

**Harder Questions Level 6**

Allow 28 minutes for this exercise

## Harder Questions Level 6

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### Q1. Solving

(a) When  $x = 5$ , work out the values of the expressions below.

$2x + 13 = \dots\dots\dots$

$5x - 5 = \dots\dots\dots$

$3 + 6x = \dots\dots\dots$

2 marks

(b) When  $2y + 11 = 17$ , work out the value of  $y$   
Show your working.

*(Handwritten scribble)*

$y = \dots\dots\dots$

2 marks

(c) Solve the equation  $9y + 3 = 5y + 13$   
Show your working.

*(Handwritten scribble)*

$y = \dots\dots\dots$

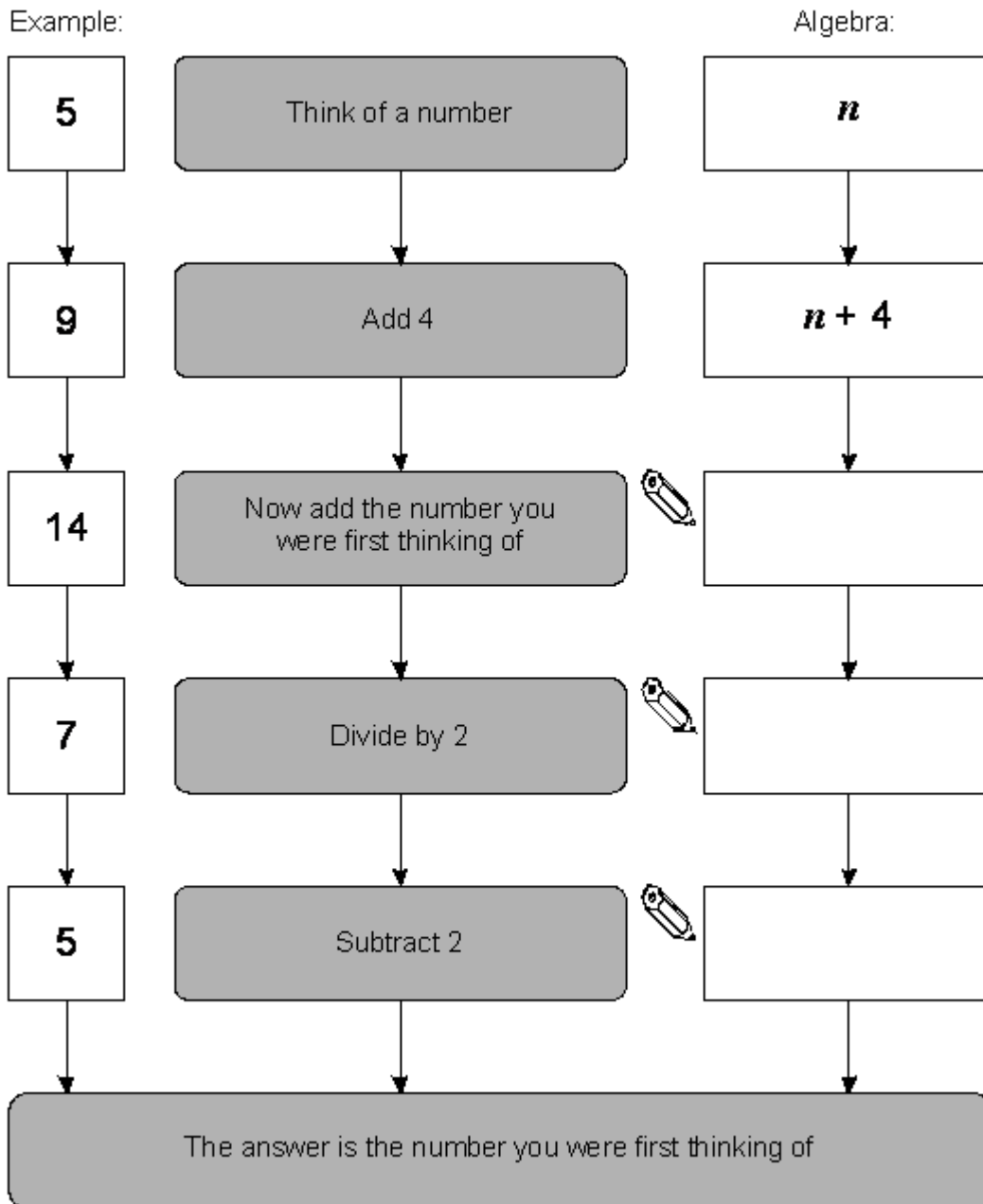
2 marks

## Harder Questions Level 6

### Q2. Puzzle

You can often use algebra to show why a number puzzle works.

Fill in the missing expressions.



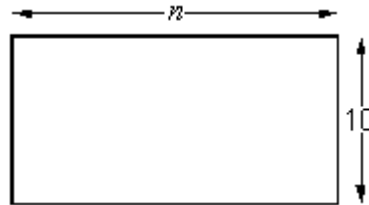
2 marks

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### Q3. Perimeters

Jenny and Alan each have a rectangle made out of paper.

One side is 10cm.  
The other side is  $n$  cm.



- (a) They write expressions for the **perimeter** of the rectangle.

Jenny writes  $2n + 20$

Alan writes  $2(n + 10)$

Tick (✓) the true statement below.

Jenny is correct and Alan is wrong.

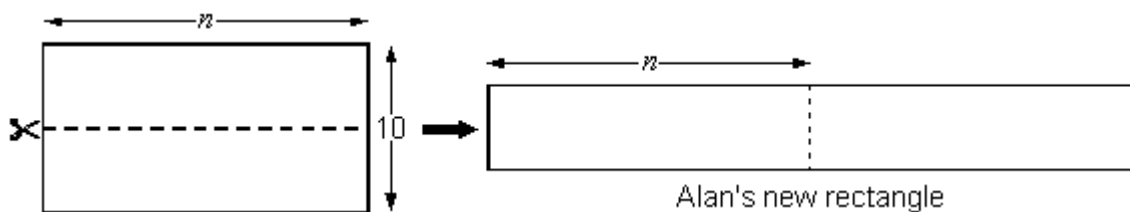
Jenny is wrong and Alan is correct.

Both Jenny and Alan are correct.

Both Jenny and Alan are wrong.

1 mark

- (b) Alan cuts his rectangle, then puts the two halves side by side.



What is the perimeter of Alan's new rectangle?

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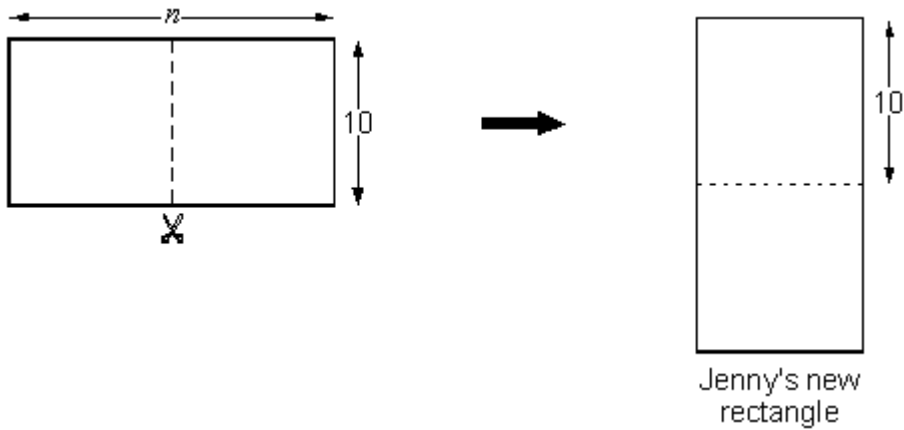
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Write your expression as simply as possible.



2 marks

- (c) Jenny cuts her rectangle a different way, and puts one half below the other.



What is the perimeter of Jenny's new rectangle?  
Write your expression as simply as possible.



2 marks

- (d) What value of  $n$  would make the perimeter of Jenny's new rectangle the **same value** as the perimeter of Alan's new rectangle?



1 mark

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### Q4. Simplify

Write each expression in its simplest form.

$$(3d + 5) + (d - 2)$$

 .....

1 mark

$$3m - (-m)$$

 .....

1 mark

### Q5. Expressions

Match each expression on the left with the equivalent expression on the right.

The first one is done for you.

$3d + d$	$3$
$3d - d$	$2d$
$3d \times d$	$3d$
$3d \div d$	$4d$
	$2d^2$
	$3d^2$
	$2d^3$

*Note: A line connects the first box on the left ( $3d + d$ ) to the fourth box on the right ( $4d$ ). A pencil icon is next to the second box on the left ( $3d - d$ ).*

2 marks

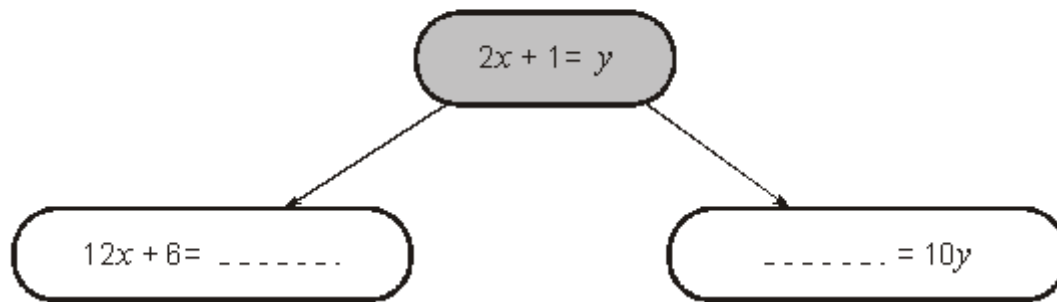
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### Q6. Using equations

Look at this equation.

$$2x + 1 = y$$

Use it to complete the equations below that involve both  $x$  and  $y$



2 marks

### Q7. Ringing expressions

- (a) I **add** the expressions  $n$  and  $n + 2$

Put a ring round the expression that shows the result.

$2n$

$4n$

$n(n + 2)$

$n^2 + 2$

$2n + 2$

1 mark

- (b) Now I **multiply** the expressions  $n$  and  $n + 2$

Put a ring round the expression that shows the result.

$2n$

$4n$

$n(n + 2)$

$n^2 + 2$

$2n + 2$

1 mark

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### Q8. Expressions

Use the expressions on cards P, Q, R, S and T to answer the questions below.

$$3a + 1$$

card P

$$2(a - 1)$$

card Q

$$a^2 - 2$$

card R


$$(a + 1)^2$$

card S


$$6 - a$$

card T


- (a) When  $a = 3$ , which card has the **highest value**?

 card .....  
1 mark

- (b) When  $a = -3$ , which card has the **highest value**?

 card .....  
1 mark

- (c) Which card's value is **never negative** whatever the value of  $a$ ?

 card .....  
1 mark

### Q9. Equations of lines

- (a) You can write the equation  $y = x + 4$  in different ways.

Circle the correct ways below.



$x + y = 4$

$x = 4 + y$

$y - x = 4$

$y + 4 = x$

$x = y - 4$

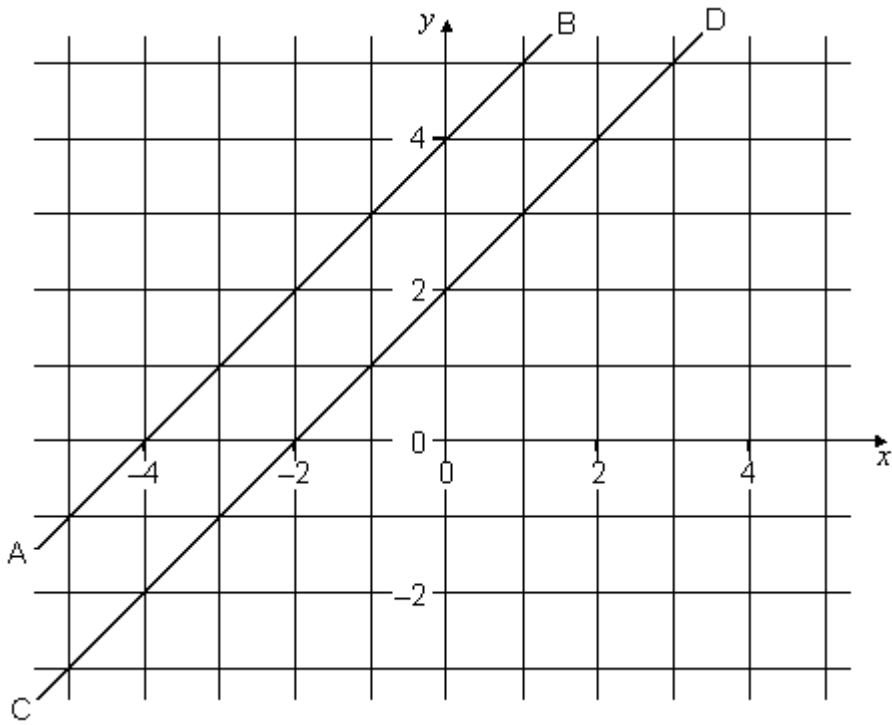
2 marks

- (b) The equation of the line **AB** is  $y = x + 4$



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Write an equation that describes line **CD**

*Handwritten scribble*

1 mark

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**M1.**  
23  
20  
33

(a) All three correct, ie

*Do not accept incorrect notation*

eg

- $23x$  for 23

2

**or**

Any two correct

1

(b) 3

**! Ambiguous notation**

eg

- $x 3$
- Mark as 1, 0

2

**or**

Subtracts 11 from both sides to give a correct algebraic equation

eg

- $-2y = 17 - 11$
- $2y + 11 - 11 = 17 - 11$
- $2y = 6$

1

(c) Correct value

eg

- $2\frac{1}{2}$

- $\frac{5}{2}$

- 2.5

*Accept equivalent fraction or decimal*

eg

- $2\frac{2}{4}$

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- $\frac{10}{4}$

*Do not accept for 2, incomplete processing*

eg

- $10 \div 4$

2

**or**

Collects together like terms

eg

- $9y - 5y = 13 - 3$

- $4y = 10$

- $y = 10 \div 4$

*Do not accept simplified expressions which are not equated*

eg

- $9y - 5y = 4y$

- $13 - 3 = 10$

or

Shows working in which the only error is to add, rather than subtract, 3 to the right-hand side, resulting in the solution  $y = 4$

eg

- $9y + 3 = 5y + 13$  so  
 $4y = 16$  (error) so  $y = 4$

or

Shows working in which the only error is to add, rather than subtract, 5y to the left-hand side, resulting in the solution  $y = \frac{5}{7}$ , or equivalent fraction or decimal between 0.71 and 0.72 inclusive

eg

- $9y + 3 = 5y + 13$

$14y$  (error) = 10 so  $y = \frac{10}{14}$

***Method used is trial and improvement***

***Note that no partial credit can be given. Also note that the correct solution must be explicitly stated rather than embedded***

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eg, **do not accept**

- $5 \times 2.5 + 13 = 9 \times 2.5 + 3$  without 2.5
- identified as the solution

1

[6]

**M2.** Writes three correct algebraic expressions, the first two of which may be unsimplified

eg, for the first box

- $2n + 4$
- $n + 4 + n$

eg, for the second box

- $n + 2$
- $(2n + 4) \div 2$

eg, for the third box

- $n$

**!** **Expression for the third box not fully simplified**

Given the context of the question, this expression must be

simplified at least as far as  $n + 2 - 2$  or  $\frac{2n}{2}$

eg, **do not accept**

- $\frac{2n + 4}{2} - 2$

Do not accept for 2, incorrect algebraic notation

eg, for the second box

- $2n + 4 \div 2$

2

**or**

Writes correct algebraic expressions for the first two boxes, even if unsimplified

or

Writes correct algebraic expressions for the last two boxes and fully simplifies, indicating that the pupil has worked upwards

eg

- $n + 9$  (error)
- $n + 2$
- $n$

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or

Within an otherwise correct response, the only error is in the notation for the expression for the second box

eg

- $2n + 4$   
 $2n + 4 \div 2$  (error in notation only)  
 $n$

or

The expression for the first or second box is incorrect, but is then followed through correctly including full simplification of the expression for the third box

eg

- $n + 9$  (error)  
 $\frac{n+9}{2}$   
 $\frac{n+5}{2}$  (or  $0.5n + 2.5$ )
- $2n + 4$   
 $n + 4$  (error)  
 $n + 2$

*Do not accept for the third box, incorrect simplification to  $n$*

eg

- $n + 9$  (error)  
 $\frac{n+9}{2}$
- $\frac{n+9}{2} - 2 = n$  (error)

1

[2]

**M3.** (a) Both correct, ie

1

(b) Correct simplified expression, eg

- $4n + 10$

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- $4(n + 2.5)$

- $2(2n + 5)$

- $(2n + 5) \times 2$

**or For only 1** Correct expression seen, even if terms are not collected together, eg

- $5 + n + n + n + n + 5$

- $2n + 2n + 10$

**or For only 1** An otherwise correct simplified expression, of  $4n + k$ , ( $k \neq 10$ ), eg

- $4n + (10 \div 2)$

- $4(n + 5)$

- $2(2n + 2)$

! *Incorrect working follows correct response  
eg, for part (a)*

- $4n + 10 = 40n$  Mark as 1, 0

! *Correct answer preceded by incorrect working*

*If the intended answer is unambiguous, ignore preceding work*

*eg, for part (b), accept*

- $5 + 2n \times 2 = 10 + 4n$

! *An otherwise correct simplified expression with the only error  
being that the brackets are omitted*

*eg, for part (b)*

- $2n + 5 \times 2$  Mark as 1, 0

2

(c) Correct simplified expression, eg

- $40 + n$

- $2(20 + \frac{1}{2}n)$

**or For only 1** Correct expression seen, even if terms are not collected together, eg

- $10 \times 4 + n$

- $40 + \frac{1}{2}n + \frac{1}{2}n$

- $2(n \div 2 + 20)$

**or For only 1** An otherwise correct simplified expression, of  $n + k$ , ( $k \neq 40$  but is a multiple of 10) eg

- $2(n \div 2 + 10)$

! *Value for n substituted into an otherwise creditworthy  
response*

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**Ignore.**

2

(d) 10

*Accept 10 cm*

1

[6]

**M4.**  $4d + 3$

1

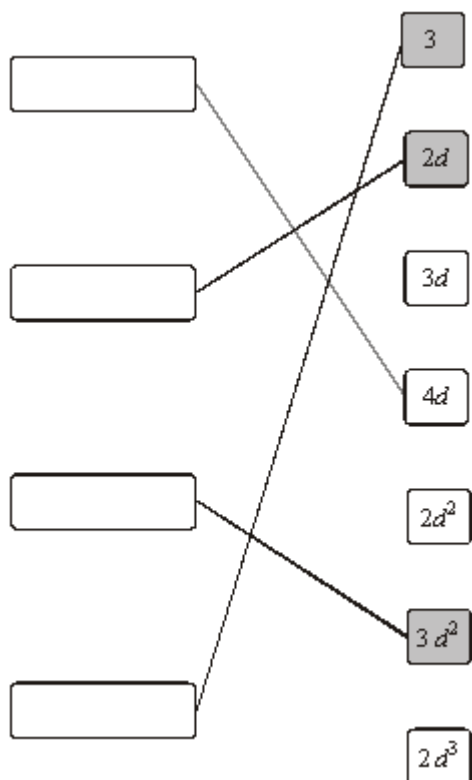
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1

**Do not accept expression not simplified**

[2]

**M5.** Matches all three expressions correctly, ie



**!** **Expression on the left matched with more than one expression on the right**

*For 2m or 1m, do not accept as a correct match*

2

**or** Matches any two of the expressions correctly

1

[2]

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**M6.** Gives a correct expression to complete the first equation

eg

- $6y$
- $2x + 1 + 5y$

**! Unconventional notation**

*As the question does not demand simplification, condone eg, for the first mark accept*

- $y \times 6$
- $y6$

2

**or** Gives a correct expression to complete the second equation

eg

- $20x + 10$
- $10(2x + 1)$
- $2x + 1 + 9y$

*Do not accept necessary brackets omitted*

eg

- $10 \times 2x + 1$

1

[2]

**M7.** (a) Indicates  $2n + 2$ , ie

— — —

— —

1

(b) Indicates  $n(n + 2)$ , ie

— — —

— —

1

[2]

**M8.** (a) S

1

(b) T

1

(c) S

*Accept unambiguous indication*

eg, for part (a)

- $(a + 1)^2$



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- 16
- 10, 4, 7, 16, 3

**!** *Value of card(s) incorrectly calculated*  
*Ignore provided there is no ambiguity*

U1

[3]

**M9.** (a) Only the correct two indicated, ie

$$x + y = 4$$

$$x = 4 + y$$

$$\textcircled{x = y - 4}$$

$$y + 4 = 6$$

$$\textcircled{y - x = 4}$$

2

**or** Only one of the correct two indicated, and none incorrect

or

The correct two indicated with only one incorrect

1

(b)  $y = x + 2$  or equivalent, eg

- $y - 2 = x$

- $y - x = 2$

1

[3]