

Solutions

2.1 $\text{moment} = Fx = 25 \text{ N} \times 0.30 \text{ m} = 7.5 \text{ N m}$.

2.2 Only the perpendicular component turns the spanner: $\text{moment} = F \sin \theta \times x = 25 \text{ N} \times \sin 50^\circ \times 0.30 \text{ m} = 5.7 \text{ N m}$.

2.3 Resultant force is zero and resultant moment about any point is zero.

2.4 The beam's weight acts at the pivot, so it has no moment. $300 \text{ N} \times 1.5 \text{ m} = 400 \text{ N} \times x$, so $x = \frac{450 \text{ N m}}{400 \text{ N}} = 1.1 \text{ m}$ to the left of the pivot.

3.1 A. Equal weights give zero resultant moment about the support, and the support's upward force balances both weights, so the resultant force is also zero. B and D keep a turning effect that symmetry removes; C forgets the support force.

3.2 C. For a fixed force, the moment is greatest when the force is perpendicular and the distance is greatest. A and D shrink the distance; B shrinks the perpendicular component.

3.3 (a) In equilibrium, the total clockwise moment equals the total anticlockwise moment. (b) About the string: the dish acts at 0.30 m; the counterweight at 0.35 m; the rule's weight has no moment. $1.8 \text{ N} \times 0.30 \text{ m} = W \times 0.35 \text{ m}$, so $W = \frac{0.54 \text{ N m}}{0.35 \text{ m}} = 1.5 \text{ N}$. (c) No: moving the string to 60 cm shortens the counterweight's distance to 0.25 m, so its moment falls below the dish's moment, and the rule tips towards the dish.