

Statics and Strength of Materials for Architecture and Building Construction (13rd Edition)

Step-by-step solution

Step 1 of 14

Draw the free body diagram of the member AE.

[Comment](#)

Step 2 of 14

Calculate the angle made by the member FD with the horizontal.

$$\tan \theta = \frac{3}{4}$$
$$\theta = \tan^{-1}\left(\frac{3}{4}\right)$$
$$\theta = 36.87^\circ$$

[Comment](#)

Step 3 of 14

Take moments about A.

$$\sum M_A = 0$$
$$-(2)(16) - (8)(32) + (F_{FD} \cos \theta)(4) + (F_{FD} \sin \theta)(20) = 0$$
$$(F_{FD} \cos 36.87^\circ)(4) + (F_{FD} \sin 36.87^\circ)(20) = 32 + 256$$
$$3.207 F_{FD} + 12 F_{FD} = 288$$
$$F_{FD} = \frac{288}{15.2}$$
$$= 18.95 \text{ k}$$

[Comment](#)

Step 4 of 14

Consider the horizontal equilibrium of the free body diagram.

$$\sum F_x = 0$$
$$A_x - F_{FD} \cos \theta = 0$$
$$A_x = 18.95 \cos 36.87^\circ$$
$$A_x = 15.16 \text{ k}$$

Hence, the horizontal reaction at A is $15.16 \text{ k} (\rightarrow)$.

[Comment](#)

Step 5 of 14

Consider the vertical equilibrium the free body diagram.

$$\sum F_y = 0$$
$$A_y - 2 - 8 + F_{FD} \sin \theta = 0$$

Substitute 18.95 for F_{FD} , and 36.87° for θ .

$$A_y = 2 + 8 - 18.95 \sin 36.87^\circ$$
$$= 10 - 11.37$$
$$= -1.37 \text{ k}$$

Hence, the vertical reaction at A is $1.37 \text{ k} (\downarrow)$.

[Comment](#)

Step 6 of 14

Draw the free body diagram of the particle at D.

[Comment](#)

Step 7 of 14

Determine the angle made by the member CD with the horizontal.

$$\tan \alpha = \frac{1}{3}$$
$$\alpha = \tan^{-1}\left(\frac{1}{3}\right)$$
$$\alpha = 18.43^\circ$$
$$\tan \beta = \frac{3}{15}$$
$$\beta = \tan^{-1}\left(\frac{3}{15}\right)$$
$$\beta = 11.31^\circ$$

[Comment](#)

Step 8 of 14

Consider the horizontal equilibrium of the free body diagram.

$$\sum F_x = 0$$
$$-F_{CD} \cos \alpha - F_{BD} \sin \beta + F_{FD} \cos \theta = 0$$
$$F_{CD} \cos 18.43^\circ + F_{BD} \sin 11.31^\circ = 18.95 \cos 36.87^\circ$$
$$0.949 F_{CD} = 15.16 - 0.196 F_{BD}$$
$$F_{CD} = 15.96 - 0.206 F_{BD} \dots\dots (1)$$

[Comment](#)

Step 9 of 14

Consider the vertical equilibrium the free body diagram.

$$\sum F_y = 0$$
$$-F_{CD} \sin \alpha - F_{BD} \cos \beta - F_{FD} \sin \theta = 0$$
$$(15.96 - 0.206 F_{BD}) \sin 18.43^\circ + F_{BD} \cos 11.31^\circ = -18.95 \sin 36.87^\circ$$
$$5.045 - 0.06512 F_{BD} + 0.981 F_{BD} = -11.37$$
$$0.916 F_{BD} = -16.42$$
$$F_{BD} = \frac{-16.42}{0.916}$$
$$= -17.92 \text{ k}$$

Hence, the force in the member BD is $17.92 \text{ k} (C)$.

[Comment](#)

Step 10 of 14

Determine the force in the member CD.

Substitute -17.92 k for F_{BD} in the equation (1).

$$F_{CD} = 15.96 - 0.206(-17.92)$$
$$= 15.96 + 3.691$$
$$= 19.65 \text{ k}$$

Therefore, the tension in the cable CD is 19.65 k .

[Comment](#)

Step 11 of 14

Determine the reactions at support B.

Consider the vertical equilibrium of the support B.

$$\sum F_y = 0$$
$$B_y + F_{BD} \sin(78.69) = 0$$
$$= -17.92 \sin(78.69)$$
$$B_y = 17.57 \text{ k} (\downarrow)$$

Hence, the vertical reaction at B is $17.57 \text{ k} (\downarrow)$.

[Comment](#)

Step 12 of 14

Consider the horizontal equilibrium of the support B.

$$\sum F_x = 0$$
$$B_x + F_{BD} \cos(78.69) = 0$$
$$B_x = -17.92 \cos(78.69)$$
$$B_x = 3.514 \text{ k} (\leftarrow)$$

Hence, the horizontal reaction at B is $3.514 \text{ k} (\rightarrow)$.

[Comment](#)

Step 13 of 14

Determine the reactions at support C.

Consider the vertical equilibrium of the support C.

$$\sum F_y = 0$$
$$C_y + F_{CD} \sin(18.43) = 0$$
$$= -19.65 \sin(18.43)$$
$$C_y = 6.21 \text{ k} (\uparrow)$$

Hence, the vertical reaction at C is $6.21 \text{ k} (\uparrow)$.

[Comment](#)

Step 14 of 14

Consider the horizontal equilibrium of the support C.

$$\sum F_x = 0$$
$$C_x + F_{CD} \cos(18.43) = 0$$
$$= -19.65 \cos(18.43)$$
$$C_x = 18.64 \text{ k} (\leftarrow)$$

Hence, the horizontal reaction at B is $18.64 \text{ k} (\leftarrow)$.

[Comment](#)

Post a question

Answers from our experts for your tough homework questions

Enter question

Continue to post

13 questions remaining

My Textbook Solutions

Solutions

Statics and Strength of...
3rd Edition

View all solutions

Solutions

Fundamentals of...
5th Edition

View all solutions

Solutions

Mechanical Vibrations
1st Edition

View all solutions

Chegg tutors who can help right now

Ryan
University of South...
457

Mohit
AIET
355

Maria
MSU-IT
1432

Find me a tutor

feedback

Recommended solutions for you in Chapter 2

Chapter 2, Solution 61SP

Draw the free body diagram of the bridge as follows:

[See solution](#)

Chapter 2, Solution 38P

Free body diagram of the truss:

[See solution](#)

1 kN

ABOUT CHEGG

Become a Tutor
Chegg For Good
College Marketing
Corporate Development
Investor Relations
Jobs
Join Our Affiliate Program
Media Center
Site Map

LEGAL

Advertising Choices
Cookie Notice
General Policies
Intellectual Property Rights
International Privacy Policy
Terms of Use
Chegg Study Terms of Service
US Privacy Policy
Your CA Privacy Rights

CHEGG PRODUCTS AND SERVICES

Cheap Textbooks
Chegg Coupon
Chegg Play
Chegg Study Help
College Textbooks
eTextbooks
Chegg Math Solver
Mobile Apps
Online Tutoring
Sell Textbooks
Solutions Manual
Study 101
Test Prep
Textbook Rental
Used Textbooks
Digital Access Codes

CHEGG NETWORK

CareerMatch
Easybib
Internships.com
Studyblue

CUSTOMER SERVICE

Customer Service
Give Us Feedback
Help with Chegg Tutors
Help to use EasyBib Plus
Manage Chegg Study Subscription
Return Your Books
Textbook Return Policy



© 2003-2018 Chegg Inc. All rights reserved.

