Answers to MEEG 2003 Sample Test Id

1.

(a) \( \mathbf{M}_A = 210 \mathbf{i} + 180 \mathbf{j} + 60 \mathbf{k} \) N·m

(b) \( M_{AB} = 40 \) N·m

(c) Since \( M_{AB} > 0 \), the action of \( \mathbf{F} \) tends to loosen the joint at \( A \).

(d) \( d_{11} = 4.72 \) m

(e) \( d_{s2} = 1.061 \) m

2.

(a) \( L = 21.6 \) in.

(b) \( P = 176 \) lb

3.

A. (e)

B. (c)

C. (f)

D. (g)

4.

A. (a) In terms of pound-mass (lbm), 1 lb is defined to be the weight of 1 lbm, where the gravitational acceleration is 9.80665 m/s\(^2\); i.e., 1 lb = 1 lbm (9.80665 m/s\(^2\)). (b) In terms of kilogram, 1 lbm = 0.45359237 kg.

B. Newton’s third law states that every action is matched by a reaction, and action and reaction are collinear, opposite in direction, and equal in magnitude.

C. (You need to draw a sketch.) In the formula \( \mathbf{M}_P = \vec{r} \times \mathbf{F} \) for computing the moment \( \mathbf{M}_P \) about point \( P \), the vector \( \vec{r} \) is a displacement vector from the moment center \( P \) to any (convenient) point (e.g., point \( A \)) on the line of action of \( \mathbf{F} \).

D. (You need to draw a sketch.) In the formula \( M_{BC} = \lambda_{BC} \cdot (\vec{r} \times \mathbf{F}) \) for computing the moment \( M_{BC} \) about axis \( BC \) of a force \( \mathbf{F} \) acting at point \( A \), the vector \( \lambda_{BC} \) is a unit vector pointing from point \( B \) toward point \( C \) on the axis \( BC \), while the vector \( \vec{r} \) is a displacement vector from any (convenient) point (e.g., point \( B \)) on the axis \( BC \) to any (convenient) point (e.g., point \( A \)) on the line of action of \( \mathbf{F} \).