Drawing Cubic Graphs from Value Tables: A Reliable Method

Original tasks 1, 2 / complete keys

Task 1

Plot y = x^3 - 4x for x from -3 to 3. Build a value table, sketch the curve, and label turning points approximately.

Answer: Table: x = -3, y = -15; x = -2, y = 0; x = -1, y = 3; x = 0, y = 0; x = 1, y = -3; x = 2, y = 0; x = 3, y = 15. Turning points approximately at (-1, 3) and (1, -3). Curve rises to local maximum, falls to local minimum, then rises.

Reason: Substitute each x into y = x^3 - 4x. For x = -2: (-8) - (-8) = 0. For x = -1: (-1) - (-4) = 3. For x = 1: 1 - 4 = -3. The direction changes between x = -2 and x = 0 (rising then falling) and between x = 0 and x = 2 (falling then rising), indicating turning points near x = -1 and x = 1.

Check: Substitute x = 2 into the equation: 8 - 8 = 0, matching the table. Confirm the curve passes through all seven points and has exactly two turning points.

Task 2

Plot y = -x^3 + 3x for x from -3 to 3. Build a value table, sketch the curve, and label turning points approximately.

Answer: Table: x = -3, y = 18; x = -2, y = 2; x = -1, y = -2; x = 0, y = 0; x = 1, y = 2; x = 2, y = -2; x = 3, y = -18. Turning points approximately at (-1, -2) and (1, 2). Curve falls to local minimum, rises to local maximum, then falls.

Reason: Substitute each x into y = -x^3 + 3x. For x = -2: -(-8) + (-6) = 8 - 6 = 2. For x = -1: -(-1) + (-3) = 1 - 3 = -2. For x = 1: -1 + 3 = 2. The direction changes between x = -2 and x = 0 (falling then rising) and between x = 0 and x = 2 (rising then falling), indicating turning points near x = -1 and x = 1.

Check: Substitute x = 2: -8 + 6 = -2, matching the table. Confirm the curve is smooth and has two turning points.

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Original tasks 3, 4 / complete keys

Task 3

Plot y = x^3 - 6x^2 + 9x for x from 0 to 4. Build a value table, sketch the curve, and label turning points approximately.

Answer: Table: x = 0, y = 0; x = 1, y = 4; x = 2, y = 2; x = 3, y = 0; x = 4, y = 4. The y-values rise from x = 0 to x = 1, fall from x = 1 to x = 3, then rise from x = 3 to x = 4. A local maximum is bracketed between x = 0 and x = 2, with sampled peak y = 4 at x = 1. A local minimum is bracketed between x = 2 and x = 4, with sampled low y = 0 at x = 3. For this cubic, $y'=3(x-1)(x-3)$, so the exact turning points are (1, 4) and (3, 0). The curve rises to the local maximum, falls to the local minimum, then rises.

Reason: Substitute each x into y = x^3 - 6x^2 + 9x. Its derivative is $y'=3x^2-12x+9=3(x-1)(x-3)$, so the turning x-values are exactly 1 and 3. The table includes both values, and their y-values are 4 and 0; here the sampled turning points coincide with the exact ones.

Check: Substitute x = 4: 64 - 96 + 36 = 4, matching the table. Confirm the curve passes through all five points, has a local maximum bracketed between x = 0 and x = 2, and a local minimum bracketed between x = 2 and x = 4, with the curve rising after x = 3.

Task 4

Plot y = 2x^3 - 3x^2 - 12x + 5 for x from -2 to 3. Build a value table, sketch the curve, and label turning points approximately.

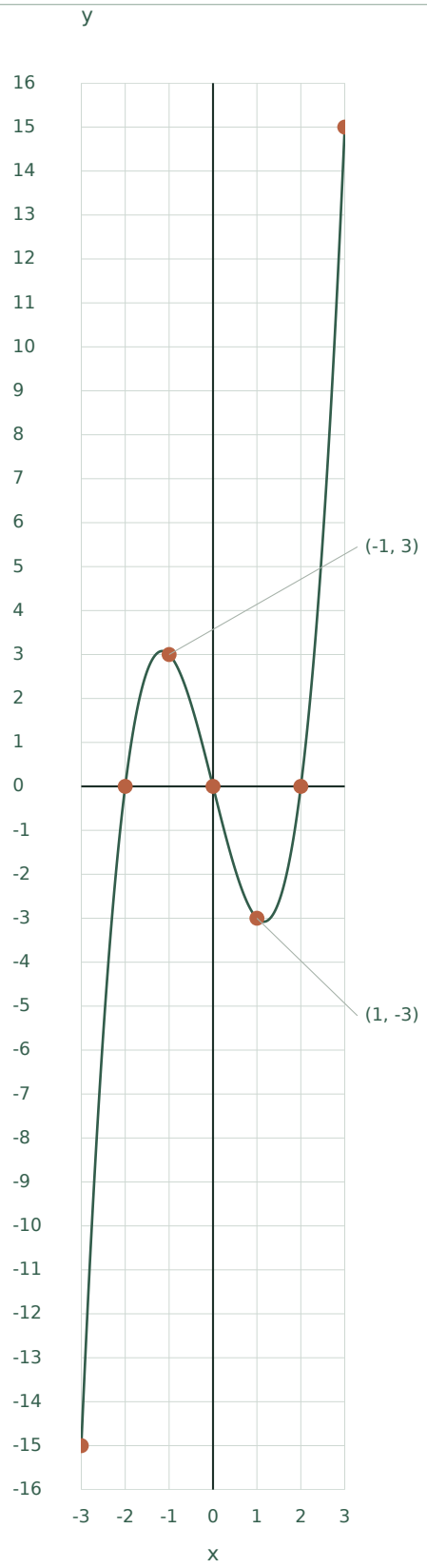
Answer: Table: x = -2, y = 1; x = -1, y = 12; x = 0, y = 5; x = 1, y = -8; x = 2, y = -15; x = 3, y = -4. The y-values rise from x = -2 to x = -1, then fall from x = -1 to x = 2, then rise from x = 2 to x = 3. So a local maximum is bracketed between x = -2 and x = 1, with sampled peak y = 12 at x = -1. A local minimum is bracketed between x = 1 and x = 3, with sampled low y = -15 at x = 2. For this cubic, $y'=6(x+1)(x-2)$, so the exact turning points are (-1, 12) and (2, -15). The curve rises to the local maximum, falls to the local minimum, then rises.

Reason: Substitute each x into y = 2x^3 - 3x^2 - 12x + 5. For $x=1$, $y=2-3-12+5=-8$; for $x=2$, $y=16-12-24+5=-15$; for $x=3$, $y=54-27-36+5=-4$. The derivative is $y'=6x^2-6x-12=6(x+1)(x-2)$, so its exact turning x-values are -1 and 2. The table includes both; evaluating the equation gives $y(-1)=12$ and $y(2)=-15$. These sampled values therefore coincide with the true turning points for this polynomial.

Check: Substitute x = 2: 2(8) - 3(4) - 12(2) + 5 = 16 - 12 - 24 + 5 = -15, matching the table. Substitute x = 3: 2(27) - 3(9) - 12(3) + 5 = 54 - 27 - 36 + 5 = -4, matching the table. Confirm the curve passes through all six points, has a local maximum bracketed between x = -2 and x = 1, a local minimum bracketed between x = 1 and x = 3, and rises after the bracketed minimum.

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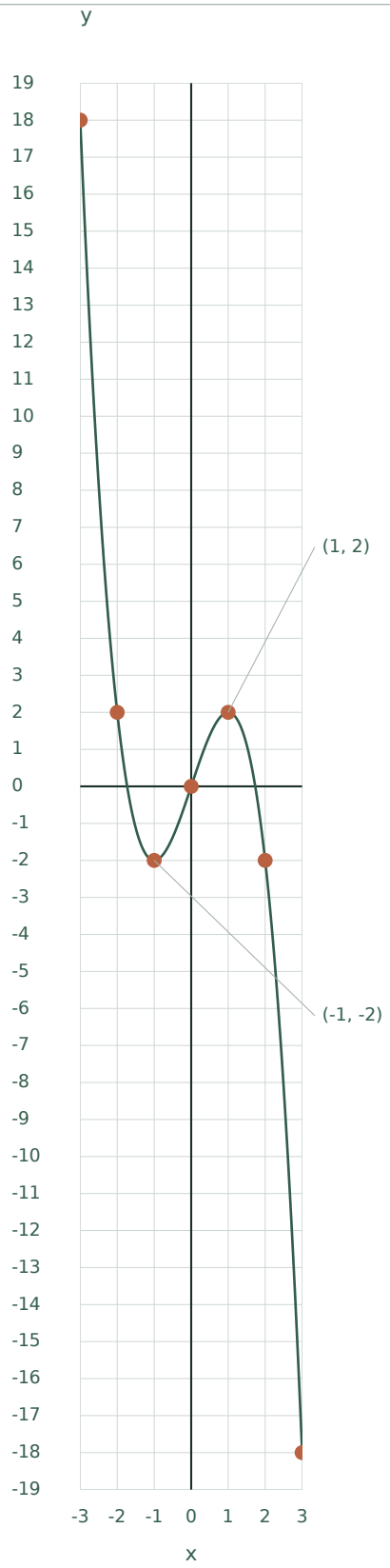
Answer graph: y = x^3 - 4x with turning points



Answer key: table points, smooth cubic, turning points labelled. Coordinate labels sit outside the plot; thin grey leaders are annotations, not function curves.

Drawing Cubic Graphs from Value Tables: A Reliable Method

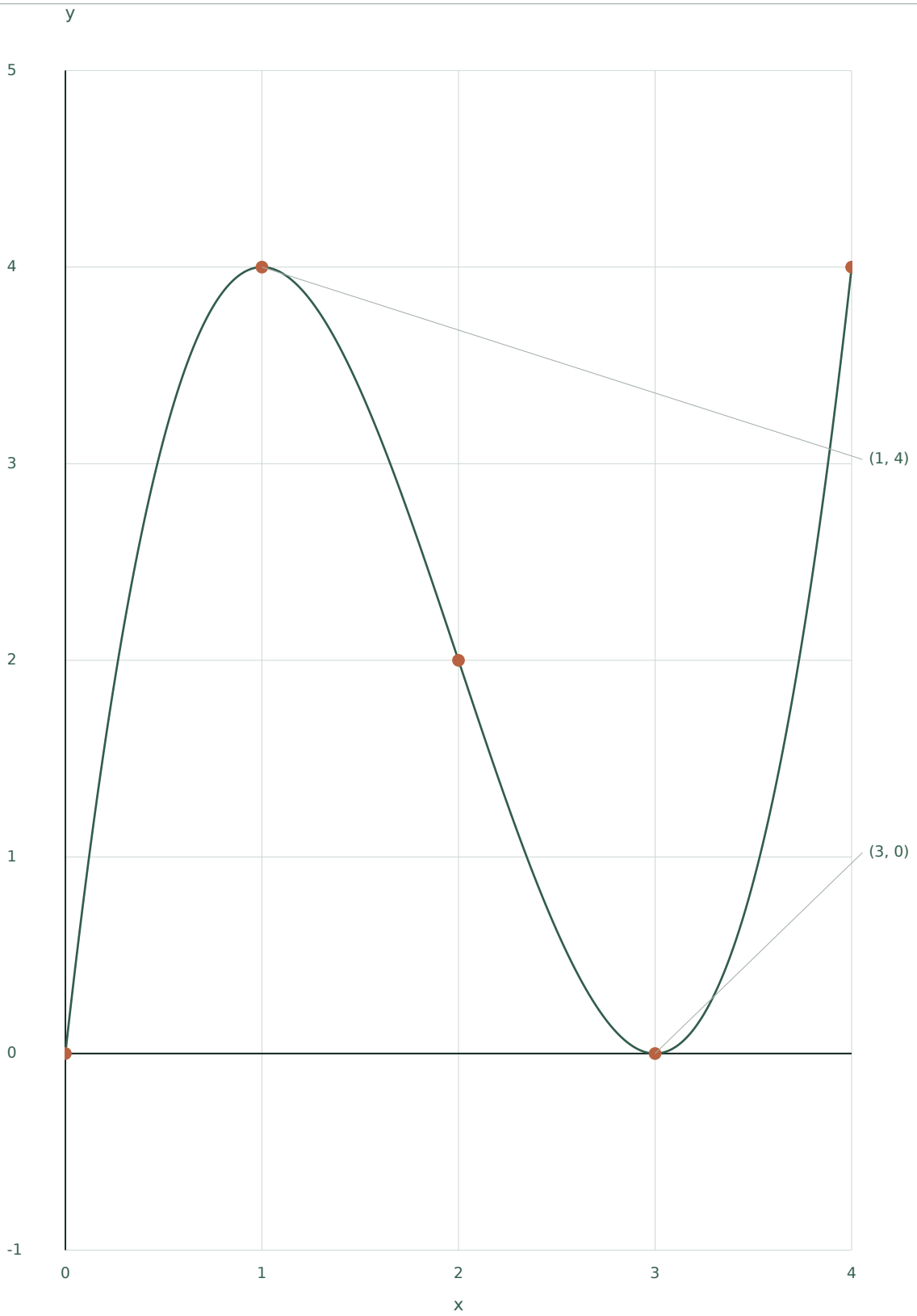
Answer graph: y = -x^3 + 3x with turning points



Answer key: table points, smooth cubic, turning points labelled. Coordinate labels sit outside the plot; thin grey leaders are annotations, not function curves.

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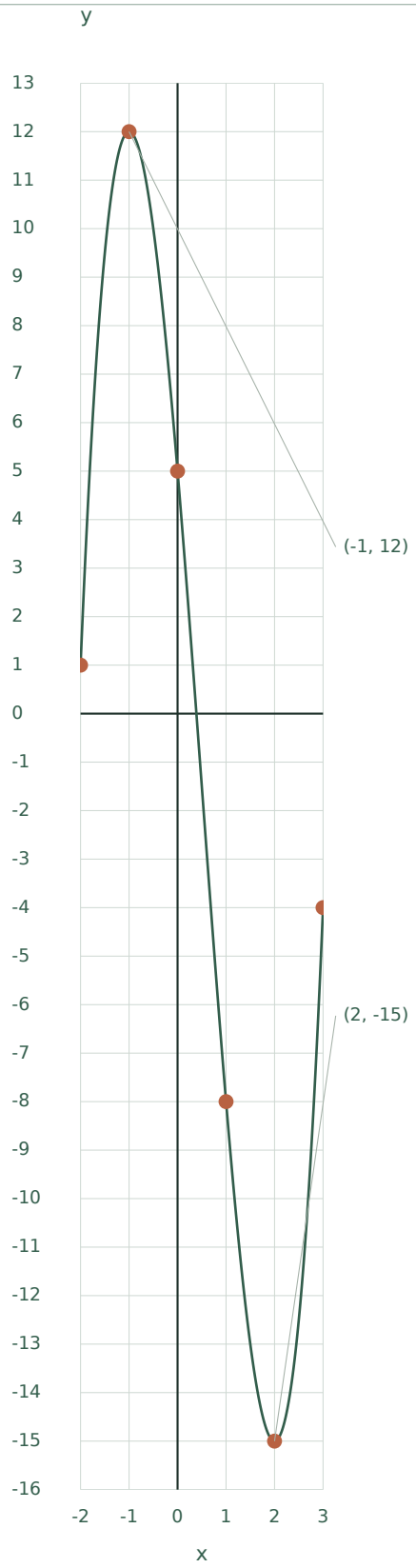
Answer graph: y = x^3 - 6x^2 + 9x with turning points



Answer key: table points, smooth cubic, turning points labelled. Coordinate labels sit outside the plot; thin grey leaders are annotations, not function curves.

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Answer graph: y = 2x^3 - 3x^2 - 12x + 5 with turning points



Answer key: table points, smooth cubic, turning points labelled. Coordinate labels sit outside the plot; thin grey leaders are annotations, not function curves.

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Source rubric / reflection

- [ ] Value table includes at least seven x-values with correct y-values.
- [ ] All plotted points match the table entries.
- [ ] Curve is smooth with no unintended sharp corners.
- [ ] Turning points are labeled with approximate coordinates and noted as approximate.
- [ ] End behavior is consistent with the sign of the leading coefficient.
- [ ] Work is neat and labels are clear.

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