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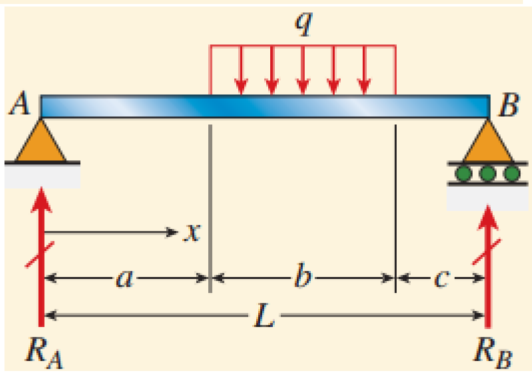
MOCK TEST: SHEAR FORCE AND BENDING MOMENT DIAGRAM

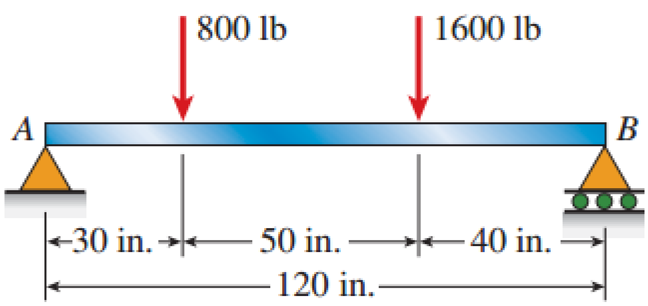
(1)

Draw the shear-force and bending-moment diagrams for a simple beam with a uniform load of intensity q acting over part of the span (



(2)

Calculate the shear force V and bending moment M at a cross section just to the left of the 1600-1b load acting on the simple beam AB shown in the figure.



(3)

For a loaded cantilever beam of uniform cross-section, the bending moment (in N·mm) along the length is $M(x) = 5x^2 + 10x$, where x is the distance (in mm) measured from the free end of the beam. The magnitude of shear force (in N) in the cross-section at $x = 10$ mm is__________

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(4)

A cantilever beam of length L and flexural modulus EI is subjected to a point load P at the free end. The elastic strain energy stored in the beam due to bending (neglecting transverse shear) is

(A) $\frac{P^2L^3}{6EI}$ (B) $\frac{P^2L^3}{3EI}$ (C) $\frac{PL^3}{3EI}$ (D) $\frac{PL^3}{6EI}$

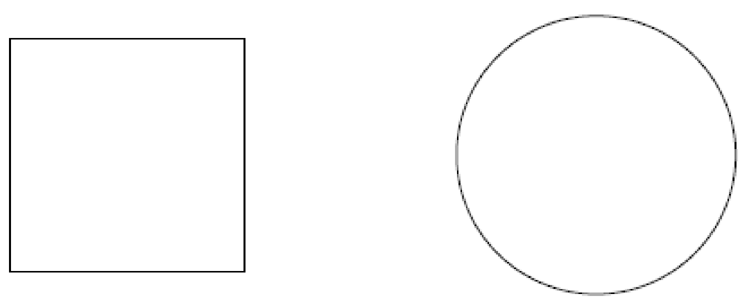
(5)

Consider a beam with circular cross-section of diameter d. The ratio of the second moment of area about the neutral axis to the section modulus of the area is

(A) $\frac{d}{2}$ (B) $\frac{\pi d}{2}$ (C) d (D) πd

(6)

The cross-sections of two solid bars made of the same material are shown in the figure. The square cross-section has flexural (bending) rigidity I_1, while the circular cross-section has flexural rigidity I_2. Both sections have the same cross-sectional area. The ratio I_1/I_2 is



(A) $1/\pi$ (B) $2/\pi$ (C) $\pi/3$ (D) $\pi/6$

(7)

A cantilever beam having square cross-section of side a is subjected to an end load. If a is increased by 19%, the tip deflection decreases approximately by

(A) 19% (B) 29% (C) 41% (D) 50%

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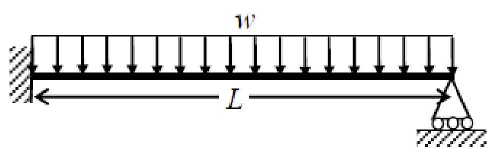
(8)

A beam of length L is carrying a uniformly distributed load w per unit length. The flexural rigidity of the beam is EI. The reaction at the simple support at the right end is



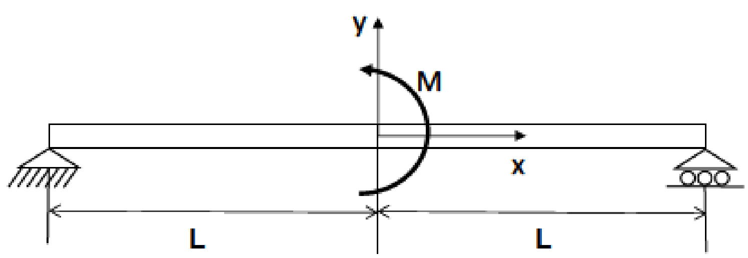
(A) $\frac{wL}{2}$ (B) $\frac{3wL}{8}$ (C) $\frac{wL}{4}$ (D) $\frac{wL}{8}$

(9)

A simply supported beam of length $2L$ is subjected to a moment M at the mid-point $x = 0$ as shown in the figure. The deflection in the domain $0 \leq x \leq L$ is given by

$$w = \frac{-Mx}{12\,EIL}(L - x)(x + c),$$

where E is the Young's modulus, I is the area moment of inertia and c is a constant (to be determined) .

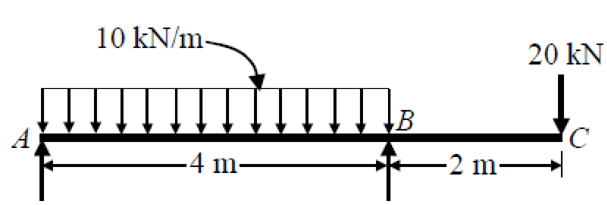


The slope at the center $x = 0$ is

(A) $ML/(2EI)$ (B) $ML/(3EI)$ (C) $ML/(6EI)$ (D) $ML/(12EI)$

(10)

For the overhanging beam shown in figure, the magnitude of maximum bending moment (in kN-m) is _________



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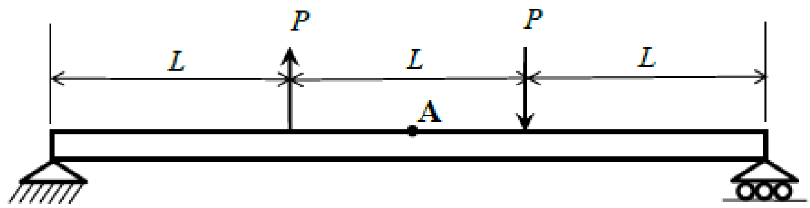
(11)

A simply-supported beam of length $3L$ is subjected to the loading shown in the figure.

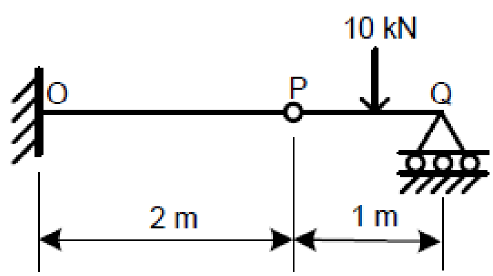


It is given that $P = 1$ N, $L = 1$ m and Young's modulus $E = 200$ GPa. The cross-section is a square with dimension 10 mm × 10 mm. The bending stress (in Pa) at the point **A** located at the top surface of the beam at a distance of $1.5L$ from the left end is ______________

(Indicate compressive stress by a negative sign and tensile stress by a positive sign.)

(12)

A cantilever beam OP is connected to another beam PQ with a pin joint as shown in the figure. A load of 10 kN is applied at the mid-point of PQ. The magnitude of bending moment (in kN-m) at fixed end O is



(A) 2.5 (B) 5 (C) 10 (D) 25

(13)

Consider a simply supported beam of length, $50h$, with a rectangular cross-section of depth, h, and width, $2h$. The beam carries a vertical point load, P, at its mid-point. The ratio of the maximum shear stress to the maximum bending stress in the beam is

(A) 0.02 (B) 0.10 (C) 0.05 (D) 0.01

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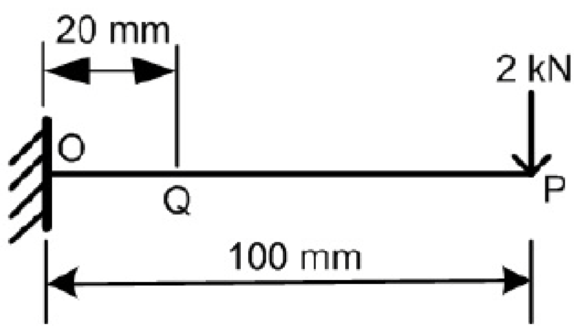
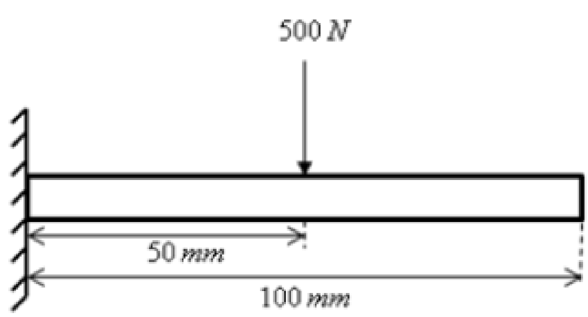
(14)

A cantilever beam with square cross-section of 6 mm side is subjected to a load of 2 kN normal to the top surface as shown in the figure. The Young's modulus of elasticity of the material of the beam is 210 GPa. The magnitude of slope (in radian) at Q (20 mm from the fixed end) is ________



(15)

A cantilever beam with flexural rigidity of 200 N.m^2 is loaded as shown in the figure. The deflection (in mm) at the tip of the beam is _______



(16)

A cantilever beam of length, L, with uniform cross-section and flexural rigidity, EI, is loaded uniformly by a vertical load, w per unit length. The maximum vertical deflection of the beam is given by

(A) $\frac{wL^4}{8EI}$ (B) $\frac{wL^4}{16EI}$ (C) $\frac{wL^4}{4EI}$ (D) $\frac{wL^4}{24EI}$

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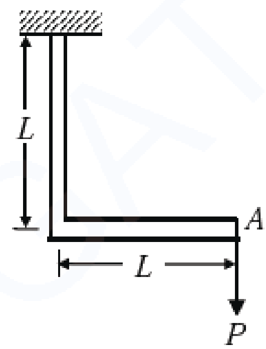
(17)

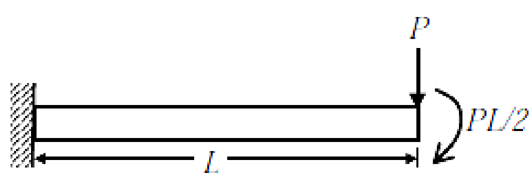
A frame is subjected to a load P as shown in the figure. The frame has a constant flexural rigidity EI. The effect of axial load is neglected. The deflection at point A due to the applied load P is



(A) $\frac{1}{3}\frac{PL^3}{EI}$ (B) $\frac{2}{3}\frac{PL^3}{EI}$ (C) $\frac{PL^3}{EI}$ (D) $\frac{4}{3}\frac{PL^3}{EI}$

(18)

The flexural rigidity (EI) of a cantilever beam is assumed to be constant over the length of the beam shown in figure. If a load P and bending moment $PL/2$ are applied at the free end of the beam then the value of the slope at the free end is



(A) $\frac{1}{2}\frac{PL^2}{EI}$ (B) $\frac{PL^2}{EI}$ (C) $\frac{3}{2}\frac{PL^2}{EI}$ (D) $\frac{5}{2}\frac{PL^2}{EI}$

(19)

A simply supported beam of length L is subjected to a varying distributed load $\sin(3\pi x/L)\ Nm^{-1}$, where the distance x is measured from the left support. The magnitude of the vertical reaction force in N at the left support is

(A) zero (B) $L/3\pi$ (C) L/π (D) $2L/\pi$

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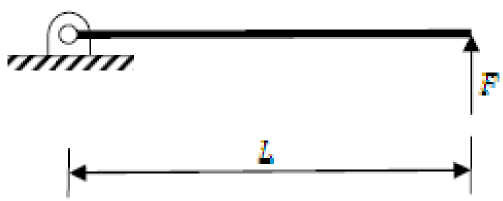
(20)

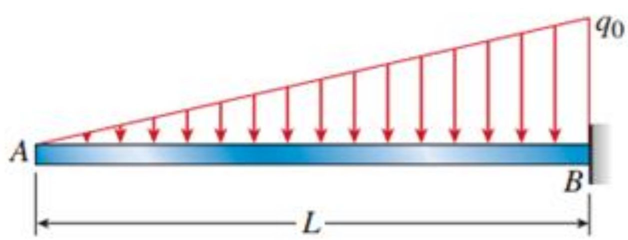
A pin jointed uniform rigid rod of weight W and length L is supported horizontally by an external force F as shown in the figure below. The force F is suddenly removed. At the instant of force removal, the magnitude of vertical reaction developed at the support is



(A) zero (B) $W/4$ (C) $W/2$ (D) W

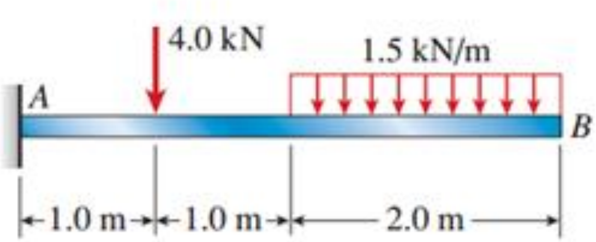
(21)

Draw the shear-force and bending-moment diagrams for a cantilever beam AB supporting a linearly varying load of maximum intensity q_0 (see figure).



(22)

Calculate the shear force V and bending moment M at a cross section located 0.5 m from the fixed support of the cantilever beam AB shown in the figure.



(23)

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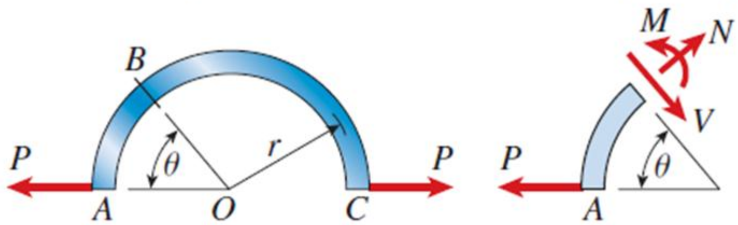
A curved bar *ABC* is subjected to loads in the form of two equal and opposite forces *P*, as shown in the figure. The axis of the bar forms a semicircle of radius *r*.

Determine the axial force *N*, shear force *V*, and bending moment *M* acting at a cross section defined by the angle θ.



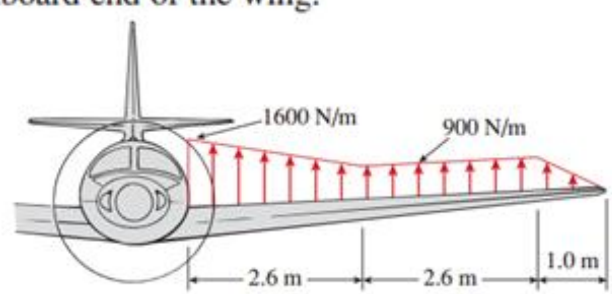
(24)

A beam of length *l* uniformly supported along its entire length carries at the ends two equal loads *P*, Fig. 70. Draw the shearing force and bending moment diagrams.

(25)

Under cruising conditions the distributed load acting on the wing of a small airplane has the idealized variation shown in the figure.

Calculate the shear force *V* and bending moment *M* at the inboard end of the wing.



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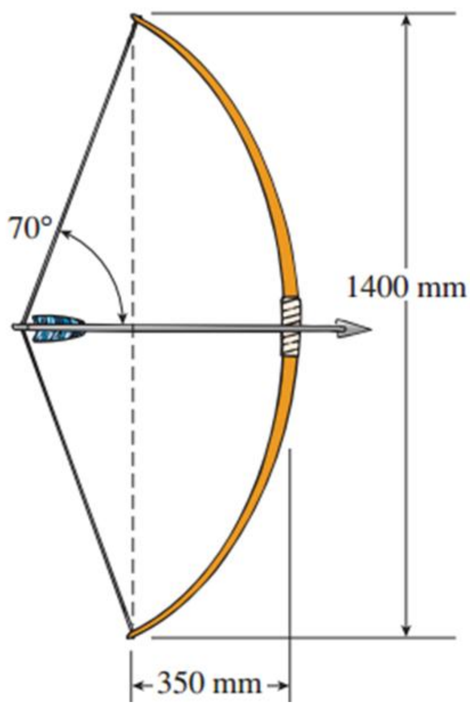
(26)

At full draw, an archer applies a pull of 130 N to the bowstring of the bow shown in the figure. Determine the bending moment at the midpoint of the bow.



(27)

A beam with two equal overhangs, Fig. 75, loaded by a uniformly distributed load, has a length l. Find the distance d between the supports such that the bending moment at the middle of the beam is numerically equal to the moments at the supports. Draw the shearing force and bending moment diagrams for this case.

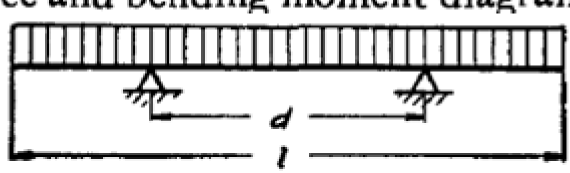


FIG. 75.

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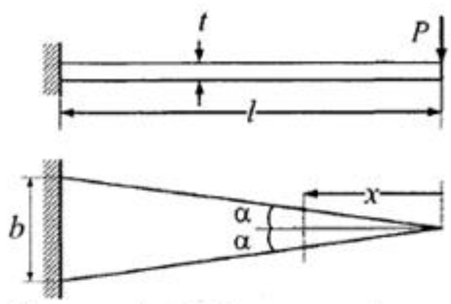
(28)

A cantilever beam of length L is subjected to a moment M at the free end. The moment of inertia of the beam cross section about the neutral axis is I and the Young's modulus is E. The magnitude of the maximum deflection is

(A) $\frac{ML^2}{2EI}$ (B) $\frac{ML^2}{EI}$ (C) $\frac{2ML^2}{EI}$ (D) $\frac{4ML^2}{EI}$

(29)

A triangular-shaped cantilever beam of uniform-thickness is shown in the figure. The Young's modulus of the material of the beam is E. A concentrated load P is applied at the free end of the beam.



The area moment of inertia about the neutral axis of a cross-section at a distance x measured from the free end is

(A) $\frac{bxt^3}{6l}$ (B) $\frac{bxt^3}{12l}$ (C) $\frac{bxt^3}{24l}$ (D) $\frac{xt^3}{12}$

The maximum deflection of the beam is

(A) $\frac{24Pl^3}{Ebt^3}$ (B) $\frac{12Pl^3}{Ebt^3}$ (C) $\frac{8Pl^3}{Ebt^3}$ (D) $\frac{6Pl^3}{Ebt^3}$

(30)

A cantilever beam AB supports a couple and a concentrated load, as shown in the figure. Draw the shear-force and bending-moment diagrams for this beam.