Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 1	*Single Brackets 1*
Activity		***Notes***
1	**Reviewing negative numbers, rules of the signs and of brackets** T: In Unit 4 we reviewed the four rules: addition, subtraction, multiplication and division. Let's go over them again.	Mental work quickly reviewing negative numbers, rules of the signs for multiplication and division and rules for brackets.
1A	**Names of polygons** **OS 8.1** T (draws on BB): $+(+\ \ ) = +$ $+(-\ \ ) = -$ $-(+\ \ ) = -$ $-(-\ \ ) = +$ $+ \times + = +$ $+ \times - = -$ $- \times + = -$ $- \times - = +$	Task appears on OHP. Asking, answering, agreeing, praising, question by question. While Ps are answering, T may sketch the two boxes of rules on BB.
1B	T: Can you remember the rules for expanding brackets? Say whether you think each of these statements is true or false, and correct the false ones. 1. (a) $5 + (8 - 3) = 5 + 8 - 3$ (b) $7 - (6 + 1) = 7 - 6 + 1$ (c) $12 - (8 - 3) = 12 - 8 + 3$ 2. (a) $5 \times (7 + 3) = 5 \times 7 + 3$ (b) $(24 - 6) \div 3 = 24 \div 3 - 6 \div 3$ (c) $60 \div (10 + 5) = 60 \div 10 + 60 \div 5$ *Solutions: 1. (a) True* *(b) False;* $7 - (6 + 1) = 7 - 6 - 1$ *(c) True* *2. (a) False;* $5 \times (7 + 3) = 5 \times 7 + 5 \times 3$ *(b) True* *(c) False; cannot be made true*	Mental review work continues. These rules have been repeated often since the start of Y7, and were looked at in detail in Unit 4 of Y8. Now letters will be used to show the expansion of brackets when they are preceded by a ' + ' or a ' –' sign.
1C	**Rules for expanding brackets** T: What is the rule we use for the signs when we expand brackets? *(If there is a + sign before a pair of brackets, the brackets can be removed and the value of the expressions remains the same.* *If there is a – sign before the brackets, the sign of every number inside the brackets is changed to the opposite sign when the brackets are removed)*	Whole class activity. T helps Ps draw up the rules, ensuring that correct mathematical language is used ...
(continued)		

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 1	*Single Brackets 1*
Activity		***Notes***
1C *(continued)*	T: It sounds complicated, doesn't it? Now we'll make it more straightforward by using letters to show what we mean. T: Who would like to show how the rule is written using letters? P$_1$: $a \times (b + c) = a \times b + a \times c$ T: Do we need to write the ' × ' in an algebraic expression? Ps: No. T: Is this statement true when there is a '–' in the brackets? P$_2$: $(b - c)a = a(b - c) = ab - ac$ T: What about division? P$_3$: $(b + c) \div a = b \div a + c \div a$ and $(b - c) \div a = b \div a - c \div a$ T: And? P$_4$: And the order of division cannot be changed. *16 mins*	... then T asks Ps to write down the rules, using letters, for expanding brackets when they are preceded by a ' – ' sign. Volunteer Ps come to BB to write the rules, using letters. After agreeing, all Ps write them in Ex.Bs. Praising.
2	**Reviewing fundamental algebraic skills** T: A few minutes ago I used the words 'algebraic expression'. What can you remember about algebraic expressions? For example, is the formula for the perimeter of a rectangle an algebraic expression? *(Yes)* T: Write it down. *($2(a + b)$)* T: What is the perimeter if $a = 2$ cm and $b = 7$ cm? *($2(2 + 7) = 18$ (cm))* T: We call this 'evaluating the expression', in algebra. T: The perimeter of a polygon is the total length of its sides. A square has four equal sides, so its perimeter ... (writes on BB): $a + a + a + a = ?$ *(is $4a$)* T: What have you just done? *(We've simplified the first expression)* T: Evaluate the following expressions, if $a = 2$ and $b = -3$: $a + 2$ Ps: $2 + 2 = 4$ $2b$ $2 \times (-3) = -6$ $a - b$ $2 - (-3) = 2 + 3 = 5$ $3a + 2b$ $3 \times 2 + 2 \times (-3) = 6 + (-6) = 0$ T: Simplify the following expressions: $3a + 2a$ Ps: $5a$ $6b - 2b$ $4b$ $2x + 1 + 5x$ $7x + 1$ $x^2 + 2x$ cannot be simplified $3x + x^2 + x$ $x^2 + 4x$ *26 mins*	Whole class activity. Reviewing 'Fundamental Algebraic Skills' from Y7, Unit 16. Questions/answers interactively. Ps write it in Ex.Bs, then T on BB. T writes expressions on BB, volunteer (and encouraged) Ps come to substitute and evaluate expressions, then to simplify others. T agrees and praises, all Ps write in Ex.Bs.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 1	*Single Brackets 1*
Activity		***Notes***
3	**Practice evaluating expressions** T: Simplify and then evaluate each of these expressions. (a) If $a = 2$, $b = 3$, $3a - b + 2a = ?$ (b) If $x = 7$, $y = 2.3$, $7x - y^2 - 6x + y^2 = ?$ *Solutions:* *(a)* $5a - b = 5 \times 2 - 3 = 7$ *(b)* $x = 7$ *31 mins*	Individual work, monitored, helped. T writes tasks on BB. Detailed checking at BB. Ensure that Ps first simplify expressions. Agreement, feedback, self-correction. Praising.
4	**Expanding brackets of algebraic expressions** T: Now we'll continue working with algebraic expressions by extending the expansion of brackets, using the rules we talked about at the start of this lesson. T: Lets write this down (writes on BB): $a(b + c) = (b + c)a = ab + ac$ $(b + c) \div a = b \div a + c \div a$ T: Now I should write them all again with a minus sign, but it takes so long ... I'll write them like this instead (completes the rules): $a(b \pm c) = (b \pm c)a = ab \pm ac$ $(b \pm c) \div a = b \div a \pm c \div a$ T: Who'd like to use one of these rules for expanding brackets for the following expression? P (at BB): $(x + 3) \times 2 = 2x + 6$ T: Can you describe what you've done? *(Each term inside the bracket has been multiplied by the number/term outside the bracket)* T: To remember this we can use boxes for expanding: **OS 8.2** P_1:	Whole class activity. T explains how to apply the processes to the expansion of single brackets for algebraic expressions. T helps to draw up the rule that Ps have written with letters at the beginning of this lesson. Task appears on OHP, volunteer Ps come to fill in the boxes and write the expansions. Other Ps listen, agree/correct and draw boxes, write solution in Ex.Bs. Praising.

×	x	2
4	$4x$	8

so $4(x + 2) = 4x + 8$

P_2:

×	x	-5
3	$3x$	-15

so $3(x - 5) = 3x - 15$

T: Who'd like to draw a box to show the expansion of $3(2x - 4)$?

Finally T encourages a slower P to come to BB and draw a table to help expand the expression given by T.

T helps and praises P.

P_3:

×	$2x$	-4
3	$6x$	-12

so $3(2x - 4) = 6x - 12$

40 mins

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 1	*Single Brackets 1*
Activity		***Notes***
5	**Practice with expansions** **PB 8.1, Q2 (c), (d)** **PB 8.1, Q3 (d)** *Solutions:* *PB 8.1, Q2 (c)* $4(x + 3) = 4x + 12$ *PB 8.1, Q2 (d)* $5(2x + 5) = 10x + 25$ *PB 8.1, Q3 (d)* $7(3x - 4) = 21x - 28$ *45 mins*	Individual work, monitored, helped. Before starting the work, T and Ps agree that they don't need to draw tables for Q2 if they can calculate without them, but that a table might be helpful in Q3 (or for both questions, if necessary). Checking: T sketches a table for each expansion to show slower Ps how to get the solution. Feedback, self-correction. Praising.
	Set homework **PB 8.1, Q1 (c), (e), (f), (h), (j)** **PB 8.1, Q2 (b)** **PB 8.1, Q3 (a) - (c)**	

×	x	3
4	$4x$	12

×	$2x$	5
5	$10x$	25

×	$3x$	-4
7	$21x$	-28

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 2	*Single Brackets 2*
Activity		***Notes***
1	**Checking homework**	T has asked one of the Ps to write solutions to Q2 and Q3, without tables, on BB as soon as P arrives. Agreement, feedback, self-correction. Praising. T also asks if anyone used tables for Q3. (These Ps will probably need further help.)
1A	**PB 8.1, Q2 (b)** $5(x-7) = 5x - 35$ **PB 8.1, Q3 (a)** $4(x+6) = 4x + 24$ **PB 8.1, Q3 (b)** $3(x-4) = 3x - 12$ **PB 8.1, Q3 (c)** $5(2x+6) = 10x + 30$	
1B	**PB 8.1, Q1 (c), (e), (f), (h), (j)** T: As you've seen, when dealing with algebraic expressions, we also need to be able to calculate with negative numbers. Let's look at the different parts of Q1 now. **T:** $-6-5=$ **Ps:** -11 $-11-(-4)=$ $-11+4=-7$ $(-6)\times(-4)=$ 24 $88\div(-4)=$ -22 $5\times(3-10)=$ $5\times(-7)=-35$	Then verbal checking of Q1. T asks, points to P to answer, agreement, feedback, self-correction, praising, question by question.
	5 mins	
2	**Review of expansion of brackets** T: Looking at the last question, is there another way you can calculate $5\times(3-10)$? *(*$5\times3-5\times10=15-50=-35$*)* T: Which is the shorter method? *(The first way)* T: Can you remember the rule we leant about expanding? Now apply it here ... **PB 8.1, Q4** T: So what's the problem here? *(Jordan has not multiplied the* (-8) *by* 3*)* T: What did we learn about this in the last lesson? *(Every term inside the bracket must be multiplied by the number outside the bracket)*	Whole class activity providing a short review of expansion of brackets. Each P reads the task in PB. T gives them a short time to think and then asks for the answer. Agreement. Praising. Finally T asks for the rule, agrees, praises.
	10 mins	
3	T: Does this rule apply only to multiplication? Let's write down the rules we had in the last lesson: $a(b\pm c) = (b\pm c)a = ab \pm ac$ $(b\pm c)\div a = b\div a \pm c\div a$ T: What does the second rule mean? *(When dividing a sum or a difference, every term inside the bracket must be divided by the number outside the bracket)* T: For example: you buy 9 apples and 6 bananas and share them equally between 3 sisters. Write down the letters to represent this. How many apples and bananas does each sister have?	Whole class activity to introduce the division of sum/difference. T writes on BB, Ps in Ex.Bs.
(continued)		

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 2	*Single Brackets 2*
Activity		***Notes***
3 *(continued)*	$((9a + 6b) \div 3 = 3a + 2b)$ T: Let's look at some similar examples: T: $(4x + 8) \div 4 =$ Ps: $x + 2$ $(2a + 2b) \div 2 =$ $a + b$ $(5x - 25) \div 5 =$ $x - 5$ $(4x - 2) \div 2 =$ $2x - 1$ *17 mins*	Volunteer P writes on BB, others agree, write in Ex.Bs. T praises, then Ps go on to other divisions written on BB by T.
4	**Further practice - individual work** (a) $(3a + 6) \div 3 =$ $(a + 2)$ (b) $(4x + 6y) \div 2 =$ $(2x + 3y)$ (c) $(8a - 4) \div 4 =$ $(2a - 1)$ (d) $(2a + 5) \div 2 =$ $(a + 2.5)$ *24 mins*	Individual work. T writes tasks on BB, then monitors Ps' work and helps slower ones (mainly those who had problems with homework). Checking on BB: Ps dictate solution, agreement, T writes on BB, feedback, self-correction, praising for each question.
5	**Brackets with negative numbers** T: Now let's get back to multiplication. Can you multiply by negative numbers? Ps: Yes. T: $(-2) \times x = ?$ Ps: $-2x$ T: $(-2) \times (-3) = ?$ Ps: $+6$ T: $(-2) \times (x - 3) = ?$ Ps: $-2x + 6$ T: $(-3)(2x - 1) = ?$ Ps: $-6x + 3$ T: Good. Now can you imagine 'x' as the term outside the bracket? Ps: Why not? T: Calculate the area of a square with sides of 3 cm. Ps:? ... $(3 \times 3)\ \text{cm}^2 = 9\ \text{cm}^2$ T: What is the area of a square with sides of x cm ? Ps: $(x \times x)\ \text{cm}^2 = x\ \text{cm}^2$ T: One of the sides of a rectangle is 2 cm longer than the other. Write down an expression for the area of the rectangle. Ps: $x(x + 2)$ T: Expand it. Ps: $x^2 + 2x$ *31 mins*	Mental work, showing negative numbers or terms as 'outsiders' when expanding brackets. T asks and also writes on questions on BB. Ps answers, T agrees and writes answers on BB.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 2	*Single Brackets 2*
Activity		***Notes***
6	**Completing expansions** **PB 8.1, Q6 (a), (b), (e), (f)** **PB 8.1, Q8 (c)** *Solutions*: PB 8.1, Q6 (a) $4x(x+8) = 4x^2 + 32x$ PB 8.1, Q6 (b) $(-3)(2x-7) = -6x + 21$ PB 8.1, Q6 (e) $3x(x-y) = 3x^2 - 3xy$ PB 8.1, Q6 (f) $(-4x)(2x+8) = -8x^2 - 32x$ PB 8.1, Q8 (c) $2x(x+9) = 2x^2 + 18x$ *37 mins*	Whole class activity. T writes task on BB, calls volunteer P to complete the missing term (writing and expanding area for Q8 (c)) in front of class, waits for other Ps to agree/correct, praises, question by question.
7	**Individual practice** **PB 8.1, Q3 (g)** $(-2)(x-4) = -2x + 8$ **PB 8.1, Q6 (d)** $6x(x-7) = 6x^2 - 42x$ **PB 8.1, Q7 (a)** $x(x-7) = x^2 - 7x$ **PB 8.1, Q7 (g)** $2x(2x+3y) = 4x^2 + 6xy$ **PB 8.1, Q8 (e)** $2x(3x-2) = 6x^2 - 4x$ *45 mins*	Individual work, monitored, helped. Checking: solutions appear on OHP after T has stopped Ps working. Self-checking and correction. Feedback. Discussion of tasks which caused problems to the most Ps. Praising.
	Set homework **PB 8.1, Q3 (h) - (j)** **PB 8.1, Q6 (c)** **PB 8.1, Q7 (b) - (f)** **PB 8.1, Q8 (b), (d)**	The homework might seem excessive, but it is important that Ps practise using the rule for expanding brackets.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 3	*Linear Equations*
Activity		***Notes***
1	**Checking homework** **PB 8.1, Q3 (h)** $(-3)(8-2x) = -24 + 6x$ **PB 8.1, Q3 (i)** $5(3x-4) = 15x - 20$ **PB 8.1, Q3 (j)** $9(2x+8) = 18x + 72$ **PB 8.1, Q6 (c)** $4x(x-9) = 4x^2 - 36x$ **PB 8.1, Q7 (b)** $x(8-2x) = 8x - 2x^2$ **PB 8.1, Q7 (c)** $6x(x+2) = 6x^2 + 12x$ **PB 8.1, Q7 (d)** $4x(3x-5) = 12x^2 - 20x$ **PB 8.1, Q7 (e)** $x(x+y) = x^2 + xy$ **PB 8.1, Q7 (f)** $x(4y-3x) = 4xy - 3x^2$ **PB 8.1, Q8 (b)** $12(x-5) = 12x - 60$ **PB 8.1, Q8 (d)** $2x(5+x) = 10x + 2x^2$ *6 mins*	T has prepared (in advance) an OS with solutions and puts it on OHP. Ps check their homework and correct errors. T monitors self-correction. Feedback, if necessary discussing at BB questions Ps found difficult. Praising.
2	Real problems leading to linear equations T: Write down mathematically, what I say, using what you have learnt in this unit. I thought of a number, took away 2 and then multiplied the difference by 3. Next I doubled my original number and subtracted it from the product. Then I added 6. T: Have you finished? Who managed to write it down? T: Let's start at the beginning and write it one step at a time. P: x $(x-2) \times 3$ $3(x-2) - 2x$ $3(x-2) - 2x + 6$ T: Let's evaluate it. Think of a number between 3 and 10, to keep the calculations simple, and then evaluate the expression using your number. I'll give you the instructions. T: What number have you got? *(The number I first thought of)* T: How can we check it? *(By simplifying the expression)* T: What will be our first step? *(Expanding the brackets)* T: OK - do it using your number. P: $3(x-2) - 2x + 6 = 3x - 6 - 2x + 6 = x$ *15 mins*	First individual work, then whole class activity finishing with a short mental exercise. Then T reads the text again, and a volunteer P is called to BB to write down what T says, step by step. Agreement, feedback, self-correction. Praising. Finally, T reads out the text once more and Ps calculate mentally. T points to and encourages a slower P to simplify expression at BB. T helps and praises P.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 3	*Linear Equations*
Activity		***Notes***
3	**Linear equations** T: Let's look at something similar, but less difficult. Write down an equation for this process: T: I thought of a number and took away 3. Then I multiplied the difference by 4, and got 16. *(* $4(x-3)=16$*)* T: What do we call this? *(An equation)* T: What do we mean by 'equation'? *(An equation is a mathematical statement in which two expressions either side of an = sign are of equal value)* T: What do we need to do here? *(We need to find the number represented by 'x' which will make the statement true)* T: What do we have to take care with? *(We have to keep the equality of the sides)* T: How do we do this? *(Whatever we do to one side of the equation, we have to do to the other)* T: For example? *(We can subtract the same number from both sides, ... etc.)* T: Can anyone help me find the number which will make our statement true? P: $4(x-3)=16$ $4x-12=16 \quad (+12)$ $4x=28 \quad (\div 4)$ $x=7$ *Check*: LHS $=4\times(7-3)=16=$ RHS *24 mins*	Whole class activity. T reads out the text slowly and clearly and Ps write in Ex.Bs. Then T points to a volunteer P to write on BB equation from P's Ex.B. Agreement, feedback, self-correction. Praising. A short recap of equations. T asks some difficult questions; Ps try to answer them, questions/ answers interactively. A volunteer P comes to BB to solve the equation and explain at each step what is being done and why. T reminds Ps to check the answer.
4A	**Linear equations** **OS 8.3** P_1: $5(x+2)=30$ $5x+10=30 \quad (-10)$ $5x=20 \quad (\div 5)$ $x=4$ *Check*: LHS $=5\times(4+2)=30=$ RHS P_2: $8(3-x)=12$ $24-8x=12 \quad (-24)$ $-8x=-12 \quad (\div(-8))$ $x=1.5$ *Check*: LHS $=8\times(3-1.5)=12=$ RHS	Whole class activity. Task appears on BB. A slower P is asked to come to BB to finish solution to Q1, helped by T if necessary. Praising. Then discussion of Q3, Q2 and an equation containing x on both sides, with volunteer Ps solving each of these at BB. Other Ps write in Ex.Bs.
(continued)		

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 3	*Linear Equations*
Activity		***Notes***
4A *(continued)*	P_3: $7(x-2)=3\frac{1}{2}$ $7x-14=3\frac{1}{2}$ $(+14)$ $7x=17\frac{1}{2}$ $(\div 7)$ $x=\frac{35}{2}\div 7=\frac{5}{2}=\underline{2.5}$ *Check*: LHS $=7\times(2.5-2)=3.5=$ RHS T: What else could you do to remove the brackets from the LHS? P_4: We could divide both sides by 7 instead of expanding the brackets. T: Come and show us. P_4: $7(x-2)=3\frac{1}{2}$ $(\div 7)$ $x-2=\frac{7}{2}\div 7$ $x-2=\frac{1}{2}$ $(+2)$ $\underline{x=2.5}$ T: Which method would you prefer to use? ...	
4B	**Practising equation solving** T: There won't be any choice for this one! T (writing on BB): $\boxed{3(x+4)=5(x+2)}$ P: $3(x+4)=5(x+2)$ $3x+12=5x+10$ $(-3x)$ $12=2x+10$ (-10) $2=2x$ $(\div 2)$ $1=x$ $\underline{x=1}$ *Check*: LHS $=3\times(1+4)=15$ RHS $=5\times(1+2)=15$	Volunteer P comes to front to solve on BB task T has written. P explains how to change both sides so that x remains on only one side. T or P reminds Ps of the convention for giving the answer with the unknown value, x, on the LHS and its value on the RHS. Agreement. Praising.
	38 mins	
5 *(continued)*	**Individual work solving equations** **PB 8.2, Q1 (h)** **PB 8.2, Q8 (d)** *Solutions:* *Q1 (h)* $10(x+7)=82$ $10x+70=82$ (-70) $10x=12$ $(\div 10)$ $x=1.2$ *Check*: LHS $=10\times(1.2+7)=82=$ RHS	Individual work, monitored, helped. After 5 minutes, T stops Ps working and puts pre-prepared OS on OHP to show solutions. Ps check their work. Self-correction, feedback. Praising.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 3	*Linear Equations*
Activity		***Notes***
5 *(continued)*	*Solutions: Q8 (d)* $4(7 - x) = 5(x + 2)$ $28 - 4x = 5x + 10 \quad (+ 4x)$ $28 = 9x + 10 \quad (- 10)$ $18 = 9x \quad (\div 9)$ $2 = x$ $x = 2$ *Check*: LHS $= 4 \times (7 - 2) = 20$ RHS $= 5 \times (2 + 2) = 20$	Volunteer P comes to front to solve on BB task T has written. P explains how to change both sides so that x remains on only one side. T or P reminds Ps of the convention for giving the answer with the unknown value, x, on the LHS and its value on the RHS. Agreement. Praising.
	45 mins	
	Set homework **PB 8.2, Q1 (f)** **PB 8.2, Q2 (d)** **PB 8.2, Q6 (e)** **PB 8.2, Q8 (c)**	

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 4	*Practising Linear Equations*
Activity		***Notes***
1	**Mental review of some of the topics covered in this unit** T: Let's go over some of the topics you should have known before you started this homework. **M 8.2**	Mental work as a warm-up activity and also to recap on some of the topics covered so far in this unit. T reads out questions, gives a short time for Ps to think, and then asks mainly slower Ps to answer. For Q5 and Q6, T writes equations on BB, but Ps have to say aloud the steps used. Agreement, praising for each question.
	7 mins	
2	**Checking homework** **PB 8.2, Q1 (f)** $3(x-4)=11$ $3x-12=11 \quad (+12)$ $3x=23 \quad (\div 3)$ $\underline{x=7\frac{2}{3}}$ **PB 8.2, Q2 (d)** $8(2x-12)=24$ $16x-96=24 \quad (+96)$ $16x=120 \quad (\div 16)$ $\underline{x=7.5}$ **PB 8.2, Q6 (e)** $2(10-3x)=17$ $20-6x=17 \quad (-20)$ $-6x=-3 \quad (\div(-6))$ $\underline{x=0.5}$ **PB 8.2, Q8 (c)** $5(x+4)=2(10x+1)$ $5x+20=20x+2 \quad (-5x)$ $20=15x+2 \quad (-2)$ $18=15x \quad (\div 15)$ $1.2=x$ $\underline{x=1.2}$ P (e.g.): $8(2x-12)=24 \quad (\div 8)$ $2x-12=3 \quad (+12)$ $2x=15 \quad (\div 2)$ $\underline{x=7.5}$	T has prepared an OS of solutions and now puts it on OHP so that Ps can check their homework. Self-correction, feedback. Praising. T reminds Ps that they should also check their answer for each of the equations. Finally, T asks Ps if anyone used a different method for solving any of the equations. If so, P can show their solution on BB. Agreement. Praising.
	14 mins	

Y8 UNIT 8 *Algebra: Brackets* Lesson Plan 4

Practising Linear Equations

Activity		*Notes*
3A (slower)	**Practice with linear equations** Suggested questions for practice: **PB 8.2, Q1 (c), (g)** *(c)* -1 *(g)* 6.4 **PB 8.2, Q2 (b)** *(b)* *1* **PB 8.2, Q6 (d)** *(d)* 1 **PB 8.2, Q8 (a)** *(a)* 5	It is essential that Ps can expand brackets and solve equations as these processes are used throughout mathematics. Ps have different abilities, but T has to help them all to develop their skills. Now T divides Ps into two groups according to the mistakes they made in their homework. Those who made mistakes sit together and work as a group with T, using BB, strengthening their skills in solving linear equations. Questions can be selected from PB or Extra Exercises for this unit.
3B (stronger)	**Further practice with linear equations** (A) John thinks of a number, subtracts it from 7 and then multiplies the difference by 3. His answer is 6 more than twice the number he thought of. What was John's original number? (B) In a triangle, the smallest angle is $30°$ less than the middle one. If the largest angle is 3 times the smallest one, find all the angles. (C) Old McDonald has a farm and on that farm he has cows and hens. The number of hens is 6 more than the number of cows. How many cows and how many hens are there on Old McDonald's farm if the total number of legs they have is 36 ? (D) When we enlarge one of the pairs of opposite sides of a square by 4 cm we get a rectangle. Find the perimeter of the square if its area is 6 cm^2 less than the area of the rectangle.	Ps who made few mistakes in their homework and who volunteer to solve more challenging problems now work as a group. They sit together and are given (one copy per pair of Ps) of extra questions. 10 minutes before the end of the lesson, T stops the work with the slower Ps; stronger Ps come to BB, introduce the problems they are solving and show solutions, one at a time. Agreement, feedback, self-correction. Praising. Slower Ps write equations in their Ex.Bs.

Solutions: *(A)*

$3(7 - x) = 2x + 6$

$21 - 3x = 2x + 6 \qquad (+ 3x)$

$21 = 5x + 6 \qquad (- 6)$

$15 = 5x \qquad (\div 5)$

$3 = x$

$\underline{x = 3}$

(B)

$x + (x - 30°) + 3(x - 30°) = 180°$

$x + x - 30 + 3x - 90 = 180°$

$5x - 120 = 180 \qquad (+ 120)$

$5x = 300$

$x = 60$

The angles are $\underline{60°,\ 30° \text{ and } 90°}$.

(continued)

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 4	*Practising Linear Equations*
Activity		***Notes***
3B *(continued)*	*(C)* $4x + 2(x + 6) = 36$ $4x + 2x + 12 = 36$ $6x + 12 = 36$ (-12) $6x = 24$ $(\div 6)$ $x = 4$ *There are 4 cows and 10 hens on the farm.* *(D)* $x(x + 4\text{ cm}) = x^2 + 6\text{ cm}^2$ $x^2 + 4x = x^2 + 6$ $(-x^2)$ $4x = 6$ $(\div 4)$ $x = 1.5$ *Since* $P = 4x$*, the perimeter of the square is 6 cm.* *45 mins*	
	Set homework **(1) PB 8.2, Q1 (e)** **PB 8.2, Q2 (a)** **PB 8.2, Q6 (f)** **PB 8.2, Q8 (b)** **(2) Only for stronger Ps:** The volume of one cuboid is 24 cm^3 more than the volume of another cuboid. We know two of the side lengths of each of the cuboids. The first cuboid has sides of length 3 cm and 4 cm; the other cuboid has sides of length 1.5 cm and 6 cm. The third sides of each of the cuboids are the same length. What is that length?	

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 5	*Common Factors*
Activity		***Notes***
1	**Checking homework** **(1) PB 8.2, Q1 (e)** $(x = 2.5)$ **PB 8.2, Q2 (a)** $(x = 4.3)$ **PB 8.2, Q6 (f)** $(x = 1\frac{2}{3})$ **PB 8.2, Q8 (b)** $(x = 1.5)$ **(2)** $a_1 = 3$ cm $a_2 = 1.5$ cm $b_1 = 4$ cm $b_2 = 6$ cm $c_1 = x$ $c_2 = x$ $V_1 = V_2 + 24\ \text{cm}^3$ $3 \times 4 \times x = 1.5 \times 6 \times x + 24$ $12x = 9x + 24 \quad (-9x)$ $3x = 24$ $x = 8\ (\text{cm})$ *6 mins*	Verbal checking of the common homework exercises. T asks only for the answers $\rightarrow$ agreement, feedback. Checking in detail if more than 2 Ps have incorrect answers. Otherwise T notes the Ps with problems. Praising. Extra homework: T asks for results, then chooses a successful P to come to front, introduce and interpret the problem and solve it at BB. T agrees, praises. (Self-correction)
2	**Mental work** T: Do these calculations in your head. Think carefully - there is a quick way to do each one! (a) $23 + 198 + 77$ (b) $341 - 78 - 22$ (c) $4 \times 53 \times 25$ (d) $4 \times 36 \times 0 \times 25$ (e) $37 \div 3 - 7 \div 3$ (f) $43 \times 26 + 26 \times 57$ *Solutions:* *(a)* $(23 + 77) + 198 = 100 + 198 = 298$ *(b)* $341 - (78 + 22) = 341 - 100 = 241$ *(c)* $(4 \times 25) \times 53 = 100 \times 53 = 5300$ *(d)* $A \times 0 = 0$ *(e)* $(37 - 7) \div 3 = 30 \div 3 = 10$ *(f)* $(43 + 57) \times 26 = 100 \times 26 = 2600$ *12 mins*	Mental work as a warm-up activity, leading to the topic for this lesson. Questions appear on OHP or T writes them on BB. T asks, gives time to think, then waits for the answer with explanation. Ps agree, T praises, question by question.
3A *(continued)*	**Introducing factorisation** T: Did you understand the rules we were using in the previous questions? Why is it that $43 \times 26 + 26 \times 57 = (43 + 57) \times 26$? *(Because* $(43 + 57) \times 26 = 43 \times 26 + 57 \times 26$*)* T: Yes, that's right.	Whole class activity. Introducing factorisation with questions/answers interactively. T writes on BB. T writes on BB.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 5	*Common Factors*
Activity		***Notes***
3A *(continued)*	T: And why can't you calculate in a similar way for (writes on BB): $23 \times 53 + 17 \times 41$? *(Because the products have no common factor)* T: What about (writes on BB): $2a + 2b$? *(The 2 is a common factor in both terms)* T: So? *(*$2a + 2b = 2(a + b)$*)* T: What is this expression? *(The formula for the perimeter of a rectangle)* T (writes on BB): $2x + 6$ P_1: There is no common factor. T: Really? Have you ever written a number as the product of its prime factors? ... So? *(*$2x + 2 \times 3 = 2(x + 3)$*)* T: Are your sure? How can you check it? *(By expanding it)*	T writes on BB.
3B	**Further practice** **OS 8.4** e.g. P (Q7): Since the prime factorisation of 21 is 3×7 and the prime factorisation of 14 is 2×7, 7 is the common factor and can be placed outside the brackets (writes): $21 - 14x = 7 \times 3 - 7 \times 2 \times x = 7(3 - 2x)$	Whole class activity, then individual work. Task appears on OHP. First, discussion of Q1-4 and Q8 with encouraged slower Ps contributing at OHP. Then monitored and helped individual work for Q5 -7. Checking at OHP with explanations by Ps. Agreement, feedback, self-correction. Praising.
	24 mins	
4 *(continued)*	**More difficult factorisations** T: Let's look at some more factorisations. How do we factorise $14x + 42$? P_1: $2(7x + 21)$ T: Can you say anything else about this? P_2: It can be factorised further. $2 \times 7 \times (x + 3) = 14(x + 3)$ T: How could you do it in one step? P_3: We would factorise both terms and find all the common terms and place them outside the brackets. T: $60x - 24 = ?$ ... Work out prime factorisations of the numbers 60 and 24 ... Ps: $2 \times 2 \times 3 \times 5 \times x - 2 \times 2 \times 2 \times 3$ $= 2 \times 2 \times 3 \times (5x - 2) = 12(5x - 2)$ T: What is the 12 ? Ps: The HCF of the two numbers.	Whole class activity. Discussion of slightly more difficult factorisations. T writes all expressions given by Ps on BB. Ps write in Ex.Bs. Individual work followed by checking: Ps write down both numbers as the product of their prime factors. Agreement. Then factorising $60x - 24$.

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Activity		***Notes***
4 *(continued)*	T: $x^2 + x = ?$ ... What is x^2 ? Ps: $x \times x$ T: Is there any factor common to both terms? Ps: x T: So it can be placed outside the brackets. What stays inside the brackets in place of x ? Ps: Nothing! T: Come and show it on the BB. P_2: $x \times (x + \ldots \ ?$ T: What is multiplied by x to get x ? Ps: 1 T: So? Ps: $x^2 + x = x \times (x + 1)$ T: Now factorise each of the following expressions and give reasons for your answers: $12x + 30 =$ Ps: $6(2x + 5)$ $4x^2 + 6x =$ $2x(2x + 3)$ $ab - ac =$ $a(b - c)$ $a^2 + ab =$ $a(a + b)$ $10x^2 - 5 =$ $5(2x^2 - 1)$ $a^2b + 2ab^2 =$ $ab(a + 2b)$	Finally T writes down some other expressions. Volunteer Ps factorise and explain to other Ps at BB. Agreement. Praising.
	35 mins	
5	**Individual practice** **PB 8.3, Q1 (g)** ***(g)*** $3(3x - 4)$ **PB 8.3, Q2 (a), (c)** ***(a)*** $x(3x + 1)$ ***(c)*** $3x(2 - x)$ **PB 8.3, Q6 (f)** ***(f)*** $x(7y + 12z)$ **PB 8.3, Q7 (a)** ***(a)*** $xy(x + y)$	Individual work, monitored, helped. Checking at BB: volunteer Ps come out to write and explain solutions. Others agree or give corrections. Feedback, self-correction. Praising.
	41 mins	
6 *(continued)*	**Practical application** Peter, Liam and James are brothers. They were born in consecutive years. They decide to buy some sweets for their 4 sisters. The youngest and the eldest brother buy 3 times as many sweets as their ages, while the middle brother buys sweets equivalent to twice his age. Can they share the sweets equally between the four girls? How many sweets does each sister get? P_1: The ages of the brothers can be written as (writes on BB): $x, \ x + 1, \ x + 2$ So the number of sweets they bought is $3x + 2(x + 1) + 3(x + 2)$ P_2: ... $= 3x + 2x + 2 + 3x + 6 = 8x + 8$	Whole class activity. Task appears on OHP. Discussion as Ps try to interpret the problem. Probably a stronger P will write down expression leading to the solution. Agreement. Praising. Then two slower Ps should be asked: - one to expand and simplify the expression

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Activity		***Notes***
6 *(continued)*	P_3: $8x + 8 = 8(x + 1) = 4 \times 2(x + 1)$, so they can share the sweets equally between the four girls. P_4: Each sister gets twice as many sweets as Liam's age.	- the other to factorise and to answer the question. Another P is asked to say how many sweets each sister will have. Agreement. Praising. All Ps write in Ex.Bs.
	45 mins	
	Set homework **PB 8.3, Q1 (c), (e), (i)** **PB 8.3, Q2 (b), (e), (f)** **PB 8.3, Q6 (a), (c)** **PB 8.3, Q7 (c)**	

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 6	*Two Pairs of Brackets*
Activity		***Notes***
1	**Checking homework** **PB 8.3, Q1 (c)** $6x + 18 = 6(x + 3)$ **PB 8.3, Q1 (e)** $3x - 21 = 3(x - 7)$ **PB 8.3, Q1 (i)** $42x + 15 = 3(14x + 5)$ **PB 8.3, Q2 (b)** $5x^2 + 10 = 5(x^2 + 2)$ **PB 8.3, Q2 (e)** $21x^2 + 14x = 7x(3x^2 + 2x)$ **PB 8.3, Q2 (f)** $15x - 25x^2 = 5x(3 - 5x)$ **PB 8.3, Q6 (a)** $xy + xz = x(y + z)$ **PB 8.3, Q6 (c)** $4pq - 8qr = 4q(p - 2r)$ **PB 8.3, Q7 (c)** $5x^2y - 35xy = 5xy(x - 7)$ *5 mins*	T has prepared an OS showing the homework solutions and puts this on OHP when Ps arrive. Checking, self-correction. (Ps may need explanations for some of the more difficult questions.) Feedback. Praising.
2	**Further work with factorisation** T: Now you are good at factorising. For practice, decide whether or not each of these expressions has been fully factorised. If not, factorise it. **PB 8.3, Q4** e.g. T: Look at question (a) ... Who thinks it's been fully factorised? *(Most Ps)* T: Who thinks it hasn't been fully factorised? *(No-one)* T: Are the rest of you still asleep? Wake up - this is maths! T: Look at part (b) ... Think about it ... Are you ready? ... Who thinks it's been fully factorised? ... Who thinks the opposite? T (to a 'not fully factorised' P): Is there anything else you can place outside the brackets? P: There is still an 'x' as a common factor to both terms inside the brackets. T: Can everyone see that? Come and finish the factorisation. P (completes $3(x^2 + 3x)$ on BB): $= 3x(x + 3)$ ... etc. *12 mins*	Whole class activity/mental work. Task appears on OHP. T asks the questions, one at a time. Firstly, T makes all Ps vote on whether the expression has been fully factorised. Then asks the 'not fully factorised' group to explain their answer and complete the factorisation. Agreement, praising at each question.
3 *(continued)*	**Introducing factorisation** T: Now we're at the end of this unit, let's go over the expansion of brackets one more time, from a slightly different point of view. **Activity 8.1, Q1-3** **Q1** P (a): $2(x + 6) = 2x + 12$ P (b): $T = 2 \times x + 2 \times 6 = 2x + 12$	Whole class activity, relating expansion of brackets to areas and then showing the expansion of two brackets with the aid of areas. Activity 8.1 appears on OHP, with Q3 and Q4 covered. Discussion, interpreting Q1 and answering at BB, comparing answers to (a) and (b).

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 6	*Two Pairs of Brackets*
Activity		***Notes***
3 *(continued)*	**Q2** P: $x \times x + x \times 3 = x^2 + 3x$, so $x(x + 3) = x^2 + 3x$ **Q3** T: Describe the third figure. *(It's a rectangle with sides $(x + 2)$ and $(x + 3)$)* T: How do we find its area? *($A = (x + 2) \times (x + 3)$)* T: Have you ever expanded two brackets? *(No)* T: You'll understand the method if you calculate the area of the parts and add them up. P: $x^2 + 2x + 3x + 6$ T: Can anyone explain what we've done? *(When multiplying $(x + 3)$ by $(x + 2)$, we have to multiply both x and 3 by $(x + 2)$)* T: What about the result? Can you suggest a rule for expanding two brackets? *(Each term in the first bracket must be multiplied by each term in the second bracket)* T: As you now have four terms after expanding the brackets, what else can you do? *(Simplify the expression: ... $= x^2 + 5x + 6$)* *20 mins*	For Q2, a volunteer P comes to front and explains at BB. Then T uncovers Q3 and asks Ps to interpret the problem and try to find how to expand two brackets. Volunteer P comes to BB to calculate the total area.
4A	**Practice expanding two brackets - whole class** **OS 8.5 and 8.6, Q1, Q3** P_1:	Whole class activity. Firstly Q1 appears on OHP. An encouraged slower P should be asked to come to OHP and expand and then simplify $(x + 4)(x + 5)$ on OS with the aid of the table (may be helped by T). Praising.

×	x	5
x	x^2	$5x$
4	$4x$	20

So $(x + 4)(x + 5) = x^2 + 4x + 5x + 20$

$= x^2 + 9x + 20$

P_3:

×	x	-9
x	x^2	$-9x$
2	$2x$	-18

Then a volunteer P shows and explains solution to Q3 without help (except if really necessary).

Agreement. Praising.

So $(x + 2)(x - 9) = x^2 + 2x - 9x - 18$

$= x^2 - 7x - 18$

4B *(continued)*	**Practice expanding two brackets - working in pairs** **OS 8.5 and 8.6, Q2, Q4**	Ps work in pairs. Each pair of Ps has a copy of Q2 and Q4 on an A4 sheet. Ps discuss in their pairs and work together on the sheet. T monitors work and may help them.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 6	*Two Pairs of Brackets*
Activity		***Notes***
4B *(continued)*	P_2: When expanding $(x + 3)(x + 8)$ we have to multiply each term in the first bracket by each term in the second bracket. So taking *x* from the first one (writes): $= x^2 + 8x + ...$ then taking 3 from it (writes): $... 3x + 8$ after simplifying, we get (writes): $= x^2 + 11x + 8$ and so on. *30 mins*	Checking at BB: T asks Ps to volunteer to show and explain solutions without table. Agreement, feedback, self-correction. Praising.
5	**Practising expansion of two brackets without a table** T: Now we'll leave tables, and look at some more expansions. **PB 8.4, Q2 (b)** **PB 8.4, Q3 (c)** **PB 8.4, Q5 (c)** P_1: $(x - 2)(x + 5) = x^2 - 2x + 5x - 10$ $= x^2 + 3x - 10$ P_2: $(x - 5)(x + 5) = x^2 - 5x + 5x - 25$ $= x^2 - 25$ T: What's happened? *(After we had simplified, the 'x's had all been eliminated)* T: Why was that? *(Because the two terms in the brackets were the same, and the signs between the terms were opposite to each other)* T: What have you got now? *(The difference of the square of the first term and the square of the second term)* P_3: $(x + 3)^2 = ?$ T: What is meant by 'a^2' ? *(Multiplying 'a' by itself)* T: And if '*a*' is a more complicated expression, what is meant by squaring it? *(The same, multiplying it by itself)* T (to P_3): So? P_3: $... = (x + 3)(x + 3) = x^2 + 3x + 3x + 9 ...$ T: What do you notice? *(Two of the expressions are the same)* T: What are these? *(The product of the first and second terms)* T (to P_3): Simplify it, please. P_3: $... = x^2 + 6x + 9$ T: What have you got now? *(The squares of the first and second terms and twice their product)* T: We'll deal with this in more detail later. At the moment you only have to know how to expand two brackets in general or in special cases. *38 mins*	Whole class activity to practise expansion of two brackets without a table. Slower Ps are asked to do expansions with T's help, at BB (after listening to the explanations). Short discussions after P_2 and P_3s' solutions. At this stage Ps do not have to know the rules of $(a \pm b)^2$ and $(a+b)(a-b)$. Questions/answers. Praising.

Y8	**UNIT 8** ***Algebra: Brackets*** Lesson Plan 6	*Two Pairs of Brackets*
Activity		***Notes***
6	**Practice expanding two brackets** **PB 8.4, Q2 (a), (e)** **PB 8.4, Q3 (b)** **PB 8.4, Q5 (b)** P_1: $(x+3)(x+4) = x^2+3x+4x+12$ $= x^2+7x+12$ P_2: $(x+2)(x-3) = x^2+2x-3x-6$ $= x^2-x-6$ P_3: $(x+2)(x-2) = x^2+2x-2x-4$ $= x^2-4$ P_4: $(x-1)^2 = (x-1)(x-1) = x^2-x-x+1$ $= x^2-2x+1$ *45 mins*	Individual work, monitored, helped. Checking in detail at BB. Ps volunteer to come to BB and explain how to expand two brackets. Stronger Ps can explain what $(x+2)(x-2)$ and $(x-1)^2$ give by expanding them. Agreement, feedback, self-correction. Praising.
	Set homework **PB 8.4, Q1 (b)** **PB 8.4, Q2 (c), (d)** **PB 8.4, Q3 (d)** **PB 8.4, Q4** **PB 8.4, Q5 (a)**	