Drawing Linear and Quadratic Graphs: Plot, Compare, and Explain

Rubric key

Concise rubric key for marking.

1. Value tables complete and checked by substitution.

2. Axes labelled and scale stated in units per square.

3. Linear points joined with a ruled straight line.

4. Quadratic points joined with a smooth curve through point centres.

5. Intercepts read correctly and stated as coordinates.

6. Symmetry claim supported by two equally spaced substitutions. 7. Comparison sentences clear and checkable. 8. Valid alternative point markers accepted if used consistently.

Drawing Linear and Quadratic Graphs: Plot, Compare, and Explain

Complete worked example / separate answer key

Plot y = x + 2 and y = x^2 - 4 on shared axes for x = -2, -1, 0, 1, 2, then compare intercepts and symmetry.

Answer: Linear table: (-2, 0), (-1, 1), (0, 2), (1, 3), (2, 4). Quadratic table: (-2, 0), (-1, -3), (0, -4), (1, -3), (2, 0). The line crosses the y-axis at (0, 2); the parabola crosses at (0, -4). Both cross the x-axis at (-2, 0) and (2, 0) for the parabola, while the line crosses at (-2, 0). The parabola is symmetric about x = 0 because x = 1 and x = -1 both give y = -3; the line has no such symmetry.

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Original tasks 1, 2 / complete keys

Task 1

Plot y = 3x - 1 and y = x^2 - 1 on shared axes for x = -1, 0, 1, 2, 3. State both y-intercepts and one x-intercept of each graph.

Answer: Linear table: (-1, -4), (0, -1), (1, 2), (2, 5), (3, 8). Quadratic table: (-1, 0), (0, -1), (1, 0), (2, 3), (3, 8). Linear y-intercept (0, -1); quadratic y-intercept (0, -1). Linear x-intercept at (1/3, 0) if the grid allows fractions, otherwise state it lies between 0 and 1; quadratic x-intercepts at (-1, 0) and (1, 0).

Reason: Substitute each x into both rules. The shared y-intercept occurs because both rules give -1 at x = 0. The quadratic factors as (x - 1)(x + 1), giving x-intercepts at -1 and 1. The linear x-intercept is found by solving 3x - 1 = 0.

Check: Substitute the stated intercept coordinates back into the rules and confirm equality; re-read the plotted points against the tables.

Task 2

Plot y = -x + 4 and y = x^2 - 2x on shared axes for x = -1, 0, 1, 2, 3. Compare the shape and state whether the quadratic has a line of symmetry, with a substitution check.

Answer: Linear table: (-1, 5), (0, 4), (1, 3), (2, 2), (3, 1). Quadratic table: (-1, 3), (0, 0), (1, -1), (2, 0), (3, 3). The line is straight with constant slope -1; the parabola opens upward. The quadratic is symmetric about x = 1 because x = 0 and x = 2 both give y = 0, and x = -1 and x = 3 both give y = 3.

Reason: The linear rule decreases by 1 for each increase of 1 in x. The quadratic values repeat at equal distances from x = 1, confirming symmetry. The line has no repeated y values for different x values, so no vertical symmetry line.

Check: Substitute x = 1 + h and x = 1 - h for h = 1 and h = 2 into the quadratic and confirm equal y values; check the linear table differences are constant.

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Original tasks 3, 4 / complete keys

Task 3

Plot y = 0.5x + 1 and y = x^2 - 3 on shared axes for x = -2, -1, 0, 1, 2. State the y-intercepts and describe where each graph crosses the x-axis using the plotted points.

Answer: Linear table: (-2, 0), (-1, 0.5), (0, 1), (1, 1.5), (2, 2). Quadratic table: (-2, 1), (-1, -2), (0, -3), (1, -2), (2, 1). Linear y-intercept (0, 1); quadratic y-intercept (0, -3). The line crosses the x-axis at (-2, 0). The parabola crosses the x-axis between -2 and -1 and between 1 and 2, since y changes sign in those intervals.

Reason: Substitution gives the tables. The linear x-intercept is exact at x = -2 because 0.5(-2) + 1 = 0. The quadratic has no integer x-intercepts, so the plotted points show sign changes that locate the crossings between grid values.

Check: Confirm sign changes in the quadratic table between consecutive x values; substitute the linear intercept back into its rule.

Task 4

Plot y = 2x + 3 and y = x^2 + 2x - 3 on shared axes for x = -3, -2, -1, 0, 1. Compare the number of x-intercepts and check the quadratic symmetry line by substitution.

Answer: Linear table: (-3, -3), (-2, -1), (-1, 1), (0, 3), (1, 5). Quadratic table: (-3, 0), (-2, -3), (-1, -4), (0, -3), (1, 0). The line has one x-intercept at (-1.5, 0) if fractions are used, otherwise between -2 and -1. The parabola has two x-intercepts at (-3, 0) and (1, 0). The quadratic is symmetric about x = -1 because x = 0 and x = -2 both give y = -3, and x = 1 and x = -3 both give y = 0.

Reason: The quadratic factors as (x + 3)(x - 1), giving x-intercepts at -3 and 1. The linear rule gives one crossing because it is a straight line with nonzero slope. Equal y values at inputs equally spaced from x = -1 confirm the symmetry line.

Check: Substitute x = -1 + h and x = -1 - h for h = 1 and h = 2 into the quadratic; confirm equal y values. Substitute the linear intercept estimate back into y = 2x + 3.

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Worked example, Task 1, Task 2, Task 3, Task 4 / Answer sheet: comparison notes and substitution checks

Checkable sentences with coordinates and arithmetic.

Linear y-intercept: (0, 2) because y = 0 + 2 = 2.

Quadratic y-intercept: (0, -4) because y = 0^2 - 4 = -4.

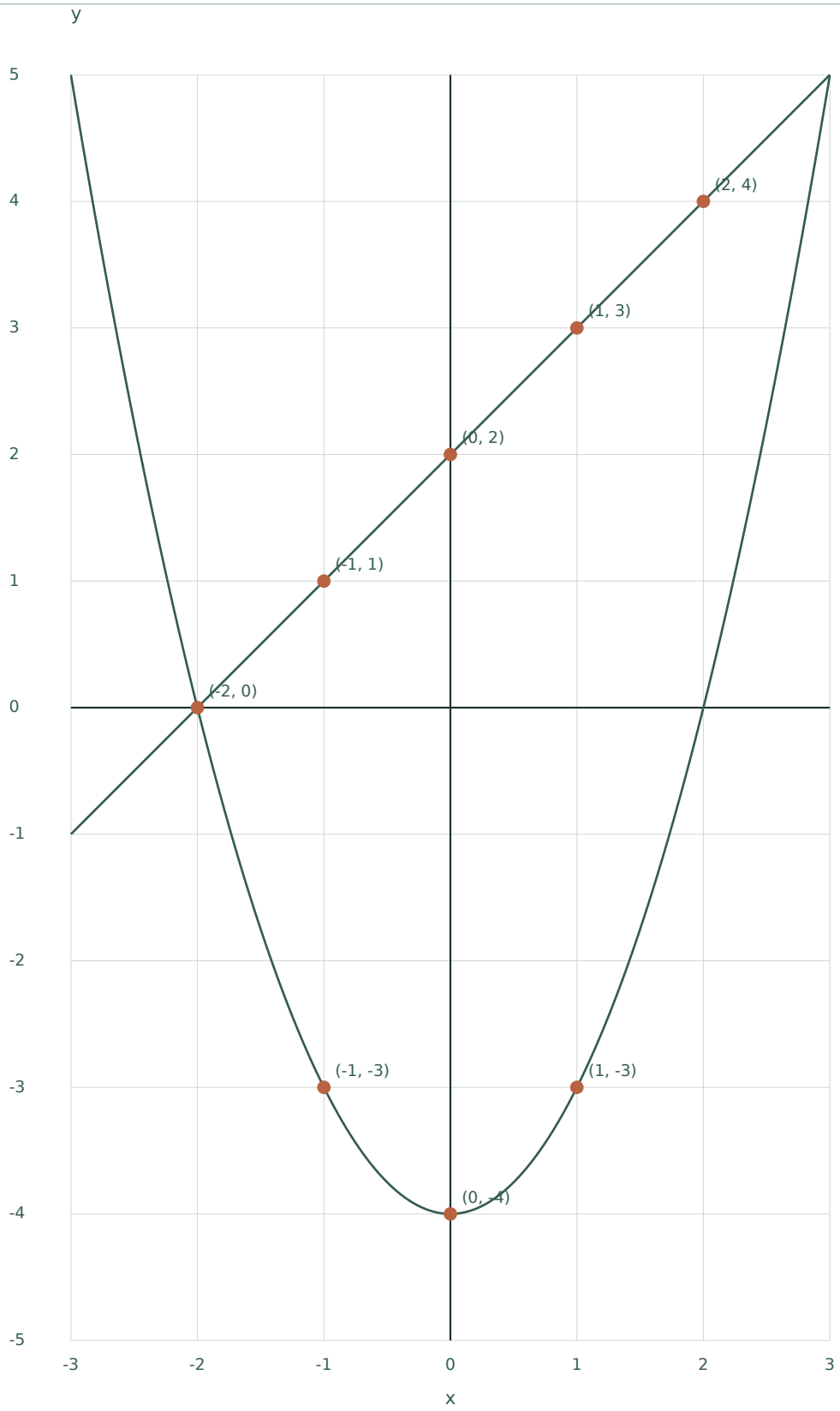
x-intercepts: the line crosses at (-2, 0) since -2 + 2 = 0. The parabola crosses at (-2, 0) and (2, 0) since (-2)^2 - 4 = 0 and 2^2 - 4 = 0.

Symmetry: the parabola is symmetric about x = 0. Substituting x = 1 and x = -1 gives y = 1 - 4 = -3 and y = 1 - 4 = -3, equal. The line has no such symmetry: x = 1 gives 3 and x = -1 gives 1, not equal.

Shape: the line is straight with constant slope 1; the parabola opens upward because the x^2 coefficient is positive.

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Worked example, Task 1, Task 2, Task 3, Task 4 / Answer sheet: plotted graphs



Both graphs cross x-axis at (-2, 0); parabola also at (2, 0).

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Worked example, Task 1, Task 2, Task 3, Task 4 / Answer sheet: completed value tables

Completed tables for the worked example.

x	y = x + 2	y = x^2 - 4
-2	0	0
-1	1	-3
0	2	-4
1	3	-3
2	4	0

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Source rubric / reflection

- [ ] Value tables are complete and checked by substitution.
- [ ] Axes are labelled and the scale is stated in units per square.
- [ ] Linear points are joined with a ruled straight line.
- [ ] Quadratic points are joined with a smooth curve through point centres.
- [ ] Intercepts are read correctly and stated as coordinates.
- [ ] Symmetry claim is supported by two equally spaced substitutions.
- [ ] Comparison sentences are clear and checkable.
- [ ] Valid alternative point markers are accepted if used consistently.

Reflection: What did you check, what did you change, and what will you try next?