



ANSWER BOOK

Moments

Mechanics · Year 12–13

6 questions · 20 marks

NAVY EDITION

SECTION A · Warm-up

- A1** Moment = force $\times$ perpendicular distance from the point to the force's line of action, [2] measured in newton metres. Each moment turns clockwise or anticlockwise about the point, and the two senses fight: equilibrium of moments means the totals match.
- A2** Balancing moments about the pivot: $300 \times 2 = 200 \times x$, so $x = 3$ m. Less weight needs [3] more distance in exact proportion: the seesaw is a moments equation you can sit on.

SECTION B · Standard

- B1** The beam's own weight acts at the support and contributes no moment. Balancing: [4] $450 \times 1 = 300 \times x$ gives $x = 1.5$ m from the centre. Uniform means the beam's weight sits at its midpoint, which here is exactly the pivot: that is why it vanishes from the equation.
- B2** The weight acts at the 4 m mark. Taking moments about the support at 1 m kills its own [4] reaction: $200 \times 3 = R_2 \times 5$, so $R_2 = 120$ N. Vertical equilibrium: $R_1 = 200 - 120 = 80$ N. Choosing the pivot at an unknown force is the labour-saving move of the whole topic.
- B3** Load beyond the far support levers the beam about it: R_2 grows and R_1 shrinks. Tipping [3] begins when $R_1 = 0$, the near support giving up entirely; setting that reaction to zero is how every on-the-point-of- tipping question is solved.

SECTION C · Stretch

- C1** Taking moments about the 300 N end: $500 \times x = 200 \times 10$, so $x = 4$ m. The centre of mass [3] sits nearer the end that carries more: non-uniform beams put their weight where the reactions say, and moments read the position straight off.