Exercise walk-through

# 2.3 Simultaneous

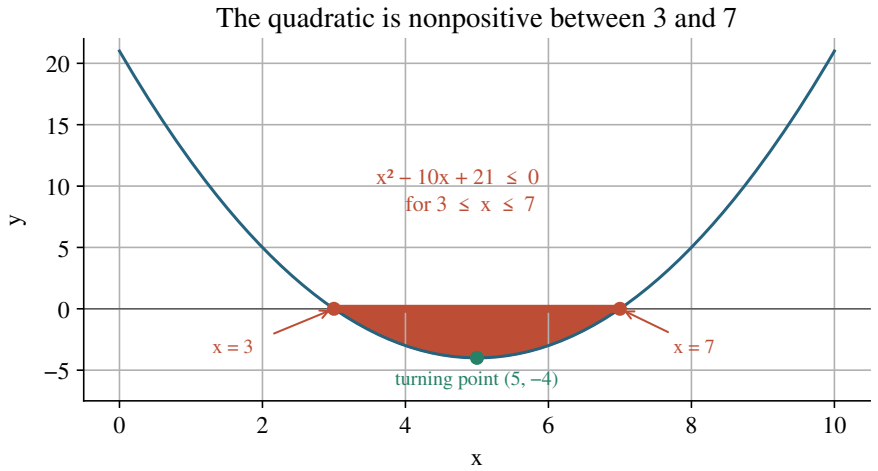
Pearson Edexcel · International GCSE · Mathematics A

# Quadratic algebra

- To factorise $x^2 + bx + c$, find two numbers that multiply to $c$ and add to $b$: $x^2 + 10x + 24 = (x+6)(x+4)$.
- (Higher) To factorise $ax^2 + bx + c$, find two numbers that multiply to $ac$ and add to $b$, then split the middle term: $6x^2 - 5x - 6 = 6x^2 - 9x + 4x - 6 = 3x(2x-3) + 2(2x-3) = (3x+2)(2x-3)$.
- The **difference of two squares** : $x^2 - a^2 = (x-a)(x+a)$, so $4x^2 - 9 = (2x-3)(2x+3)$.

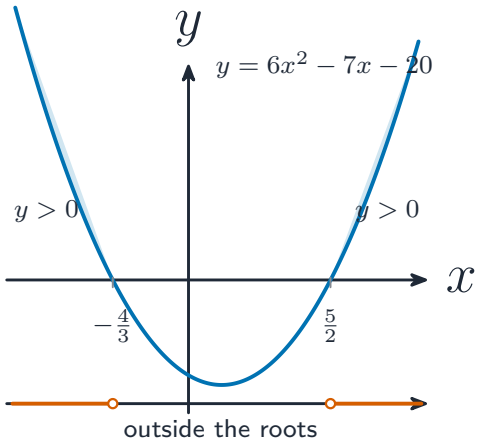
$$\frac{x^2-4}{x^2+5x+6} = \frac{(x-2)(x+2)}{(x+2)(x+3)} = \frac{x-2}{x+3}$$

# Figure: Completing the square and solving quadratics (2)




- $x^2 - 10x + 21 = (x - 3)(x - 7)$.
- It is $\leq 0$ for $3 \leq x \leq 7$.

# Figure: Inequalities and linear–quadratic pairs

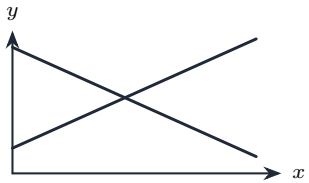



positive quadratic: $>$ holds
outside the critical values

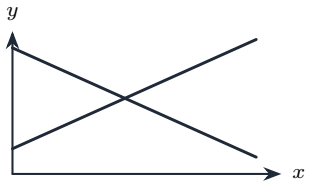
- Roots $-4/3$ and $5/2$.
- Positive outside the roots.

# Exercises 2.1·2.2

**2.1** Solve $7(x+3) = 5x + 8$ [2]

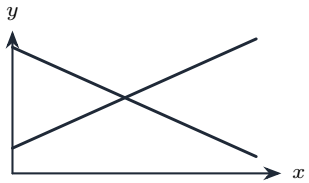



**2.2** Solve $\frac{4}{5}x + 3 = \frac{2}{3}$ [3]



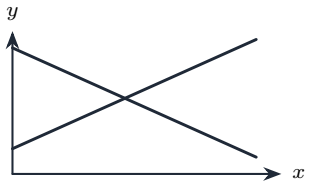
# Exercises 2.1·2.2

**2.1** Solve $7(x+3) = 5x + 8$ [2]




**2.1** $7x + 21 = 5x + 8$, so $2x = -13$ and $x = -6.5$.

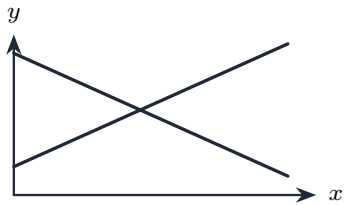
**2.2** Solve $\frac{4}{5}x + 3 = \frac{2}{3}$ [3]




**2.2** Multiply by 15: $12x + 45 = 10$, so $x = -\frac{35}{12}$.

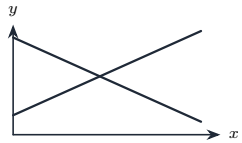
# Setup for exercise 2.3

**2.3** Solve the pair $x + y = 14$, $x - y = 2$ [2]



# Exercise 2.3

**2.4** Solve the pair $2a + 5b = 12$, $3a + b = 5$ [3]




**2.5** $y$ is directly proportional to $x^3$; $y = 24$ when $x = 2$. Find $y$ when $x = 3$. [3]



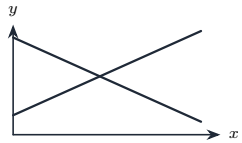

**2.6** $p$ is inversely proportional to $x^2$; $p = 8$ when $x = 2$. Find $p$ when $x = 4$. [3]




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# Exercise 2.3

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**2.3** Adding: $2x = 16$, $x = 8$; then $y = 6$.

**2.4** From the second, $b = 5 - 3a$; substituting: $2a + 25 - 15a = 12$, so $-13a = -13$, $a = 1$, $b = 2$.

Full solution on next slide

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# Full solution 2.3

**2.3** Adding: $2x = 16$, $x = 8$; then $y = 6$.

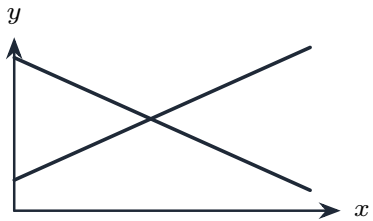
**2.4** From the second, $b = 5 - 3a$; substituting: $2a + 25 - 15a = 12$, so $-13a = -13$, $a = 1$, $b = 2$.

**2.5** $y = kx^3$: $24 = 8k$ gives $k = 3$; at $x = 3$, $y = 3 \times 27 = 81$.

**2.6** $p = k/x^2$: $8 = k/4$ gives $k = 32$; at $x = 4$, $p = 32/16 = 2$.

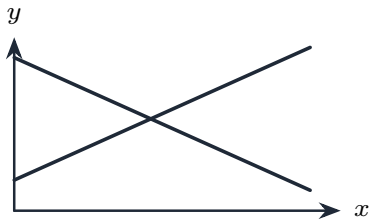
# Exercise 3.1

**3.1** *(Edexcel-style, specification example.)* Solve the simultaneous equations $2x + 3y = 17$ and $3x - 5y = 35$. [3]



# Exercise 3.1

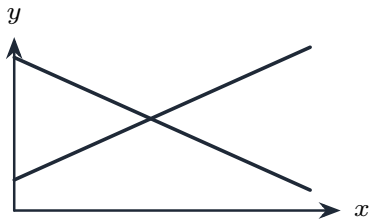
**3.1** *(Edexcel-style, specification example.)* Solve the simultaneous equations $2x + 3y = 17$ and $3x - 5y = 35$. [3]




**3.1** Triple the first, double the second: $6x + 9y = 51$ and $6x - 10y = 70$. Subtracting: $19y = -19$, so $y = -1$ and $x = \frac{17 - 3(-1)}{2} = 10$. Check: $3(10) - 5(-1) = 35$. ✓

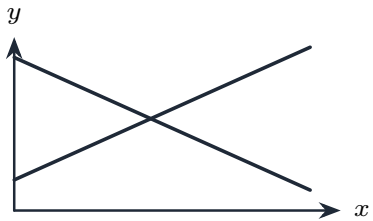
# Exercise 3.2

**3.2** *(Original.)* A cinema ticket for an adult costs \$$(a)$ and for a child \$$(c)$. Two adults and three children pay \$34; one adult and four children pay \$27. (a) Form two equations. (b) Find the cost of each ticket. [4]



# Exercise 3.2

**3.2** *(Original.)* A cinema ticket for an adult costs $\$(a)$ and for a child $\$(c)$. Two adults and three children pay $\$34$; one adult and four children pay $\$27$. (a) Form two equations. (b) Find the cost of each ticket. [4]




**3.2** (a) $2a + 3c = 34$ and $a + 4c = 27$. (b) From the second, $a = 27 - 4c$; substituting: $54 - 8c + 3c = 34$, so $5c = 20$, $c = 4$ and $a = 27 - 16 = 11$: adult $\$11$, child $\$4$. Check: $2(11) + 3(4) = 34$. ✓

# Exercise 3.3

**3.3** *(Original.)* $y$ is inversely proportional to $x$. When $x = 6$, $y = 5$.

(a) Find the equation linking $x$ and $y$. (b) Find $x$ when $y = 2$. (c) Sketch, or describe, the graph of $y$ against $x$. [4]



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**3.3** (a) $y = k/x$: $5 = k/6$ gives $k = 30$, so $y = 30/x$. (b) $2 = 30/x$ gives $x = 15$. (c) A hyperbola in the first (and third) quadrant, never touching either axis.

Local review guidance: elimination or substitution with a stated multiplier; exact answers checked in the unused equation; proportion models stated as $y = kx^n$ before substitution. This is authored classroom guidance.