

# 1.1 Quadratics

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 16 marks

**KEY WORDS** quadratic 二次式 • quadratic equation 二次方程 • discriminant 判别式  
• simultaneous equations 联立方程 • real roots 实根

## Objective

Build the skills to answer exam questions on **quadratics** 二次式 — completing the square, the **discriminant** 判别式, solving equations and inequalities, and simultaneous equations.

You must be able to:

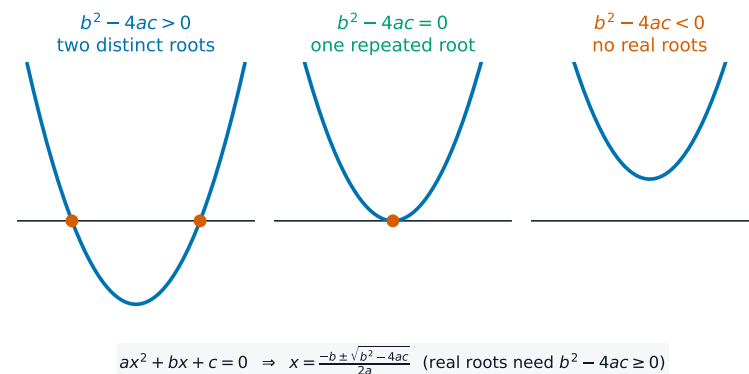
- write  $ax^2 + bx + c$  in completed-square form  $a(x + p)^2 + q$
- use  $b^2 - 4ac$  to decide the number of real roots
- solve quadratic equations and inequalities
- solve a linear-quadratic pair by substitution

## 1 Worked examples

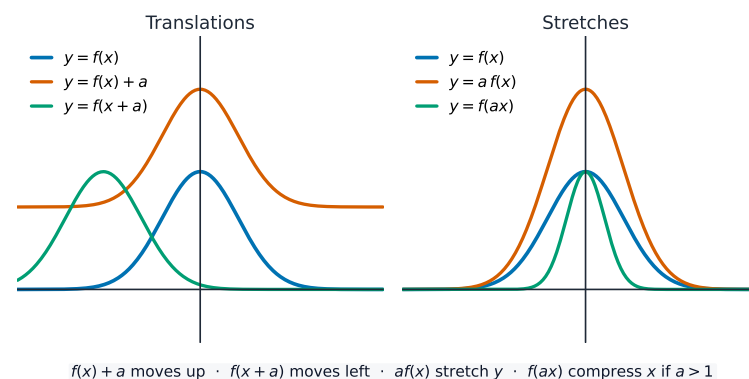
### ■ Completing the square & the discriminant

Write  $2x^2 - 12x + 5$  as  $a(x + p)^2 + q$ .

$$2x^2 - 12x + 5 = 2(x^2 - 6x) + 5 = 2((x - 3)^2 - 9) + 5 = 2(x - 3)^2 - 13.$$



The sign of  $b^2 - 4ac$  decides how many times the parabola meets the x-axis



Completing the square shifts and stretches the parabola

Find the values of  $k$  for which  $x^2 + kx + 9 = 0$  has two distinct real roots.

Two distinct roots need  $b^2 - 4ac > 0$ :  $k^2 - 36 > 0 \Rightarrow (k - 6)(k + 6) > 0 \Rightarrow k < -6$  or  $k > 6$ .

## 2 Practice

2.1 Express  $x^2 + 8x + 3$  in the form  $(x + p)^2 + q$ . [2]

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2.2 State the condition on the discriminant for a quadratic to have **no** real roots. [1]

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## 3 Exam-style questions

3.1 The equation  $2x^2 - 4x + c = 0$  has a repeated root. The value of  $c$  is: [1]

- |   |   |
|---|---|
| A | B |
| C | D |
- A 0  
B 1  
C 2  
D 4

3.2 Express  $3x^2 + 12x + 7$  in the form  $a(x + b)^2 + c$  and hence write down the least value of the expression. [4]

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3.3 Find the set of values of  $k$  for which the line  $y = kx - 2$  meets the curve  $y = x^2 - 3x + 2$  at two distinct points. [4]

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3.4 Solve the simultaneous equations  $y = 2x - 1$  and  $x^2 + y^2 = 2$ . [4]

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