Co-Planar Vector Addition in Two Dimensions: Two forces shown act at point O.

|  |  |  |
| --- | --- | --- |
| 1. | Determine the magnitude of resultant . ***Hint: Rotate Axes so x’ is the direction of F2.*** | |
|  | a. | b. |
|  | c. | d. 2 |

|  |  |  |
| --- | --- | --- |
| 2. | Determine the angle between the resultant and force . | |
|  | a. | b. 2 |
|  | c. | d. 2 |

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7

24









25

60o

Cartesian Vectors in Two Dimensions: Forces and are concurrent at point O .

|  |  |  |
| --- | --- | --- |
| 3. | Express the resultant as a Cartesian Vector. | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 4. | Determine the magnitude of the projection of in the direction of . | |
|  | a. 159 | b. 166 |
|  | c. 180 | d. |

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Cartesian Vectors in Three Dimensions: Three Forces are concurrent at point O.















|  |  |  |
| --- | --- | --- |
| 5. | Determine the magnitude of resultant . | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 6. | Select the expression for a unit vector in the direction of . | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 7. | Determine the angle between forces and . | |
|  | a. 87. | b. 7 |
|  | c. | d. |

Particle Equilibrium in Two Dimensions: Cables are knotted at A and B.













15

17

8





|  |  |  |
| --- | --- | --- |
| 8. | Determine the force in cable AB. | |
|  | a. | b. 801 |
|  | c. 865 | d. 86 |

|  |  |  |
| --- | --- | --- |
| 9. | Determine the force in cable AE. | |
|  | a. 765 | b. 795 |
|  | c. 736 | d. |

|  |  |  |
| --- | --- | --- |
| 10. | Determine the force in cable BD. | |
|  | a. 3 | b. |
|  | c. 360 | d. 376 |

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Particle Equilibrium in Three Dimensions: The cables are knotted at O.

|  |  |  |
| --- | --- | --- |
| 11. | Determine the force in cable OC. | |
|  | a. 15. | b. |
|  | c. 16 | d. 12 |

|  |  |  |
| --- | --- | --- |
| 12. | Determine the force in cable OB. | |
|  | a. 4 | b. 3 |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 13. | Determine the force in cable OA. | |
|  | a. | b. 3 |
|  | c. 4 | d. 2 |

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Moments





















|  |  |  |
| --- | --- | --- |
| 14. | Determine the moment of about the origin of coordinates. | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 15. | Determine the magnitude of the moment of about the y-axis. | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 16. | Determine the moment of the couple comprised of forces and . | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 17. | Determine the shortest distance between the lines of action of forces and . | |
|  | a. | b. |
|  | c. 6.44 | d. |











Rigid Body Equilibrium in Two Dimensions

|  |  |
| --- | --- |
| 18. | Sketch a compete free body diagram of bar AB. Simplify the Distributed Loads to Force Resultants at their C.G. |

|  |  |  |
| --- | --- | --- |
| 19. | Determine the vertical component of reaction at hinge A. | |
|  | a. | b. |
|  | c. | d. 3.95 |

|  |  |  |
| --- | --- | --- |
| 20. | Determine the vertical component of reaction at roller B. | |
|  | a. 3.95 | b. |
|  | c. 3.6 | d. |

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BS

BS

A

B

C

D

E

8 m

3 m

1 m

3 m

100 kg

z

y

x

**3-D Equilibrium**

Rigid bar ABCD, supporting a mass at point C, lies in the x-y plane and is supported by a Ball-and-Socket at points A and D and cable BE.

1. Sketch a Free Body Diagram of Rigid Bar ABCD.
2. Express the tension in cable BE, as a Cartesian Vector.

a. b.

c. d.

1. Determine the magnitude of the moment of the force applied at point C about line AD.

a. 2350 N-m b. 0

c. 2440 N-m d. 2530 N-m

1. Determine the magnitude of the force in cable BE.

a. 1.42 kN b. 1.48 kN

c. 1.38 kN d. 1.54 kN













Truss Analysis by the Method of Joints

1. Determine the force in member AD

|  |  |  |
| --- | --- | --- |
|  |  | |
|  | a. | b. |
|  | c. 58 | d. |

1. Determine the force in member AB

|  |  |  |
| --- | --- | --- |
|  |  | |
|  | a. | b. 33 |
|  | c. | d. 315 |

1. Determine the force in member BD

|  |  |  |
| --- | --- | --- |
|  |  | |
|  | a. | b. |
|  | c. 62 | d. |

1. Determine the force in member BE

|  |  |  |
| --- | --- | --- |
|  |  | |
|  | a. 27 | b. 26 |
|  | c. | d. |

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Truss Analysis by the Method of Sections

|  |  |
| --- | --- |
| 29. | Sketch a compete free body diagram of section the truss that will facilitate determination of the forces in members DF, EF, and EG . |

|  |  |  |
| --- | --- | --- |
| 30. | Determine the force in member EF. | |
|  | a. | b. 11. |
|  | c. | d. 10.7 |

|  |  |  |
| --- | --- | --- |
| 31. | Determine the force in member DF. | |
|  | a. 7.33 | b. 7 |
|  | c. 8 | d. 7.66 |

|  |  |  |
| --- | --- | --- |
| 32. | Determine the force in member EG. | |
|  | a. 24 | b. |
|  | c. 25 | d. |

Frame and Machine Analysis: Member AB is Circular with radius .















|  |  |
| --- | --- |
| 33. | Sketch a complete free body diagram of bar BC. |

|  |  |  |
| --- | --- | --- |
| 34. | Determine the magnitude of the force that AB exerts on bar BC at pin B. | |
|  | a. | b. 544 |
|  | c. 522 | d. 566 |

|  |  |  |
| --- | --- | --- |
| 35. | Determine the horizontal component of reaction force that hinge C exerts on bar BC. | |
|  | a. | b. 375 |
|  | c. 350 | d. 42 |

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area ccrap.EMFProperties of Plane Sections by Integration: The shaded section is bounded on the left by the line , on the right by the line , above by the x axis, and below by the curve .

|  |  |  |
| --- | --- | --- |
| 36 | Determine the area of the shaded section. | |
|  | a. | b. 24.5 |
|  | c. 25.8 | d. |

|  |  |  |
| --- | --- | --- |
| 37. | Determine the x-coordinate of the centroid of the shaded section. | |
|  | a. 5 | b. 4.69 |
|  | c. | d. 4.90 |

|  |  |  |
| --- | --- | --- |
| 38. | Determine the second moment of area of the shaded section with respect to the x-axis, . | |
|  | a. 22 | b. 25 |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 39. | Determine the product of inertia of the shaded section with respect to the xy-axes, . | |
|  | a. | b. |
|  | c. | d. |

**Moments and Products of Inertia for Composite Areas, Parallel Axis Theorem**



















**For the shaded area shown to the right**

|  |  |  |
| --- | --- | --- |
| 40. | The vertical distance from the base to the centroidal x-axis, , is: | |
|  | A 3.05 in | B 3.19 in | |
|  | C 3.45 in | D 3.32 in | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 41. | The second moment of area about the centroidal x-axis, , is: | | | | | |
|  | A 114 in4 | B 110 in4 | | | |
|  | C 119 in4 | D 105 in4 | | | |
|  |  | |  | |
| 42. | The second moment of area about the centroidal y-axis, , is: | | | | | | |
|  | A | | | B |
|  | C | | | D |

**Fluid Pressure**

3

4

**x**

A

B

Dam

18 ft

12 ft

30 ft

seawater

The 50 ft wide dam shown retains seawater with a specific weight, γ = 66.

1. Determine the pressure, , the seawater exerts at point A.

a. 198 b. 214

c. 206 d. 0

1. Determine the pressure, , the seawater exerts at point B.

a. 824 b. 760 c. 856 d. 792

1. Determine the magnitude of the resultant fluid force, ,

on the sloping surface of the dam.

a. 386 kips b. 371 kips c. 342 kips d. 356 kips

Dry Friction







|  |  |  |
| --- | --- | --- |
| 46. | Determine the magnitude of the friction force the rough plane exerts on the block if , , and . | |
|  | a. 5 | b. 4 |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 47. | Determine the smallest magnitude of force for which motion of the block impends if and. | |
|  | a. 45 | b. |
|  | c. 50 | d. |







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**Slipping or Tipping**: The uniform triangular object weighs.

|  |  |  |
| --- | --- | --- |
| 48. | Determine the magnitude of the force  for which slipping impends provided it acts at height h sufficiently small so that tipping does not occur. | |
|  | a. | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 49. | If force  determine the height h at which tipping impends. | |
|  | a. 8 | b. |
|  | c. | d. |

|  |  |  |
| --- | --- | --- |
| 50. | Determine the height h at which the force acts to create slipping AND tipping at the same time. | |
|  | a. 8.0 | b. 13.3 |
|  | c. 10. | d. 15.0 |