Engineering Mechanics I MCQ

Author: Stephanie Redfern

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Table of Contents

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1. Mechanics I MCQ
- Unit 03: Bending, Yield, Fracture, Buckling and Creep
- Unit 02: Material Mechanics and Analysis of Solid Objects
- Unit 01: Statics

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4. Chapter: Unit 03: Bending, Yield, Fracture, Buckling and Creep

1. Unit 03: Bending, Yield, Fracture, Buckling and Creep Questions

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4.1.1. Which of the following assumptions are necessary in order for the b...

Author: Stephanie Redfern

Which of the following assumptions are necessary in order for the beam deflection equation to be well represented by d[sup]4[/sup]w(x)/dx[sup]4[/sup] EI = q(x)?

I. Constant E

II. Continuously distributed loads only

III. Constant I

Please choose only one answer:

- I only
- II only
- Both II and III
- Both I and II
- I, II, and III

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4.1.2. How do beams differ from truss elements?

Author: Stephanie Redfern

How do beams differ from truss elements?

Please choose only one answer:

- Beams are wider and stiffer than truss elements.
- Beams are solid, but truss elements usually have void spaces for weight concerns.
- Beams have more complex cross sections than truss elements.
- Truss elements are usually pin connected and carry only axial loads, but beams may have connections like welds that impart transverse loads.
- Truss elements are subject to bending forces, but beams are not.

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4.1.3. For a cantilevered beam with a downward load L at the free end, whi...

Author: Stephanie Redfern

For a cantilevered beam with a downward load L at the free end, which of the following statements is true? I. The shearing force is constant over the length of the beam. II. The magnitude of the bending moment increases linearly from the fixed end to the free end. III. The magnitude of the shearing force increases linearly from the free end to the fixed end. IV. The beam bends so that it is concave up.

Please choose only one answer:

- II, III, and IV
- Both III and IV
- Both II and III
- I only
- Both I and II

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4.1.4. Which of the following correctly represents Euler's expression for ...

Author: Stephanie Redfern

Which of the following correctly represents Euler's expression for the critical loading force at which bending begins for a long column? Here, E is Young's modulus, L[sub]eff[/sub] is a measure of column length, A is the cross-sectional area of the column, and I is the area moment of inertia.

Please choose only one answer:

- $$F_{cr} = EI \pi^2/L^2_{eff}$$
- $$F_{cr} = EI \pi^3/L^2_{eff}$$
- $$F_{cr} = EI /L^2_{eff}$$
- $$F_{cr} = EI \pi^2/L^3_{eff}$$
- $$F_{cr} = EI \pi^2/L_{eff}$$

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4.1.5. How does creep differ from fatigue?

Author: Stephanie Redfern

How does creep differ from fatigue?

Please choose only one answer:

- Creep refers to slow deformation resulting in change in macroscopic shape; fatigue refers to the weakening of material over time caused by repeated use or loading.
- They do not differ.
- Creep refers to the overall weakening of a material through pressure; fatigue refers to the weakening that occurs at susceptible stress points.
- Creep is temperature dependent; fatigue is not.
- Creep is more significant for very large pieces than fatigue; fatigue is more important for small pieces that fail as a result of small-crack propagation.

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4.1.6. Which number of cycles conventionally lies between low-cycle and hi...

Author: Stephanie Redfern

Which number of cycles conventionally lies between low-cycle and high-cycle fatigue?

Please choose only one answer:

- 10
- 1000
- 200,000
- 20,000,000
- 1,000,000,000

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4.1.7. Which of the following correctly describes the deflection of a beam...

Author: Stephanie Redfern

Which of the following correctly describes the deflection of a beam of length L, Young's modulus E, area moment of inertia I subjected to a point load P at the center point of the beam?

Please choose only one answer:

- PL^{3}/(48 EI)
- PL^{2}/(48 EI)
- PL^{3}/(48 EI^{2})
- PL^{3}/(48 E^{2}I)
- PL^{3}/(8 EI)

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4.1.8. Which of the following best describes the process of fatigue for en...

Author: Stephanie Redfern

Which of the following best describes the process of fatigue for engineering materials?

Please choose only one answer:

- Fatigue is material corrosion that prevents further use.
- Fatigue is the failure or weakening of material caused by repeated or continued stress or loading
- Fatigue is the natural aging of material that leads to failure.
- Fatigue is the weakening of engineering materials caused by thermal cycling and the resulting molecular rearrangements that occur.
- Fatigue is the temporary weakening of materials resulting from continued use; materials may recover strength if random molecular rearrangements are allowed to occur during a period of disuse.

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4.1.9. Which of the following statements best describes finite element ana...

Author: Stephanie Redfern

Which of the following statements best describes finite element analysis?

Please choose only one answer:

- It is a numerical method for inverting a matrix or tensor.
- It is a computational technique for solving for stress as a function of strain.
- It is a modeling technique limited to a finite number of engineering pieces.
- It is a useful numerical method limited to linear differential equations.
- It is a numerical method for approximating solutions to differential and other equations.

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4.1.10. Why did full-scale engineering-material specimens fracture at lower...

Author: Stephanie Redfern

Why did full-scale engineering-material specimens fracture at lower loads than expected in early metal airplanes (see specifically the Comet 1)? I. The effects of cyclic fatigue were not appreciated for airplane pressurization/depressurization. II. The effects of stress concentration at the corners of square windows were not appreciated. III. The effects of defect presence and growth were not appreciated for large structures

Please choose only one answer:

- I only
- Both II and III
- I, II, and III
- Both II and III
- Both I and III

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4.1.11. Which of the following is a correct definition of Poisson's ratio?

Author: Stephanie Redfern

Which of the following is a correct definition of Poisson's ratio?

Please choose only one answer:

- It is the ratio of transverse strain to normal strain, resulting from normal stress.
- It is the ratio of specimen volume upon compression with a known stress to that without compression.
- It is the ratio of the rebound length of a material specimen after temporary extension to its initial length.
- It is the ratio of shear stress to normal stress.
- It is the ratio of shear strain to normal strain.

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4.1.12. Which of the following are well-established experimental tools for ...

Author: Stephanie Redfern

Which of the following are well-established experimental tools for determining localized strains in engineering pieces? I. Localized electrical resistance measurements in strain gauges II. Optical methods based on photoelasticity III. Ultrasonic displacement mapping IV. X-ray or computed tomography

Please choose only one answer:

- II only
- Both II and III
- Both I and IV
- Both I and II
- I, II, III, and IV

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4. Chapter: Unit 02: Material Mechanics and Analysis of Solid Objects

1. Unit 02: Material Mechanics and Analysis of Solid Objects Questions

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4.1.1. Which of the following represents the area moment of inertia of a t...

Author: Stephanie Redfern

Which of the following represents the area moment of inertia of a thin, rectangular body about an axis through the center of the body and parallel to the long dimension of the rectangle? The long dimension of the rectangle is 10 cm and the short dimension is 5 cm.

Please choose only one answer:

- 1.0 x 10 [sup] -6 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] 2 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] -4 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] -6 [/sup] m [sup] 2 [/sup]
- 2.0 x 10 [sup] -5 [/sup] m [sup] 4 [/sup]

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4.1.2. Which of the following best describes the role of constitutive equa...

Author: Stephanie Redfern

Which of the following best describes the role of constitutive equations or relations in the calculation of mechanical behavior?

Please choose only one answer:

- Constitutive relations describe laminate mechanics.
- Constitutive equations allow calculation of material density as a function of external loads.
- Constitutive relations permit calculation of shear strains from normal stresses.
- Constitutive equations permit the calculation of dynamic behavior from molecular properties.
- Constitutive equations relate material stresses to material strains.

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4.1.3. Which of the following statements best describes the difference bet...

Author: Stephanie Redfern

Which of the following statements best describes the difference between elastic and plastic deformation?

Please choose only one answer:

- Elastic deformation causes strain oscillations; plastic deformation does not.
- Elastic deformation occurs immediately upon application of a stress and reverses upon removal of the stress; plastic deformation is permanent.
- Elastic deformation occurs immediately upon application of a stress; plastic deformation occurs slowly.
- Plastic deformation occurs immediately upon application of a stress and reverses upon removal of the stress; elastic deformation is permanent.
- Elastic deformation results in dissipation of energy as heat; plastic deformation conserves energy.

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4.1.4. Which of the following statements is true for a two-dimensional sta...

Author: Stephanie Redfern

Which of the following statements is true for a two-dimensional statically determinate truss?

I. There are at most two unknown forces at a pin joint.

II. The forces in the truss are independent of material properties.

III. Joint displacements need not be considered to calculate the internal forces.

Please choose only one answer:

- Both I and II
- II only
- I, II, and III
- Both II and III
- Both I and III

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4.1.5. Which of the properties below may be deduced from tensile tests?

Author: Stephanie Redfern

Which of the properties below may be deduced from tensile tests?

Please choose only one answer:

- Hardness
- Ultimate strength
- Viscosity
- Density
- Rebound index

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4.1.6. Which of the following are the correct units for Young's modulus?

Author: Stephanie Redfern

Which of the following are the correct units for Young's modulus?

Please choose only one answer:

- Pa
- psi
- force per area
- A and B
- A, B, and C

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4.1.7. Which of the following best describes the use of Mohr's circle?

Author: Stephanie Redfern

Which of the following best describes the use of Mohr's circle?

Please choose only one answer:

- It is a graphical representation of hardness indices for engineering materials.
- It is a graphical method for remembering how stresses and strains transform from one coordinate system to another by matrix or tensor operations.
- It is a graphical method for diagonalizing the stress tensor.
- Mohr's circle is a way of enforcing continuity of stresses and strains in numerical computations.
- Mohr's circle shows the time dependence of hardness as a result of fatigue.

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4.1.8. Which of the following formulas correctly describes the area and ma...

Author: Stephanie Redfern

Which of the following formulas correctly describes the area and mass moments of inertia respectively? In the equations below, m represents mass, A represents area, and r represents the distance from the point about which the moment is calculated.

Please choose only one answer:

- $$I_A= \int_Ar^2 dA, \quad I_m= \int_m r^2 dm$$
- $$I_A= \int_Ar^1 dA, \quad I_m= \int_mr^ 1 dm$$
- $$I_A= \int_Ar^3 dA, \quad I_m= \int_mr^3 dm$$
- $$I_A= \int_Ar^2 dm dA, \quad I_m= \int_mr^2 dA dm$$
- $$I_A= \int_Ar^3 dm dA, \quad I_m= \int_m^3 dA dm$$

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4.1.9. Consider a spherical pressure vessel of diameter 100 cm and wall th...

Author: Stephanie Redfern

Consider a spherical pressure vessel of diameter 100 cm and wall thickness 0.5 cm. If the internal pressure (gauge) is 7 atm, then which of the following represents the tensile stress in the spherical wall?

Please choose only one answer:

- 35.5 MPa
- 35.5 kPa
- 71 MPa
- 71 x 10 [sup]5[/sup] Pa
- 71 GPa

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4.1.10. Which of the following best describes the difference between stiffn...

Author: Stephanie Redfern

Which of the following best describes the difference between stiffness and strength in engineering usage?

Please choose only one answer:

- Strength refers to resistance to bending, and stiffness refers to resistance to compression.
- Strength refers to resistance to elongation, and stiffness refers to resistance to bending.
- Strength refers to the load required for material failure, and stiffness refers to the load required to produce a set deformation.
- Stiffness refers to resistance to shear, and strength refers to the load required to produce a set compression.
- Stiffness refers to the elastic response of a material, and strength refers to the plastic deformation of a material.

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4.1.11. The term stress concentration refers to which of the following?

Author: Stephanie Redfern

The term stress concentration refers to which of the following?

Please choose only one answer:

- Stress per unit area
- Stress per unit volume
- Local stress elevation caused by local geometrical features or defects
- Stress focusing from careful location of external loads
- Crack propagation due to applied stress

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4.1.12. A cylindrical body of length body of length 5 cm and diameter 1 cm ...

Author: Stephanie Redfern

A cylindrical body of length body of length 5 cm and diameter 1 cm is subject to a tension force of 1000 N. The cylinder extends by 3 mm in length. If the body behaves elastically, which of the following represents Youngs modulus for that material?

Please choose only one answer:

- 212 MPa
- 848 MPa
- 848 kPa
- 212 KPa
- 424 kPa

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Question: A cylindrical body of length body of length Stephanie @The Saylor

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4.1.13. Which of the following statements best describes the difference bet...

Author: Stephanie Redfern

Which of the following statements best describes the difference between normal and shear stresses?

I. Normal stresses are more common than shear stresses.

II. Normal stresses may result in elongation or compression.

III. Shear stresses may cause a change in shape or sliding motions.

IV. Normal and shear stresses may have different units.

Please choose only one answer:

- Both I and IV
- Both II and IV
- III only
- Both II and III
- I only

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Question: Which of the following statements best Stephanie Redfern Saylor Mechanics

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4.1.14. Which relationship below correctly defines Young's modulus for one-...

Author: Stephanie Redfern

Which relationship below correctly defines Young's modulus for one-dimensional deformation?

Please choose only one answer:

- It is the ratio of stress to strain.
- It is the ratio of strain to stress.
- It is the ratio of dimensionless strain to stress.
- It is the ratio of force to area.
- It is the ratio of stress to elongation.

Check the answer of this question online at QuizOver.com:
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4. Chapter: Unit 01: Statics

1. Unit 01: Statics Questions

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4.1.1. The pin-connected truss shown in the figure below is anchored at po...

Author: Stephanie Redfern

The pin-connected truss shown in the figure below is anchored at points F and D. All acute angles in the truss are 45 degrees. For the conditions shown, what is the load in the member BF?

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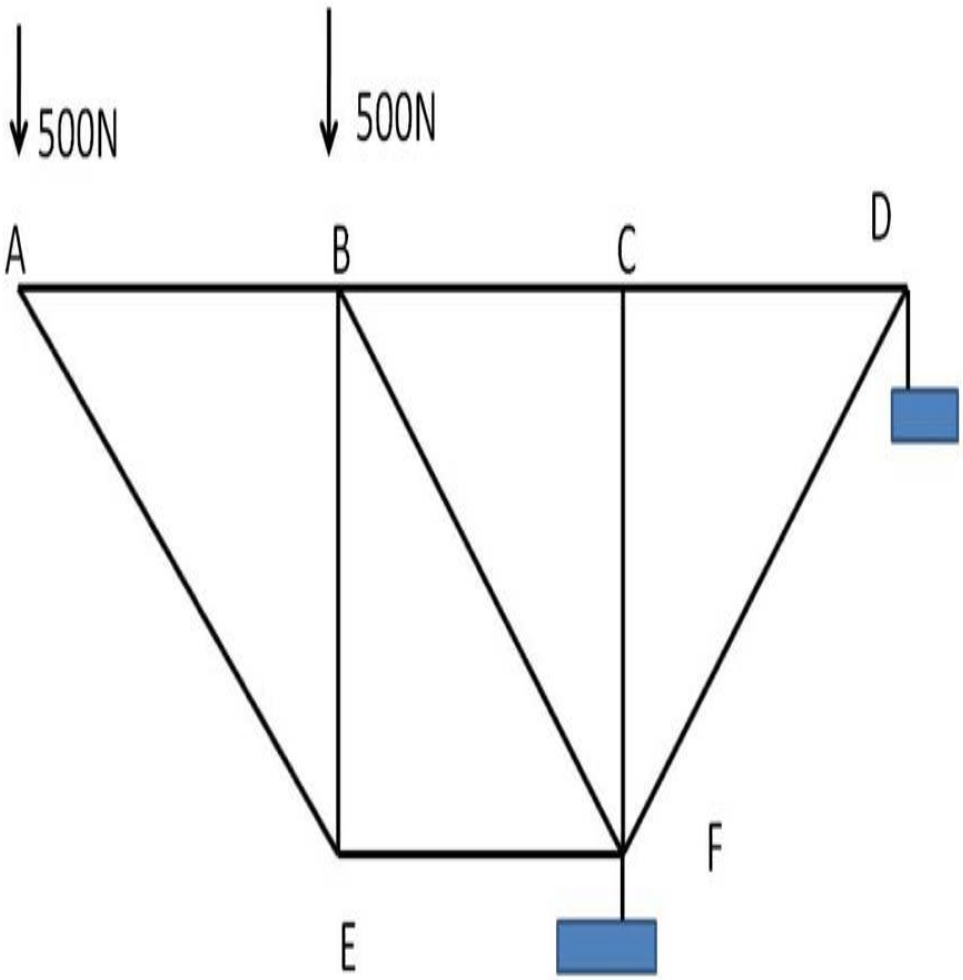

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Please choose only one answer:

- 500 N, tension
- 1000 N, compression
- 1414N, compression
- 1414 N, compression
- 1414 N, tension

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Question: The pin-connected truss shown in the figure Stephanie Saylor Foundat

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4.1.2. Which of the following best describes a couple as used in mechanics?

Author: Stephanie Redfern

Which of the following best describes a couple as used in mechanics?

Please choose only one answer:

- A moment resulting from forces with resultant force acting on the system
- A pair of forces acting in conjunction with no net moment
- A pair of moments that cancel one another
- A pair of forces that produce zero net force and zero net torque
- The reduction of all forces acting on a system to a pair of forces and moments

Check the answer of this question online at QuizOver.com:
Question: Which of the following best describes a Stephanie Redfern Saylor

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4.1.3. Sometimes you may be able to see a brace used in fencing near corne...

Author: Stephanie Redfern

Sometimes you may be able to see a brace used in fencing near corners or in the middle of a long section (like shown in the figure below). In this problem, you will consider only the tension of the fence on one side of the brace. For the conditions shown, what are the forces F1 and F2?

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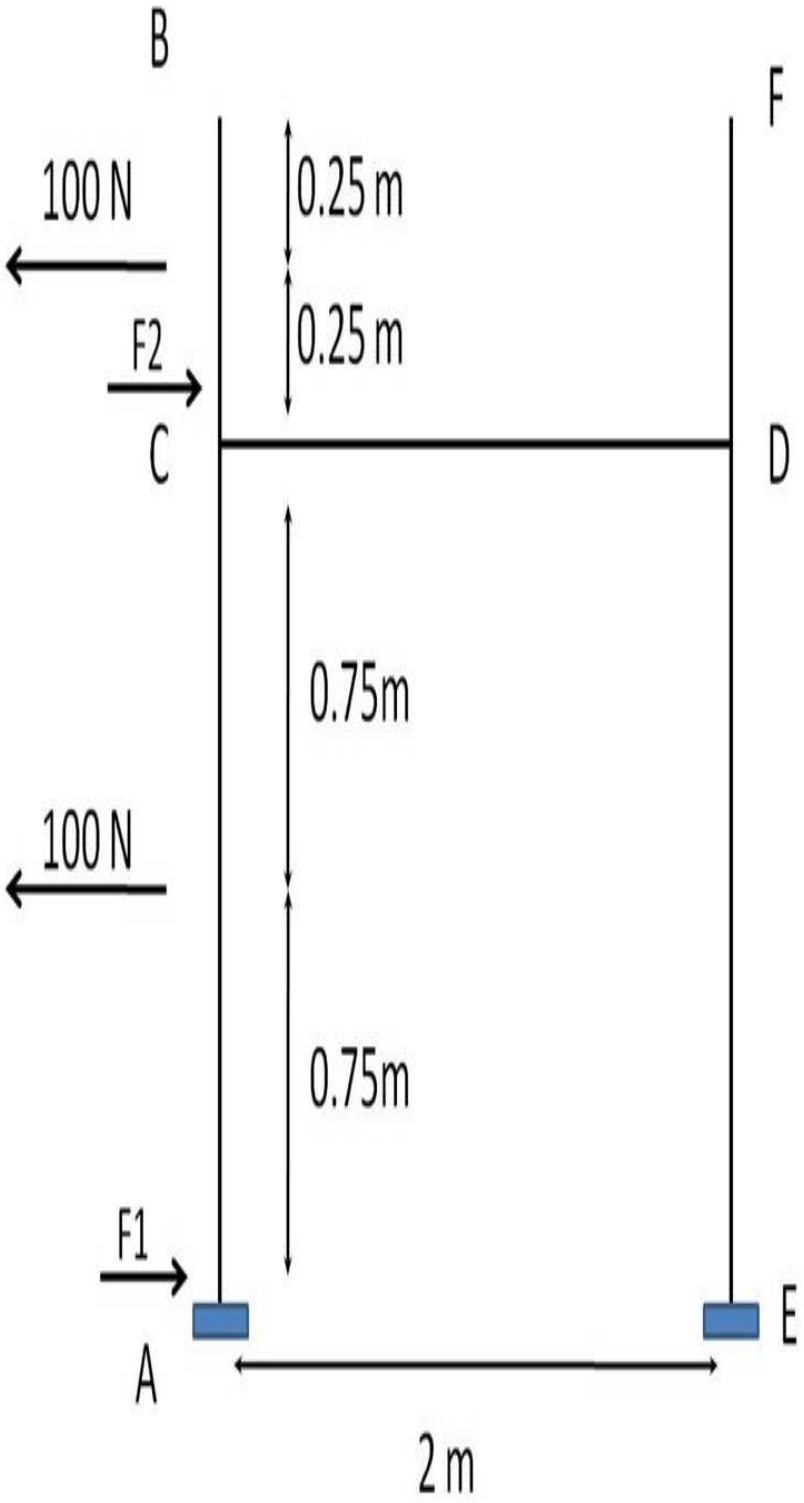

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Please choose only one answer:

- 150N, 50 N
- 33 N, 167 N
- 133N, 67 N
- 50 N, 150 N
- 133 N, 7 N

Check the answer of this question online at QuizOver.com:
Question: Sometimes you may be able to see a brace Stephanie Redfern @The Mechanics

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4.1.4. A weight is hung from two hooks such that the wire forms a isoscele...

Author: Stephanie Redfern

A weight is hung from two hooks such that the wire forms a isosceles triange in which the angle alpha is 75 degrees as depicted in the schematic below.

What is the horizontal component of force exerted on the hook at point B for the load shown?

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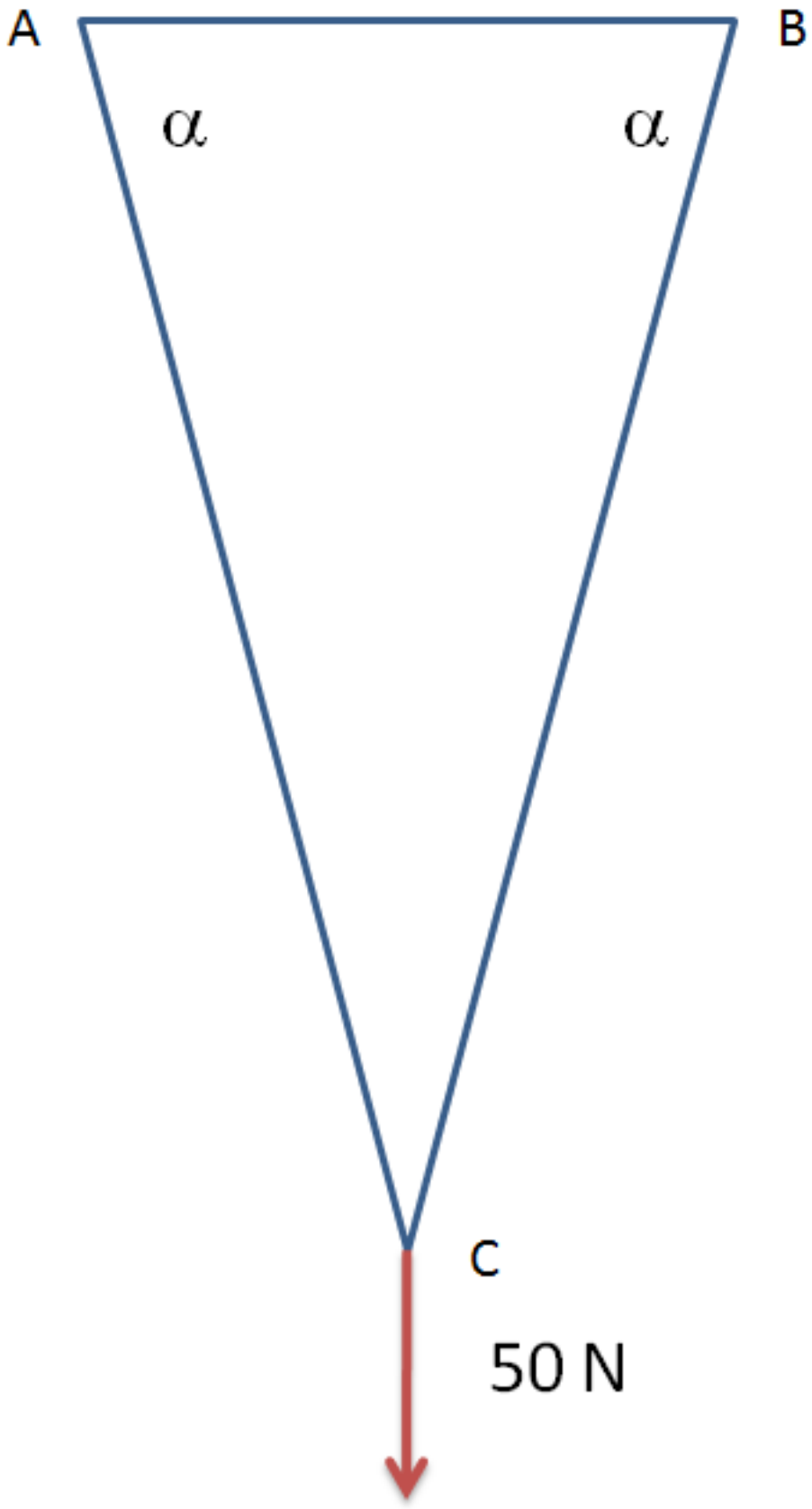

Please choose only one answer:

- 50 N

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- 10 N
- 13 N
- 7 N
- 3 N

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Question: A weight is hung from two hooks such that Stephanie @The Saylor Mechanics

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4.1.5. A weight is hung from two hooks such that the wire forms a isoscele...

Author: Stephanie Redfern

A weight is hung from two hooks such that the wire forms a isosceles triange in which the angle alpha is 75 degrees as depicted in the schematic below.

What is the tension in segment AB for the load shown?

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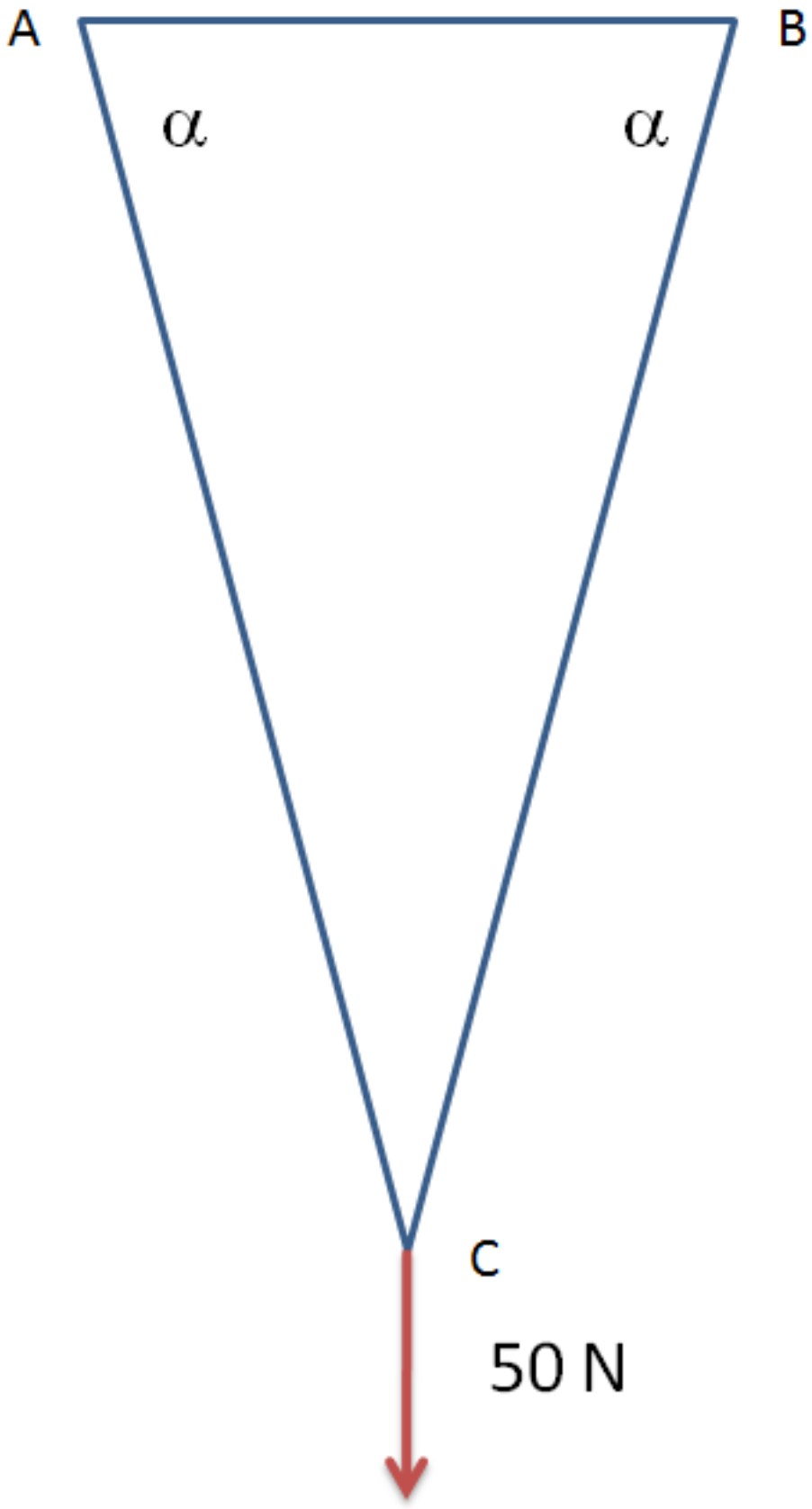

Please choose only one answer:

- 50 N

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- 100 N
- 26 N
- 103 N
- 46 N

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4.1.6. For the vectors A= 4 i + 2 j + 8 k and B = 3i -2 j - 7 k, where i, ...

Author: Stephanie Redfern

For the vectors A= 4 i + 2 j + 8 k and B = 3i -2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following tasks. Calculate ||A|| and ||B||.

Please choose only one answer:

- 7.87, 9.16
- 9.16, 7.87
- 10.82, 9.17
- 84, 61.9
- 61.9, 84

Check the answer of this question online at QuizOver.com:
Question: For the vectors A 4 i 2 j 8 k and B 3i - Stephanie Redfern Saylor

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4.1.7. For the vectors A 4 i + 2 j + 8 k and B= 3i - 2 j - 7 k, where i, j...

Author: Stephanie Redfern

For the vectors A 4 i + 2 j + 8 k and B= 3i - 2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following task. Calculate A • B.

Please choose only one answer:

- 54
- -48
- 48
- 44
- 12

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4.1.8. For the vectors A= 4 i + 2 j + 8 k and B = 3i-2 j - 7 k, where i, j...

Author: Stephanie Redfern

For the vectors A= 4 i + 2 j + 8 k and B = 3i-2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following task. From the formula A · B = cos(q) ||A|| ||B||, calculate q.

Please choose only one answer:

- 2.3 radians
- 84.3 degrees
- 0.843 degrees
- 38.4 degrees
- 3.84 radians

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4.1.9. For the vectors A= 4 i + 2 j + 8 k and B = 3i -2 j - 7 k, where i, ...

Author: Stephanie Redfern

For the vectors A= 4 i + 2 j + 8 k and B = 3i -2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following task. Calculate A x B.

Please choose only one answer:

- -14 k + 52 j+ 2i
- -14 k - 52 j+ 2i
- -14 k + 12 j + 2i
- -14 k + 52 j- 2i
- 14 k- 52 j - 2i

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4.1.10. For the vectors A= 4 i + 2 j + 8 k and B = 3 i -2 j - 7 k, where i,...

Author: Stephanie Redfern

For the vectors A= 4 i + 2 j + 8 k and B = 3 i -2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following task. Calculate B x A.

Please choose only one answer:

- -14 k + 52 j+ 4i
- -12 k - 52 j+ 2i
- 14 k - 52 j - 2i
- -14 k + 52 j- 2i
- -14 k+ 52 j + 2i

Check the answer of this question online at QuizOver.com:
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4.1.11. For the vectors A= 4 i + 2 j + 8 k and B = 3 i -2 j - 7 k, where i,...

Author: Stephanie Redfern

For the vectors A= 4 i + 2 j + 8 k and B = 3 i -2 j - 7 k, where i, j, and k are unit vectors in a rectangular coordinate system, perform the following task. From the formula ||A x B|| = ||A|| ||B|| sin(q), calculate q.

Please choose only one answer:

- 38.4 degrees
- 84.3 degrees
- 0.843 degrees
- 0.85 radians
- 3.84 radians

Check the answer of this question online at QuizOver.com:
Question: For the vectors A 4 i 2 j 8 k and B 3 i Stephanie Redfern Saylor

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4.1.12. You find experimentally that the force required to start sliding mo...

Author: Stephanie Redfern

You find experimentally that the force required to start sliding motion of a block of mass 20 kg on a horizontal surface is 12 N. If the same surface is inclined to a 30 degree slope with respect to gravity, what force (in addition to gravity) is required to initiate sliding motion of the object?

Please choose only one answer:

- 0 N
- 196 N
- 12 N
- 108 N
- 170 N

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4.1.13. Convert 1000 kg ft /(hr[sup]2[/sup] m[sup]2[/sup]) to units of psi.

Author: Stephanie Redfern

Convert 1000 kg ft /(hr[sup]2[/sup] m[sup]2[/sup]) to units of psi.

Please choose only one answer:

- 0.035
- 14.7
- 100
- 0.015
- 108

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Question: Convert 1000 kg ft / hr sup 2 /sup m sup Stephanie Redfern @The Mechanics

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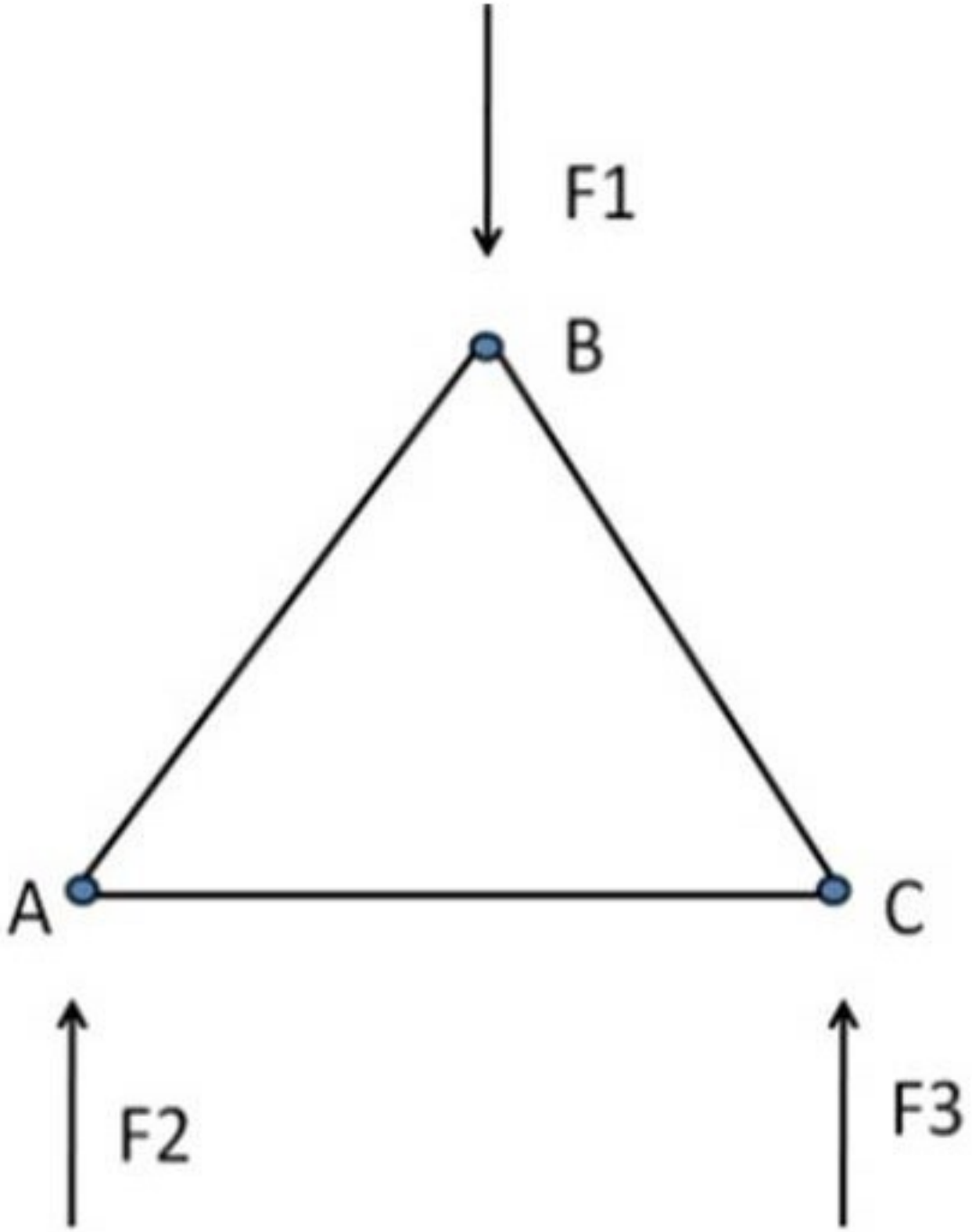
4.1.14. For the pin-connected structure below, the internal angles are all ...

Author: Stephanie Redfern

For the pin-connected structure below, the internal angles are all 60 degrees and the structure is supported from below by a flat table. If the load F1 is 10 N, then what is the force in the member BC?



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Please choose only one answer:

- 5N, compression
- 10N, compression
- 6.66N, compression
- 5.77N, compression

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