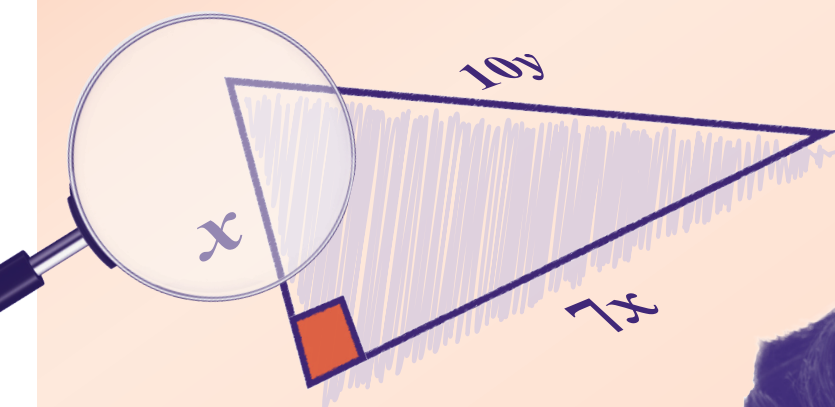


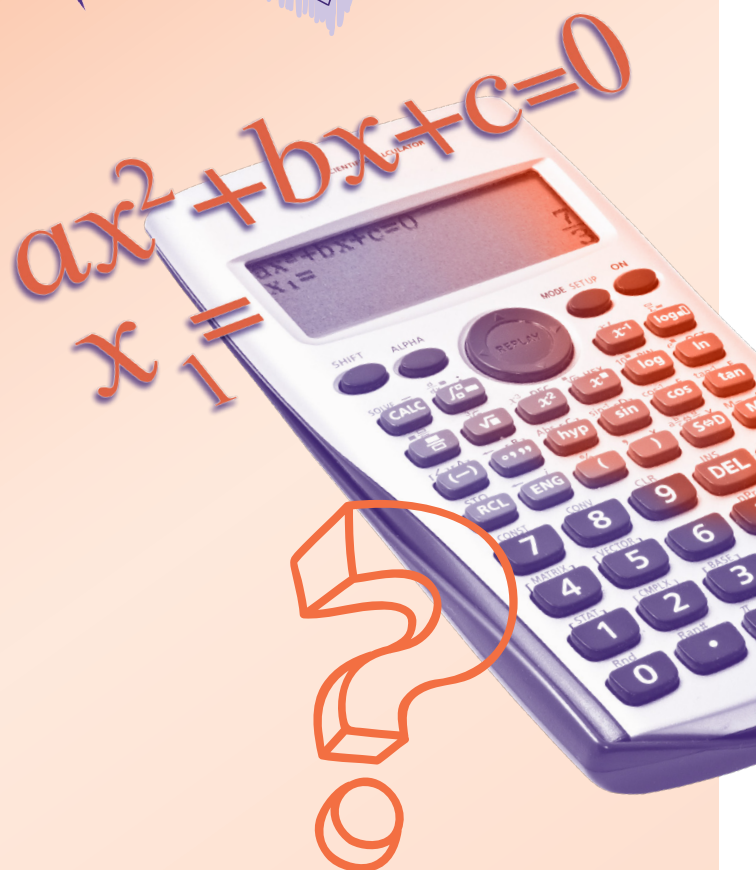
# GCSE Maths Focus on:

## Quadratics

Build on your students' assessment performance using our self-guided, modular training pack



Activities  
booklet





Contents	Page
Activity 1a (Manipulating expressions – exam questions)	4
Activity 1b (Manipulating expressions – intelligent practice)	6
Activity 1c (Manipulating expressions – ‘ssdd’)	10
Activity 1d (Manipulating expressions - squaring)	11
Activity 1e (Manipulating expressions - squaring)	13
Activity 2 (Solving equations)	15
Activity 3a (Approaching graphs)	17
Activity 3b (Graphs - Fill in the gaps)	19
Activity 3c (Graphs - A challenging ‘ssdd’ problem)	22
Activity 3d (‘Goal-free’)	23
Activity 4 (Next steps)	24
Post-session health check	26

# Manipulating expressions

## Activity 1a – exam questions

### Exercise 1

- 3 Circle the expression that is equivalent to  $3a - a \times 4a + 2a$  [1 mark]
- $8a^2 + 2a$        $12a^2$        $5a - 4a^2$        $3a - 6a^2$

### Exercise 2

- Add brackets to make this expression equivalent to each expression below.  $3a - a \times 4a + 2a$  [1 mark]
- $8a^2 + 2a$        $12a^2$        $5a - 4a^2$        $3a - 6a^2$

This is a simple example of adapting an exam question into a classroom task

### Exercise 3

- 26 Expand and simplify  $(x - 4)(2x + 3y)^2$  [4 marks]
- 5 Multiply out and simplify  $(x - 8)^2$  [2 marks]
- 16 (b) Factorise  $3x^2 - 22x + 7$  [2 marks]
- 5 (a) Factorise  $x^2 - 100$  [1 mark]

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## Discussion notes

# Manipulating expressions

## Activity 1b – intelligent practice

Work through each of the exercises and then answer the questions below.

### Exercise 1

Factor each of the following. Ex.,  $100x^2 - 25 \longrightarrow (10x - 5)(10x + 5)$

1.  $x^2 - 64$

2.  $4x^2 - 100$

3.  $x^2 - 100$

4.  $9x^2 - 64$

5.  $16 - 16x^2$

6.  $1 - x^2$

7.  $x^2 - 1$

8.  $36x^2 - 25$

9.  $4x^2 - 4$

10.  $100x^2 - 169$

11.  $81x^2 - 9$

12.  $x^2 - 81$

13.  $144 - 64x^2$

14.  $81x^2 - 4$

15.  $4 - 36x^2$

16.  $49x^2 - 36$

17.  $9x^2 - 9$

18.  $9x^2 - 36$

19.  $36x^2 - 64$

20.  $81 - 4x^2$

21.  $x^2 - 121$

22.  $121x^2 - 81$

23.  $49x^2 - 144$

24.  $16x^2 - 49$

How would you use the above exercise?

Do you feel the exercise represents 'intelligent practice'?

## Exercise 2

### Expanding Brackets and Factorising Quadratics

<b>Section A: Expanding Brackets</b>		3. $3x^2 - 10x + 8$	
1. $x(2x-3)$		4. $6x^2 + 17x + 12$	
2. $(x+1)(x-4)$		<b>Section F: a mixture</b>	
3. $(2x+1)(2x-1)$		1. $4x^2 - 9$	
4. $(3x-1)(4x-3)$		2. $x^2 + 8x + 15$	
<b>Section B: Difference of two squares</b>		3. $6x^2 - x - 1$	
1. $x^2 - 4$		4. $x^2 - 10x - 24$	
2. $x^2 - 2500$		5. $1 - x^2$	
3. $(4x)^2 - y^2$		6. $x^2 + 11x + 28$	
4. $9y^2 - 100$		7. $x^2y^2 - 2xy + 1$	
<b>Section C: Common Factor</b>		8. $x^2 + 5x - 24$	
1. $x^2 - 3x$		9. $9x^2 - 6x + 1$	
2. $2x^2 - 6xy$		10. $x^2 + 7x + 6$	
3. $15a^2b + 9ab^2$		11. $3 + 2x - x^2$	
4. $5a^2 - 20a$		12. $5x^2 - 61x + 12$	
<b>Section D: Coefficient of <math>x^2</math> is 1</b>		13. $25x^2 - 16$	
1. $x^2 + 5x + 6$		14. $9x^2 + 30x + 25$	
2. $x^2 - 4x + 3$		15. $6x^2 + 11xy + 4y^2$	

How would you use the above exercise?

Do you feel the exercise represents 'intelligent practice'?

### Exercise 3

1.  $x^2 + 9x - 10 =$

2.  $x^2 - 9x - 10 =$

3.  $x^2 - 9x =$

4.  $x^2 + 9x =$

5.  $x^2 + 9 =$

6.  $x^2 - 9 =$

7.  $x^2 - 8 =$

8.  $x^2 - 4 =$

9.  $x^2 + 4 =$

10.  $x^2 + 4x =$

11.  $x^2 + 4x + 4 =$

12.  $x^2 + 5x + 4 =$

13.  $x^2 + 5x + 5 =$

14.  $x^2 + 5x + 6 =$

15.  $x^2 - 5x - 6 =$

16.  $x^2 - 5x =$

17.  $x^2 - 5 =$

18.  $x^2 - 50 =$

19.  $2x^2 - 50 =$

20.  $2x^2 - 50x =$

21.  $2x^2 - 50x - 52 =$

22.  $2x^2 - 5x - 52 =$

23. ???

How would you use the above exercise?

Do you feel the exercise represents 'intelligent practice'?



Choose two things you like about the collection.	
1	
2	

Choose two things you would change in the collection.	
1	
2	

Record two different explanations you would use in class to describe the relationship between consecutive questions.	
1	
2	

Choose two problems to continue the sequence.	
1	
2	

---

# Manipulating expressions

## Activity 1c – ‘ssdd’

What do you like about this approach?

What don't you like?

How and when might you use ‘ssdd’ in your teaching?

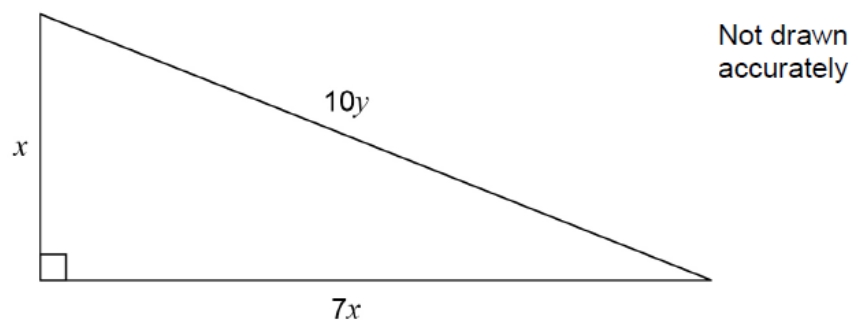
# Manipulating expressions

## Activity 1d - squaring

Take a look at Exercise 1 and Exercise 2. 79.7% of attempts achieved zero marks for Exercise 1 and only 33.7% of attempts generated 1 mark for Exercise 2. Why do you think performance on these two questions was so poor?

### Exercise 1

20 All dimensions are in centimetres.

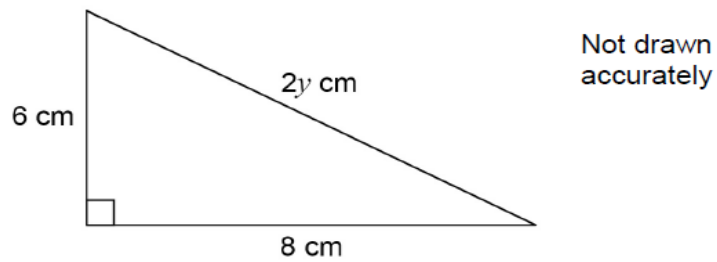


Use Pythagoras' theorem to work out the exact value of  $\frac{x}{y}$

[3 marks]

## Exercise 2

- 15 Sami is trying to work out the exact value of  $y$  using Pythagoras' theorem.



Here is her working.

$$\begin{aligned}(2y)^2 &= 6^2 + 8^2 \\ 2y^2 &= 36 + 64 \\ 2y^2 &= 100 \\ y^2 &= 100 \div 2 \\ y^2 &= 50 \\ y &= \sqrt{50}\end{aligned}$$

- 15 (a) What error has she made in her working?

[1 mark]

Why do you think performance on the first two was so poor?

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# Manipulating expressions

## Activity 1e - squaring

Look at the practice exercise below and complete the actions on the following page.

$$(a)^2$$

$$(3a^3)^2$$

$$(3\sqrt{a})^2$$

$$(2a)^2$$

$$(3a^2)^3$$

$$(ab^2)^3$$

$$(5a)^2$$

$$7(a)^2$$

$$\left((ab)^2\right)^3$$

$$(5a)^3$$

$$(7a)^2$$

$$\sqrt{(ab)^2}$$

$$(a^2)^3$$

$$(\sqrt{a})^2$$

$$(a+b)^2$$

Choose two things you like about the collection.	
1	
2	

Choose two things you would change.	
1	
2	

Record two different explanations you would use in class to describe the relationship between consecutive questions.	
1	
2	

Choose two problems to continue the sequence.	
1	
2	

---

# Solving equations

## Activity 2 – Notes

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# Notes (continued)



# Approaching graphs

## Activity 3a

Look at the two exam questions that follow. Write down and then discuss all the mathematical skills and knowledge that students will need to be able to answer the questions fluently. Also, discuss the approach you would take to teaching this knowledge discreetly and then connecting it all together.

- 23 The equation of a curve is  $y = (x + 3)^2 + 5$

Circle the coordinates of the turning point.

[1 mark]

(5, 3)

(5, -3)

(3, 5)

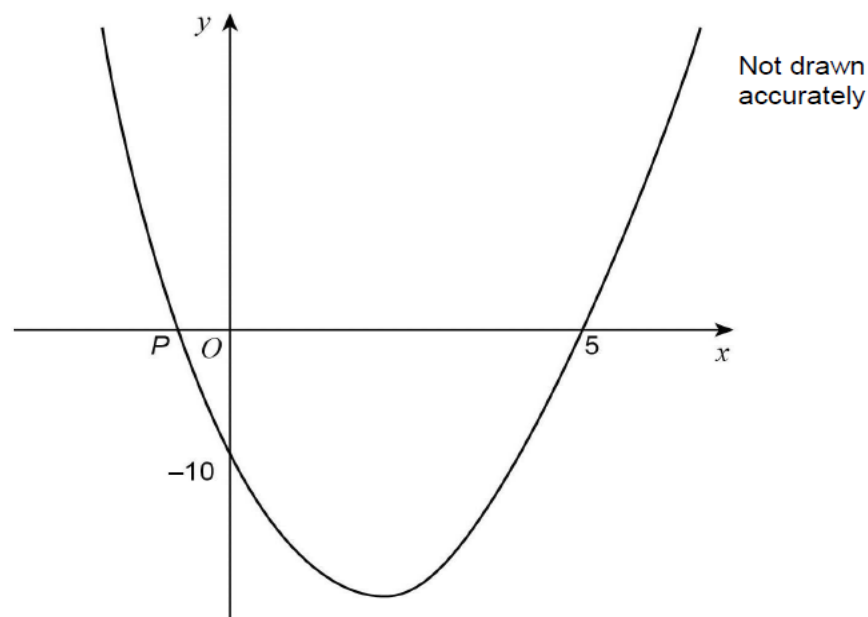
(-3, 5)

- 23 Here is a sketch of  $y = x^2 + bx + c$

The curve intersects

the  $x$ -axis at (5, 0) and point  $P$

the  $y$ -axis at (0, -10)



Work out the  $x$ -coordinate of the turning point of the graph.

[4 marks]

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## Answers

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# Fill in the gaps

## Activity 3b

### Exercise 1

When would you use an exercise like this (if at all)?

How would you use it in class?

Which aspects of the exercise would you draw particular attention to in your teaching?

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## Exercise 2

Can the gaps be completed in any order?

Can any single cell be given as a starting point for a row?

How can you use the links between rows as well as the links across each row?

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### Exercise 3

Can the gaps be completed in any order?

Can any single cell be given as a starting point for a row?

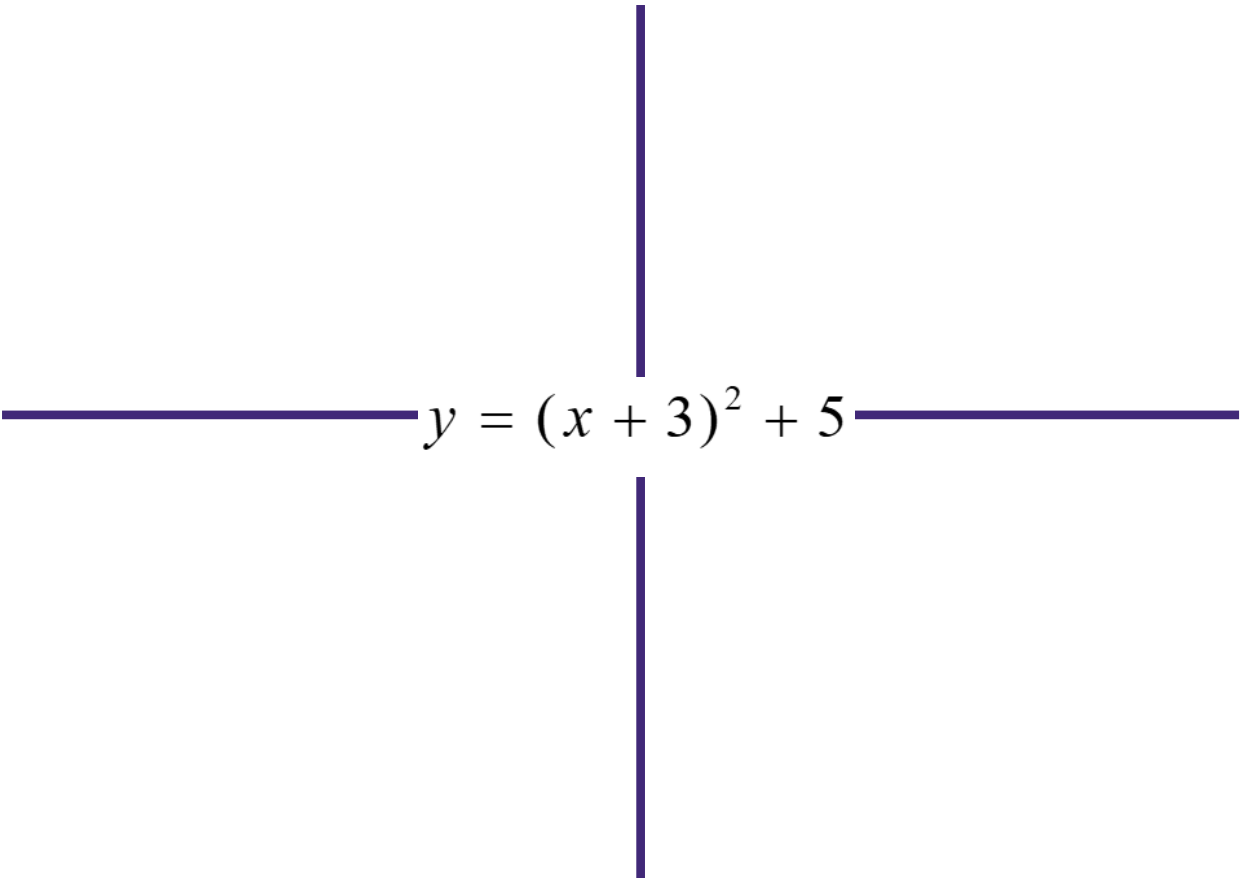
How can you use the links between rows as well as the links across each row?

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# A challenging 'ssdd' problem

## Activity 3c

Using the 'ssdd' problem provided on the slide, record four other questions about the given equation.


$$y = (x + 3)^2 + 5$$

# 'Goal-free'

## Activity 3d

Discuss in your pairs or with your group the advantages and disadvantages of setting 'Goal-free' problems and entire 'Goal-free' mock exams.

Advantages	
1	
2	
3	

Disadvantages	
1	
2	
3	

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# Next steps

## Activity 4a

Visit the websites listed in the *Handout booklet* (page 4) and select some 'intelligent practice' exercises to use in your teaching next term.

**Website(s) visited:**

**Exercise(s) selected:**



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## Activity 4b

Have a look at the same websites listed (especially the 'get involved' section). Follow the guidance to design your own exercises on quadratics or any other aspect of algebra. You may wish to share these with other members of the group at a later time.

# Post-session health check

Grade the area of development statements according to your confidence where 0 is not confident at all and 5 is very confident.

Area of development	Grading 0-5	Reasons/notes
I am familiar with the way quadratic expressions, equations and graphs are assessed in the Higher tier of GCSE Maths.		
I am familiar with the resources on Craig Barton's various websites.		
I understand the principles of variation theory and apply them in my teaching.		
I have good subject knowledge in this area of content and understand the most effective way to teach all aspects of this content.		

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# Notes

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