Practice**	T divides Ps into two groups according to results of Revision Questions. Those who had problems sit together and work as a group, using BB, for further simple practice in their area of weakness.
4 (stronger)	**Extra practice** **Activity 14.3**	Those who had no problem with the Revision Questions now work in pairs. Each pair has a copy of Activity 14.3 and a sheet of paper to work on. At the end of the lesson T collects the sheets of solutions to correct/mark and bring to the next lesson.
	45 mins	
	Set homework **M 14.3** **PB 14.4, Q8 (a), (c)**	Each P is given a copy of Mental Test 14.3 (without answers).