BALANCE THE BEAM. CHECK BOTH REACTIONS.

Find the support reactions of a simply supported beam with one point load, then check equilibrium.

THE DECISION PATH

1 Isolate the beam

Draw the applied load and both vertical support reactions. The pin also allows a horizontal reaction; with no horizontal load, it is zero.

[F1, F2]

2 Take moments about a support

Choose A as the moment center so its reaction has zero lever arm. Use one sign convention consistently.

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ΣM_A = 0: R_B × L - P × a = 0
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[F1, F2]

3 Balance and cross-check

Use vertical force balance for the other reaction. Check moments about B independently.

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ΣF_y = 0: R_A + R_B - P = 0
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[F1, F2]

WORKED EXAMPLE / ORIGINAL STUDYMAPS SCENARIO

A 12 kN load, 2 m from A

A horizontal beam spans 6 m from pin A to roller B. A single 12 kN downward load acts 2 m from A. Ignore beam weight.

1. Take counterclockwise moments as positive about A.
2. R_B × 6 - 12 × 2 = 0, so R_B = 4 kN upward.
3. R_A + 4 - 12 = 0, so R_A = 8 kN upward.
4. Check about B: -8 × 6 + 12 × 4 = 0 kN·m. Both balances hold.

RESULT

A: 8 kN up. B: 4 kN up.

Principles: [F1, F2]. Original example: StudyMaps.

Catch this mistake Equal reactions require a symmetric loading situation. Splitting every point load in half skips moment balance.

CLOSE THE BOARD. SHOW YOUR WORKING.

Original practice problems. Answer key on page 3.

02

Recall and apply

PRACTICE 1

A 20 kN point load is at the midpoint of an 8 m simply supported beam. What is R_B? Ignore beam weight.

A. 5 kN up
B. 10 kN up
C. 15 kN up
D. 20 kN up

PRACTICE 2

A 15 kN load is 1 m from A on a 5 m simply supported beam. What is R_A? Ignore beam weight.

A. 3 kN up
B. 7.5 kN up
C. 12 kN up
D. 15 kN up

PRACTICE 3

For the worked 12 kN example, a solution claims A = 6 kN and B = 6 kN. Which check rejects it?

A. Vertical force balance alone
B. Moments about A: 6 × 6 - 12 × 2 = 12 kN·m
C. Horizontal force balance
D. No check; it is correct

Return later

A 16 kN load acts 3 m from A on an 8 m simply supported beam. Ignore beam weight. Find R_A and R_B.

A. A = 8, B = 8 kN up
B. A = 6, B = 10 kN up
C. A = 10, B = 6 kN up
D. A = 16, B = 0 kN up

Write your reasoning before checking page 3.

CHECK THE REASONING, TOO.

PRACTICE 1

10 kN up

Taking moments about A: R_B × 8 = 20 × 4. Therefore R_B = 10 kN upward.

Use the load distance from A, which is 4 m, in the moment equation.

PRACTICE 2

12 kN up

R_B = 15 × 1 / 5 = 3 kN. Vertical force balance gives R_A = 15 - 3 = 12 kN upward.

Moment balance about A finds B first. Then use the force balance to find A.

PRACTICE 3

Moments about A: 6 × 6 - 12 × 2 = 12 kN·m

The reactions add to 12 kN, so vertical forces balance. But the nonzero 12 kN·m moment means rotational equilibrium fails.

A correct sum of vertical forces is necessary but not sufficient for rigid-body equilibrium.

RETURN LATER

A = 10, B = 6 kN up

R_B = 16 × 3 / 8 = 6 kN. R_A = 16 - 6 = 10 kN. About B, -10 × 8 + 16 × 5 = 0.

Solve with moments about A, then verify with moments about B.

Sources and scope

Planar static equilibrium, one vertical point load, pin and roller supports; beam self-weight neglected. A focused statics supplement; this simplified beam model is not structural design guidance.

[F1] OpenStax University Physics: Conditions for Static Equilibrium · https://openstax.org/books/university-physics-volume-1/pages/12-1-conditions-for-static-equilibrium · Checked 2026-09-09

[F2] OpenStax University Physics: Examples of Static Equilibrium · https://openstax.org/books/university-physics-volume-1/pages/12-2-examples-of-static-equilibrium · Checked 2026-09-09

[F3] NCEES FE Civil specification, effective July 2020 · https://ncees.org/wp-content/uploads/2022/09/FE-Civil-CBT-specs-1.pdf · Checked 2026-09-09