GCSE 7+ Session 4
Independent Practice
Quadratic graphs

KING'S MATHS SCHOOL

Revise, refresh, recall *the core knowledge and skills:*

1 Copy and complete this table, filling in the empty cells. The first row is an example.

Equation of graph	y-intercept	Factorisation	x-intercept(s)	Complete the square	Vertex / turning pt
$y = x^2 - 6x + 8$	$(0, 8)$	$y = (x - 2)(x - 4)$	$(2, 0)$ and $(4, 0)$	$y = (x - 3)^2 - 1$	$(3, -1)$
$y = x^2 - 6x + 5$		$y = (x - 1)(x - 5)$			
$y = x^2 + 4x - 12$					
		$y = (x + 3)(x - 7)$			
				$y = (x - 2)^2$	
$y = x^2 - 4$					

2 Now use the information in the table to sketch the graphs

a) $y = x^2 - 6x + 5$ b) $y = x^2 - 4x + 4$

3 Copy and complete this table, filling in the empty cells. The first row is an example.

Equation of graph	y-intercept	Factorisation	x-intercept(s)	Partial factorisation	Vertex / turning pt
$y = x^2 - 8x + 7$	$(0, 7)$	$y = (x - 1)(x - 7)$	$(1, 0)$ and $(7, 0)$	$y = x(x - 8) + 7$	$(4, -9)$
$y = x^2 - 2x - 35$		$y = (x - 7)(x + 5)$			
$y = x^2 - 3x - 10$					
				$y = x(x + 5) - 24$	
				$y = -x(x - 4) + 5$	

4 Now use the information in the table to sketch the graphs

a) $y = x^2 - 3x - 10$ b) $y = 5 + 4x - x^2$

Practice makes permanent: *these questions will help you embed and make secure your factual knowledge, procedural fluency and conceptual understanding:*

5 Copy and complete each table, filling in the empty cells. Then sketch each graph.

Equation of graph	y-intercept	Factorisation	x-intercept(s)	Partial factorisation	Vertex / turning pt
$y = 2x^2 + x - 15$					

Equation of graph	y-intercept	Factorisation	x-intercept(s)	Partial factorisation	Vertex / turning pt
$y = 6 + x - x^2$					

6 Copy each table, filling in the empty cells. Then sketch each graph.

Equation of graph	y-intercept	Partial factorisation	Vertex / turning pt
$y = x^2 - 3x + 6$			

Equation of graph	y-intercept	Partial factorisation	Vertex / turning pt
$y = 2x - 4 - x^2$			

7 What are the equations of each of these quadratic graphs?

a) vertex (turning point) at $(2, -3)$ and y-intercept at $(0, 1)$

b) vertex (turning point) at $(2, -6)$ and y-intercept at $(0, 2)$

c) vertex (turning point) at $(2, -3)$ and y-intercept at $(0, -7)$

Productive struggle: *these harder questions require deeper thinking.*

8 a) Factorise and also complete the square in $x^4 - 2x^2 - 3$

b) Hence sketch $y = x^4 - 2x^2 - 3$, giving the coordinates of the axis intercepts and any turning points.

c) Now factorise and also complete the square in $9^x - 2 \times 3^x - 3$

d) Hence sketch $y = 9^x - 2 \times 3^x - 3$, giving the coordinates of the axis intercepts and any turning points.

9 For each of the following, first work out real numbers a, b and c that complete the square, and then state the minimum value obtained by each expression and the corresponding x-value:

a) $2x^2 + 4x - 3 \equiv a(x + b)^2 + c$ b) $2x^2 + 6x - 3 \equiv (ax + b)^2 + c$

c) $4x^2 + 12x - 3 \equiv (ax + b)^2 + c$ d) $4x^4 + 12x^2 - 3 \equiv (ax^2 + b)^2 + c$

10 For each of the following, first complete the square and then state the minimum value obtained by each expression and the corresponding x, y and z-values:

a) $x^2 + y^2 + 6x - 10y + 50$ b) $x^2 - 2xy + 2y^2 + 8y + 20$

c) $x^2 + 3y^2 + 4z^2 + 4xz + 12y$