

inkMaths

ANSWER BOOK

Graphs, proportion and transformations

Algebra and functions · Year 12–13

7 questions · 20 marks

NAVY EDITION

SECTION A · Warm-up

- A1** A crossing at $x = 1$ from the simple factor, a touch at $x = -2$ from the squared one, and a y-intercept of $(0 - 1)(0 + 2)^2 = -4$. Squared factor, touch; simple factor, crossing: the factorised form hands over the whole sketch. [3]
- A2** $y = kx^2$, and $12 = 4k$ gives $k = 3$, so $y = 3x^2$ and $y = 75$ at $x = 5$. Writing the constant in, then pinning it with the given point, is all the routine there is. [2]

SECTION B · Standard

- B1** $y = k/x$ with $k = 24$, so at $x = 6$, $y = 4$: doubling x halves y . The graph is the reciprocal curve with asymptotes $x = 0$ and $y = 0$, the axes themselves, approached but never met at either end. [3]
- B2** Outside the bracket acts on the output: $f(x) + 2$ lifts the whole graph up 2. Inside acts on the input, and backwards: $f(x + 2)$ feeds the function an x from 2 further along, so the picture slides 2 to the left. The inside move is the one that defies intuition, which is why examiners like it. [3]
- B3** Inside the bracket, $x - 2$ must equal 4, so $x = 6$: the point moves right 2. Outside, 5 is added to the output, lifting 3 to 8. The image point is $(6, 8)$. Chasing one point through the brackets beats memorising rules. [3]
- B4** Outside doubles the output: $(4, 6)$. Inside, $2x$ must equal 4, so $x = 2$: the point $(2, 3)$, squeezed towards the y -axis. Outside stretches vertically by 2; inside squashes horizontally by 2, the backwards behaviour again. [3]

SECTION C · Stretch

- C1** Subtracting 1 outside drops the whole picture: the horizontal asymptote falls from $y = 0$ to $y = -1$, while the vertical one stays at $x = 0$. The new curve crosses the axis where $4/x = 1$, at $x = 4$: a crossing the original curve never had, created by the shift. [3]