

**PRAIRIE VIEW A&M UNIVERSITY
ROY G. PERRY COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
3102 PROFESSIONAL ENGINEERING I
SPRING 2022**

- I. COURSE DESCRIPTION IN ABET FORMAT**
- II ASSESSMENT RESULTS FOR CURRENT AND PAST PERIOD(S)**
 - Program Outcomes Assessed in Course**
 - Assessment Summary of Class Semester Averages for Outcomes**
 - End of Semester Course Outcomes Assessment Reports**
- II. TESTS: Subject Tests on NCEES FE-CIVIL Topics**
 - Summary of Topics covered by Test**
 - Original Test Questions**
 - (Summary of topics can be a separate page or include on the assignment itself)**
 - Above Average (Graded original work)**
 - Average (Graded original work)**
 - Below Average (Graded original work)**
- III. FE-CIVIL MOCK TEST: 5-hour Mock Test on NCEES FE-CIVIL Topics**
 - Original Test Questions**
 - Above Average (Graded original work)**
 - Average (Graded original work)**
 - Below Average (Graded original work)**

**One or Two Page Course Description
in ABET Format**

Department of Civil & Environmental Engineering

CVEG 3102 – Professional Engineering I

CREDIT HOURS	1
CONTACT HOURS	3
INSTRUCTOR/ COURSE COORDINATOR	Dr. Iftekhar Ahmed, PE, Civil Engineering
TEXTBOOK	(1) NCEES Formula Book (2) <i>FE Civil Practice Problems</i> , 2014 or 2017 Edition, by Lindeburg
SUPPLEMENTAL MATERIALS	Class handouts and representative problems from various sources
CATALOG DESCRIPTION	Fundamentals of engineering and related science subjects include computers, engineering economics, ethics, fluid mechanics, mathematics/probability & statistics, statics, dynamics, mechanics of materials, and <u>CEE Topics</u> : Environmental, Water Resources, Structures, Materials, Geotechnical, Transportation, and Construction & Surveying.
PREREQUISITES	MATH 3023, MATH 4173, CVEG 3023, CVEG 3063, CVEG 3043, CVEG 3053, CHEG 2003, CVEG 3083 and CVEG 4013
CO-REQUISITES	CVEG 3083
DESIGNATION	Required
COURSE LEARNING OUTCOMES/GOALS	N/A
TOPICS COVERED	I. Statics II. Dynamics III. Mechanics of Materials IV. Materials (CE) V. Engineering Economics VI. Ethics VII. Fluid Mechanics VIII. Hydrology and Hydraulic Systems IX. Geotechnical Engineering X. Structural Analysis and Design (RC and Steel) XI. Transportation Engineering XII. Environmental Engineering XIII. Mathematics XIV. Computers

II ASSESSMENT RESULTS FOR CURRENT AND PAST FOUR ASSESSMENT PERIODS

Program ABET Outcomes Assessed in this course

Student Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Assessment Summary of Class Semester Averages for Outcomes: Spring 2020-2022

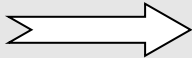
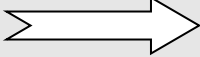
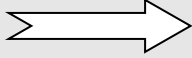
Outcomes	4	N/A
Semester		
Spring 2022	71%	
Spring 2021	Not Assessed	
Spring 2020	Not Assessed	
Comments on Data	This course was assessed for the first time in Spring 2022.	

*Expected Class Average = 70%

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
CVEG 3102-PROFESSIONAL ENGINEERING I
SPRING 2022

Report Prepared by: Dr. Iftekhar Ahmed, P.E.

Report Date: May 20, 2022

Semester	Analysis Type	Number of Students	Outcome 4 Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts			
			Expected Class Average	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Spring 2022	Direct	12	70	70	71	75
Implementation Summary	Items implemented from previous report or after meeting previous instructor 	This course was assessed for the first time in Spring 2022. Students took 13 tests comprising of NCEES FE-CIVIL subjects, and ended the semester with an online MOCK FE test with 100 questions covering the spectrum of CE topics and others (Ethics, Engr. Econ., Math, Contracts and Computers).				
Perceived Problems	Perceived problems are directly related to the PC and the sub items under them 	Students are selective on what subjects they place more weight on because 70% is the passing target in all tests. At times, some students fall short of the 70% passing average on the subject tests. So, the students are advised to take all subject tests during the semester for a better outcome.				
Plans for Addressing Problems	Plans for address specific measures to address PC and their sub areas 	The following is recommended for implementation: Continue to encourage students to take all subject tests during the semester for better outcome. Also encourage them to take the subject matter seriously by instilling in their minds the importance of licensure in civil engineering profession.				
Overall Trend over Periods	Ascertain if there were improvements over previous semesters 	Over the years, the student performance in this class has varied, and so has the number of students passing the actual FE test. Given the recent move to Civil based FE format, it is the hope that the FE exam will become popular goal of majority, if not all, students and thus, a culture will evolve in the Department.				
Were Expectations Met?		YES				

**PROFESSIONAL ENGINEERING I
SPRING 2022**

TEST 1: STATICS

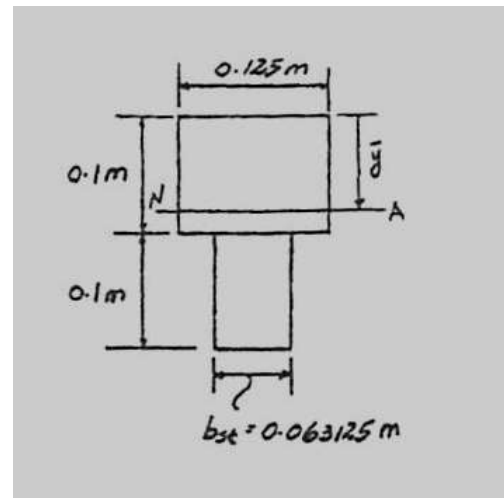
TOPICS COVERED IN TEST 1:

1. FUNDAMENTALS OF STATICS

Department of Civil & Environmental Engineering
CVEG 3102: Professional Engineering I
STATICS TEST (CLOSED Books/Notes; OPEN NCEES Formula Sheets)
January 25, 2022 (IN-CLASS Proctored 2-Hour Test)
Dr. I. Ahmed

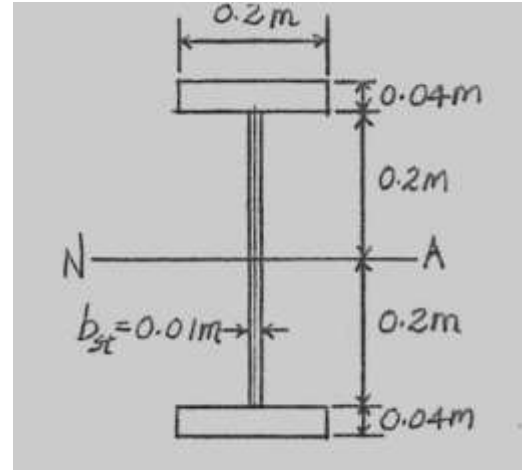
Name: _____

1. $\bar{y}$ (as shown in the figure) for the composite area is most nearly (measured from the top):



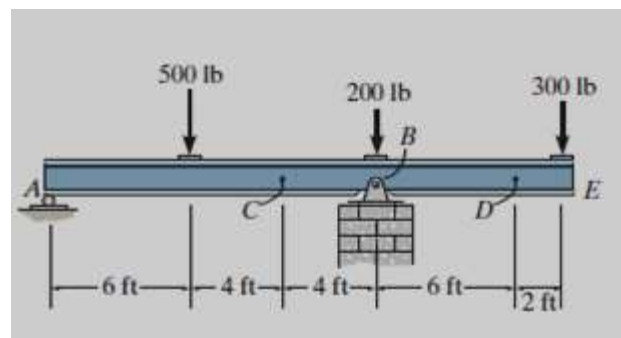
- a. 1.00056 m
- b. 0.08355 m
- c. 0.00567 m
- d. None of the above

2. Area Moment of Inertia about the neutral axis, I_{NA} of the composite area, is most nearly:



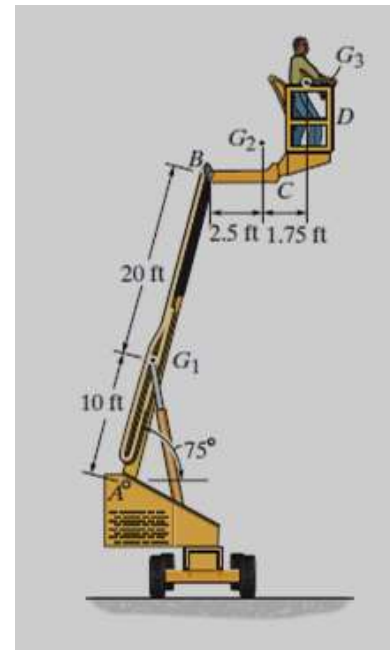
- a. None of the answers below
- b. $0.45682 \times 10^{-3} \text{ m}^4$
- c. $0.97645 \times 10^{-3} \text{ m}^4$
- d. $0.82987 \times 10^{-3} \text{ m}^4$

3. Shear force **and** bending moment at point D in the beam is, respectively, most nearly (assume counter-clockwise moment as positive):



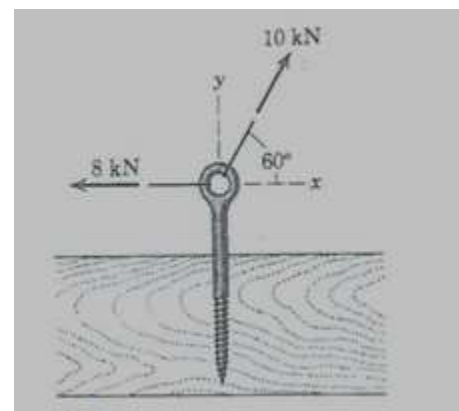
- a. 300 lb; -600 lb.ft
- b. -386 lb; -857 lb.ft
- c. -500 lb; 600 lb.ft
- d. None of the above

4. If the 1500-lb boom AB , the 200-lb cage BCD , and the 175-lb man have centers of gravity located at points G_1 , G_2 and G_3 , respectively, the **resultant moment** produced by all the weights about point A is most nearly (assuming counter-clockwise moment as positive):



- a. 8 kip-ft (clockwise)
- b. 8 kip-ft (counter-clockwise)
- c. 10 kip-ft (clockwise)
- d. 10 kip-ft (counter-clockwise)

5. The magnitude of the resultant force vector for the situation shown is nearly:



- a. 9 N
- b. 5 N
- c. 112 N
- d. 60 N

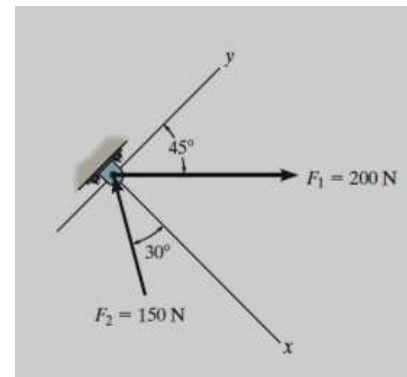
6. The distance 'PQ' between the points P (1, -3, 5) and Q (-3, 4, -2) is:

- a.
- b.
- c. 8
- d. —

7. A *position vector* is $\{2\mathbf{i} - 4\mathbf{j} - 6\mathbf{k}\}$ ft. The corresponding *unit vector* is:

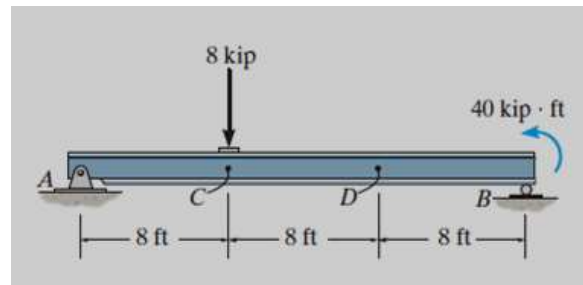
- a. $\{0.267\mathbf{i} - 0.535\mathbf{j} - 0.802\mathbf{k}\}$
- b. $\{13.36\mathbf{i} - 26.73\mathbf{j} - 40.09\mathbf{k}\}$
- c. $\{-26.2\mathbf{i} - 41.9\mathbf{j} - 62.9\mathbf{k}\}$
- d. None of the above

8. The x-component of the resultant vector (not shown in the figure) is 11.518 Newton and the y-component is 216.421 Newton. The *direction angle* of the resultant vector, measured counter clockwise, from the positive x-axis is most nearly:



- a. 45 degrees
- b. 53 degrees
- c. 97 degrees
- d. 87 degrees

9. A_y is most nearly:



- a. 9 kip
- b. 5 kip
- c. 12 kip
- d. 7 kip

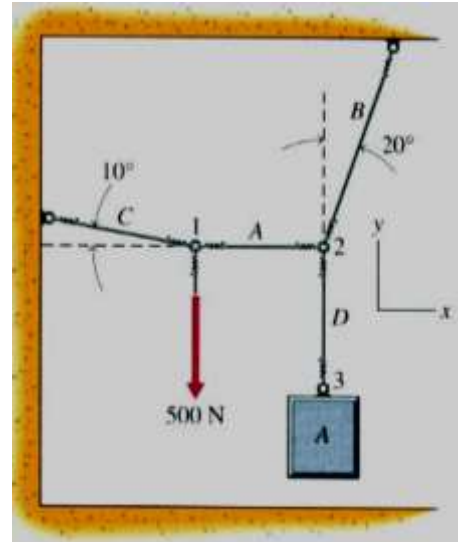
10. Given Friction force (F), static friction coefficient (μ_s) and Normal force (N) acting on a particle, the condition that needs to be satisfied for the particle to remain in equilibrium is given by:

- a. $F = \mu_s N$
- b. $F \geq \mu_s N$
- c. $F \leq \mu_s N$
- d. $F < \mu_s N$

11. If a particle is experiencing impending motion (about to slip, but hasn't slipped yet), which of the following relationships holds true (F = Friction force, μ_s = coefficient of static friction, N = Normal force)?

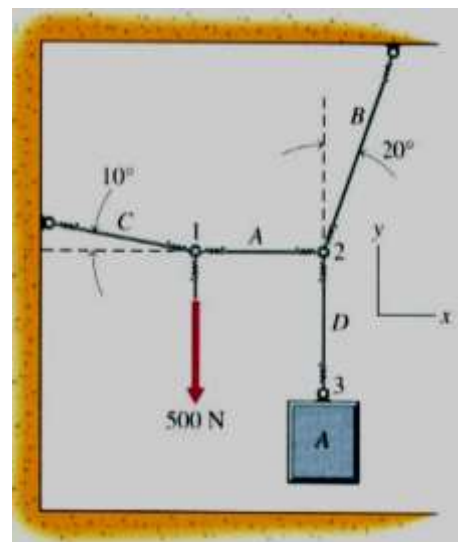
- a. $F = \mu_s N$
- b. $F \geq \mu_s N$
- c. $F \leq \mu_s N$
- d. $F < \mu_s N$

12. The Mass of block A is unknown. **Tension, T_A , along cable A , is nearly:**



- a. 2435 N
- b. 1435 N
- c. 1635 N
- d. 2835 N

13. **Tension, T_B , along cable B , is nearly:**



- a. 2189 N
- b. 1289 N
- c. 1789 N
- d. 8289 N

ABOVE AVERAGE

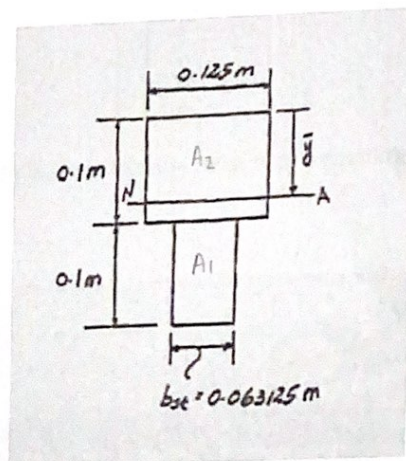
**Student sample work could
not be collected on request**

AVERAGE

09/15

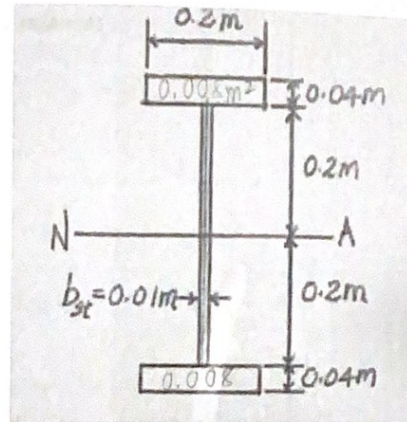
Name: Perla Zaldivar

1. $\bar{y}$ (as shown in the figure) for the composite area is most nearly (measured from the top):



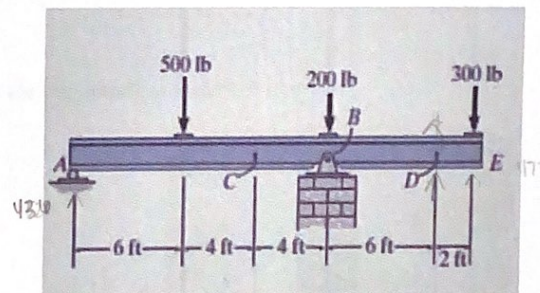
- a. 1.00056 m
b. 0.08355 m
c. 0.00567 m
d. None of the above

2. Area Moment of Inertia about the neutral axis, I_{NA} of the composite area, is most nearly:



- a. None of the answers below
- b. $0.45682 \times 10^{-3} \text{ m}^4$
- c. $0.97645 \times 10^{-3} \text{ m}^4$
- ☒ d. $0.82987 \times 10^{-3} \text{ m}^4$

3. Shear force **and** bending moment at point D in the beam is, respectively, most nearly (assume counter-clockwise moment as positive):



- a. 300 lb; -600 lb.ft
- b. -386 lb; -857 lb.ft
- c. -500 lb; 600 lb.ft
- ☒ d. None of the above

$$\sum M_D = 0$$

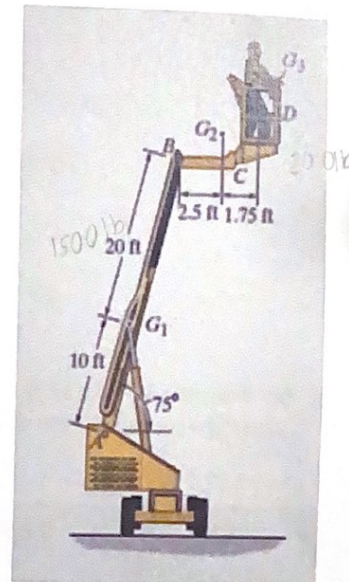
$$M_D = 0$$

$$\sum M_E = 0$$

$$-F_A(22) + 500(16) + 200(8) = 0$$

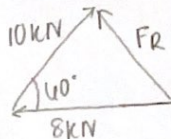
$$F_A = 436$$

4. If the 1500-lb boom AB , the 200-lb cage BCD , and the 175-lb man have centers of gravity located at points G_1 , G_2 and G_3 , respectively, the resultant moment produced by all the weights about point A is most nearly (assuming counter-clockwise moment as positive):

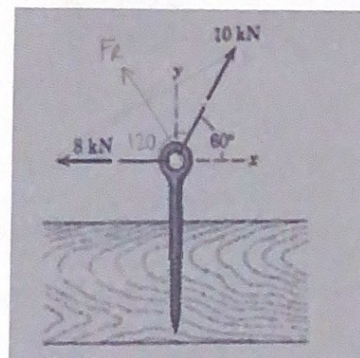


- a. 8 kip-ft (clockwise)
- b. 8 kip-ft (counter-clockwise)
- c. 10 kip-ft (clockwise)
- d. 10 kip-ft (counter-clockwise)

5. The magnitude of the resultant force vector for the situation shown is nearly:



$$\frac{F_R}{\sin 40} = \frac{10}{\sin 60}$$



- a. 9 N
- b. 5 N
- c. 112 N
- d. 60 N

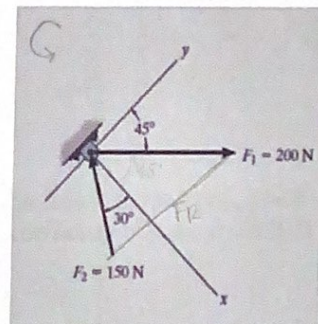
6. The distance 'PQ' between the points P (1, -3, 5) and Q (-3, 4, -2) is:

- a. $\sqrt{10}$
- ☒ b. $\sqrt{14}$
- c. 8
- d. $\sqrt{114}$

7. A position vector is $\{2\mathbf{i} - 4\mathbf{j} - 6\mathbf{k}\}$ ft. The corresponding unit vector is:

- ☒ a. $\{0.267\mathbf{i} - 0.535\mathbf{j} - 0.802\mathbf{k}\}$
- b. $\{13.36\mathbf{i} - 26.73\mathbf{j} - 40.09\mathbf{k}\}$
- c. $\{-26.2\mathbf{i} - 41.9\mathbf{j} - 62.9\mathbf{k}\}$
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8. The x-component of the resultant vector (not shown in the figure) is 11.518 Newton and the y-component is 216.421 Newton. The direction angle of the resultant vector, measured counter clockwise, from the positive x-axis is most nearly:

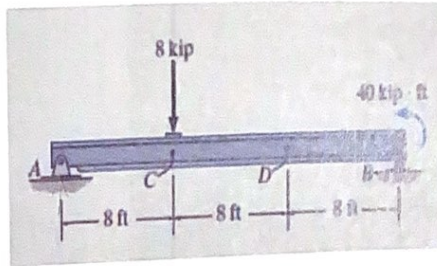


11.518 N

- a. 45 degrees
- b. 53 degrees
- c. 97 degrees
- ☒ d. 87 degrees

9. A_y is most nearly:

$$\begin{aligned} \sum M_A &= 0 \\ -8(8) + 40 + F_B(24) &= 0 \\ F_B &= 1 \\ \sum F_y &= 0 \\ A_y - 8 + 1 &= 0 \\ A_y &= 7 \end{aligned}$$



- a. 9 kip
- b. 5 kip
- c. 12 kip
- ☒ d. 7 kip

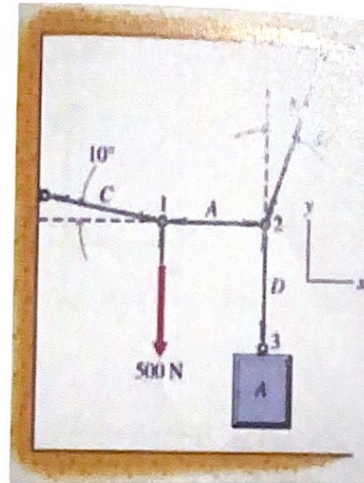
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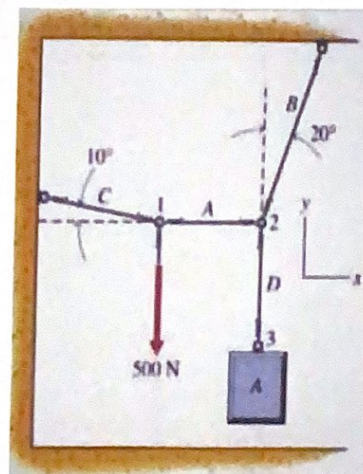
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12. The Mass of block A is unknown. Tension, T_A , along cable A , is nearly:



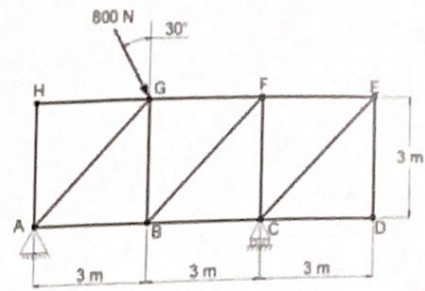
- a. 2435 N
- b. 1435 N
- ☒ c. 1635 N
- d. 2835 N

13. Tension, T_B , along cable B , is nearly:



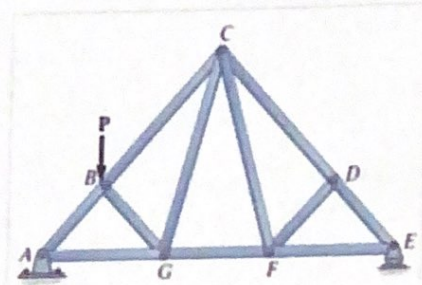
- a. 2189 N
- ☒ b. 1289 N
- c. 1789 N
- d. 8289 N

14. How many zero force members are there in the truss shown in the figure?



- a. Four
- b. Two
- c. Six
- d. Zero

15. The zero force members in the truss shown are:



- a. BG and DF
- b. DE and DC
- c. FD and FC
- d. FD only

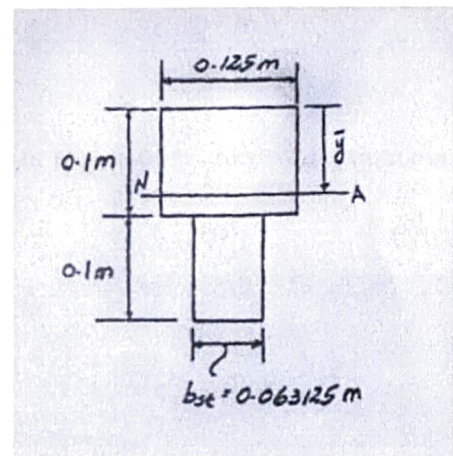
BELOW AVERAGE

04/15!

Department of Civil & Environmental Engineering
CVEG 3102: Professional Engineering I
STATICS TEST (CLOSED Books/Notes; OPEN NCEES Formula Sheets)
January 25, 2022 (IN-CLASS Proctored 2-Hour Test)
Dr. I. Ahmed

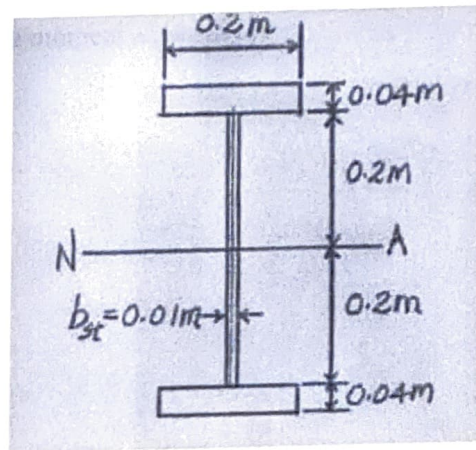
Name: Michael LeBlanc

1. $\bar{y}$ (as shown in the figure) for the composite area is most nearly (measured from the top):



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- b. 0.08355 m
- ☒ c. 0.00567 m
- d. None of the above

2. Area Moment of Inertia about the neutral axis, I_{NA} of the composite area, is most nearly:



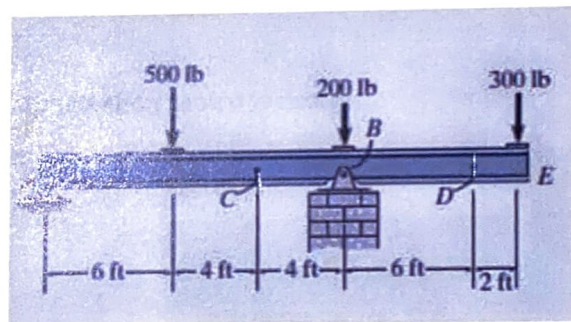
a. None of the answers below

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c. $0.97645 \times 10^{-3} \text{ m}^4$

d. $0.82987 \times 10^{-3} \text{ m}^4$

3. Shear force **and** bending moment at point D in the beam is, respectively, most nearly (assume counter-clockwise moment as positive):



a. 300 lb; -600 lb.ft

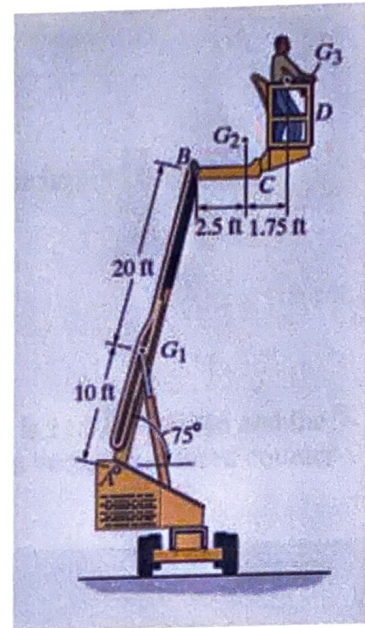
b. -386 lb; -857 lb.ft

c. -500 lb; 600 lb.ft

d. None of the above

$$\sum M_D = -200(6) + C_y(10) + 500(14) + A_y(20)$$

4. If the 1500-lb boom AB , the 200-lb cage BCD , and the 175-lb man have centers of gravity located at points G_1 , G_2 and G_3 , respectively, the resultant moment produced by all the weights about point A is most nearly (assuming counter-clockwise moment as positive):



- a. 8 kip-ft (clockwise)
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- ☒ c. 10 kip-ft (clockwise)
- d. 10 kip-ft (counter-clockwise)

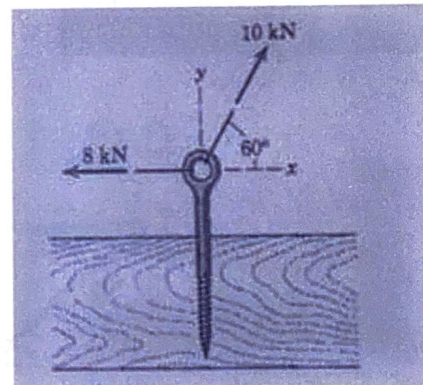
5. The magnitude of the resultant force vector for the situation shown is nearly:

$$R = \sqrt{F_1 + F_2}$$

$$F_1 = 10 \sin(60^\circ)$$

$$F_2 = 8 \cos(180^\circ)$$

$$R = \sqrt{(8.66)^2 + (8)^2}$$



- ☒ a. 9 N
- b. 5 N
- c. 112 N
- d. 60 N

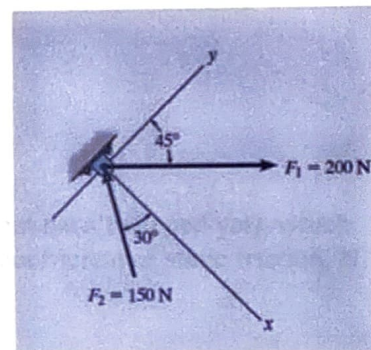
6. The distance 'PQ' between the points P (1, -3, 5) and Q (-3, 4, -2) is:

- ☒ a. $\sqrt{10}$
- ☐ b. $\sqrt{14}$
- ☐ c. 8
- ☐ d. $\sqrt{114}$

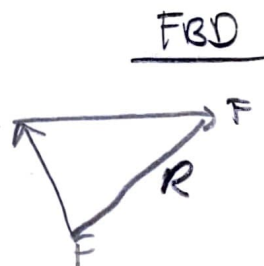
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- ☒ b. $\{13.36\mathbf{i} - 26.73\mathbf{j} - 40.09\mathbf{k}\}$
- ☐ c. $\{-26.2\mathbf{i} - 41.9\mathbf{j} - 62.9\mathbf{k}\}$
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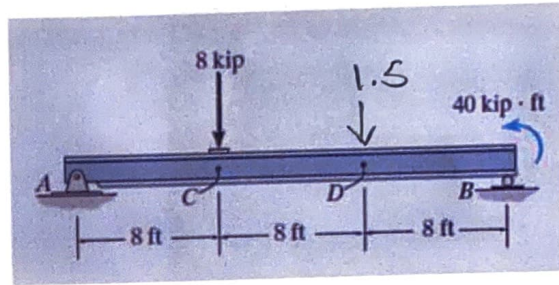


- a. 45 degrees
- b. 53 degrees
- c. 97 degrees
- ☒ d. 87 degrees



$$\sum M_B = 40 + -1.5(8) + 8(16) + A_y(24)$$

9. A_y is most nearly:



- a. 9 kip
- ☒ b. 5 kip
- c. 12 kip
- d. 7 kip

$\sum M_A = 8(-8) + 16(D) + 40 \text{ kip} \cdot \text{ft} = 0$

$$-64 + 16(D) = 0$$

$$D = 1.5$$

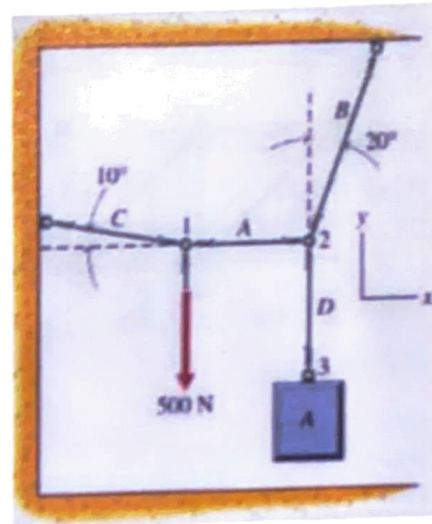
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- ☒ c. $F \leq \mu_s N$
- d. $F < \mu_s N$

11. If a particle is experiencing impending motion (about to slip, but hasn't slipped yet), which of the following relationships holds true (F = Friction force, μ_s = coefficient of static friction, N = Normal force)?

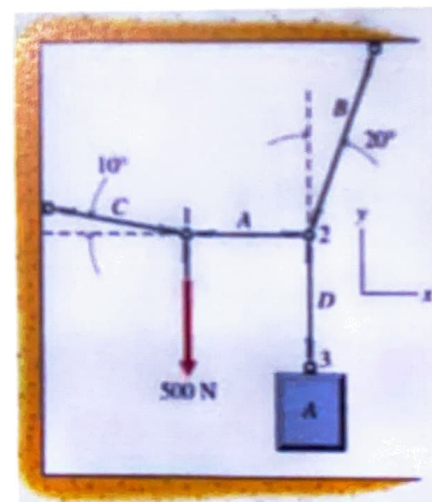
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- c. $F \leq \mu_s N$
- d. $F < \mu_s N$

12. The Mass of block A is unknown. Tension, T_A , along cable A , is nearly:



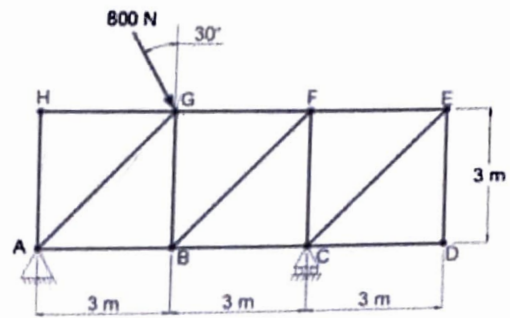
- ☒ a. 2435 N
☐ b. 1435 N
☐ c. 1635 N
☐ d. 2835 N

13. Tension, T_B , along cable B , is nearly:



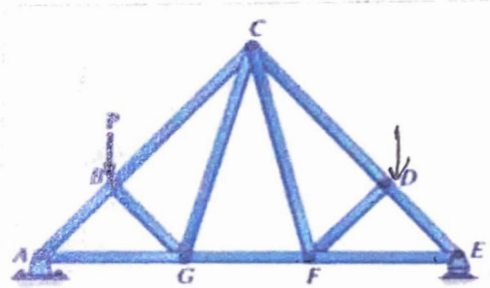
- ☐ a. 2189 N
☐ b. 1289 N
☒ c. 1789 N
☐ d. 8289 N

14. How many zero force members are there in the truss shown in the figure?



- a. Four
- b. Two
- ☒ c. Six
- d. Zero

15. The zero force members in the truss shown are:



- a. BG and DF ✗
- b. DE and DC
- ☒ c. FD and FC
- d. FD only

**PROFESSIONAL ENGINEERING
SPRING 2022**

TEST 2: DYNAMICS

TOPICS COVERED IN TEST 2:

1. FUNDAMENTALS OF DYNAMICS

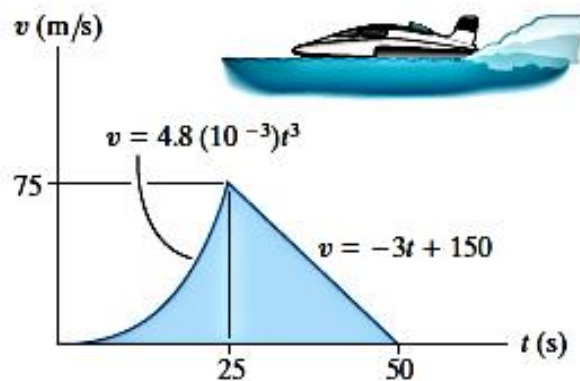
Department of Civil & Environmental Engineering
CVEG 3102: Professional Engineering I
DYNAMICS TEST (CLOSED Books/Notes; OPEN NCEES Formula Sheets)
February 1, 2022 (IN-CLASS Proctored 2-Hour Test)
Dr. I. Ahmed

Name: _____

1. A baseball leaves a bat with a velocity of 35 m/s at an angle of 32° above horizontal. There is a billboard at centerfield, 8.0m tall above the field. (A sketch may help). The highest point in its Path is nearly:

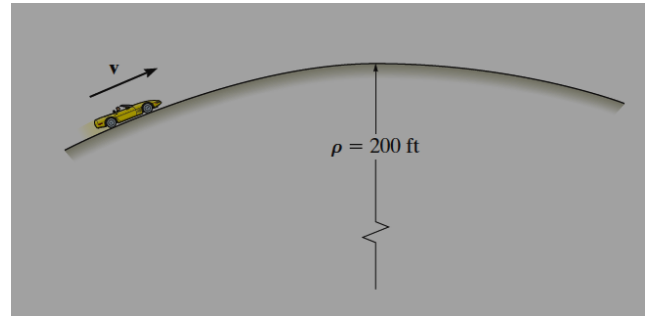
- a. 17.5 m
- b. 16.0 m
- c. 55.0 m
- d. None of the above

2. The v - t graph for the motion of a jet-powered boat is shown. The s - t relationship in the time domain $0 \leq t \leq 25$ is:



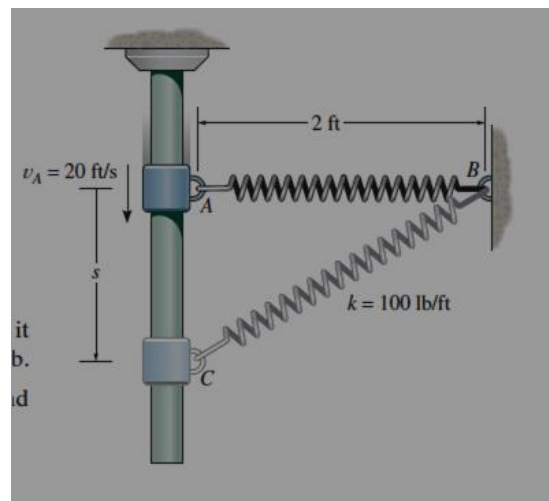
- a. $s = 1.2 \times 10^{-3} t^4$
- b. $s = 1.2 \times 10^{-3} t^6$
- c. $s = 1.2 \times 10^{-3} t$
- d. $s = 0.82987 \times 10^{-3} t$

3. If the crest of the hill has a radius of curvature $\rho = 200$ ft, The maximum constant speed at which the car can travel over it without leaving the surface of the road is nearly what? Neglect the size of the car in the calculation. The car has a weight of 3500 lb. Free Body Diagram may help!



- a. 90 ft/s
- b. 45 ft/s
- c. 80 ft/s
- d. None of the above

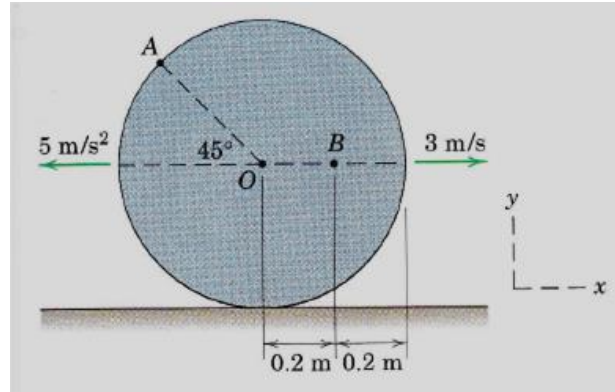
4. The 2-lb collar is given an initial velocity of 20 ft/s when it is at A. The collar falls to position C, one foot below A. If the spring has an un-stretched length of 2 ft and a stiffness of $k = 100$ lb/ft, the Spring Force at position C is most nearly:



- a. 28 N
- b. 35 N
- c. 12 N
- d. 24 N

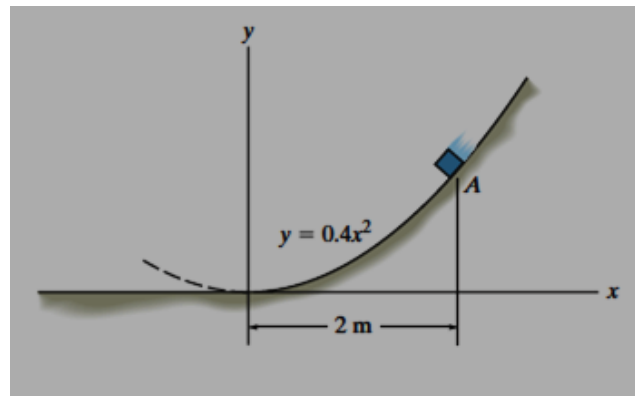
5. The center O of the *rigid* disk has the linear velocity and linear deceleration shown in the figure. The disk rolls *without slipping* on the horizontal surface. The *angular velocity* and *angular acceleration* of the disk respectively are most nearly:

[Hint: Assume counterclockwise rotation as **positive**; keep track of signs!].



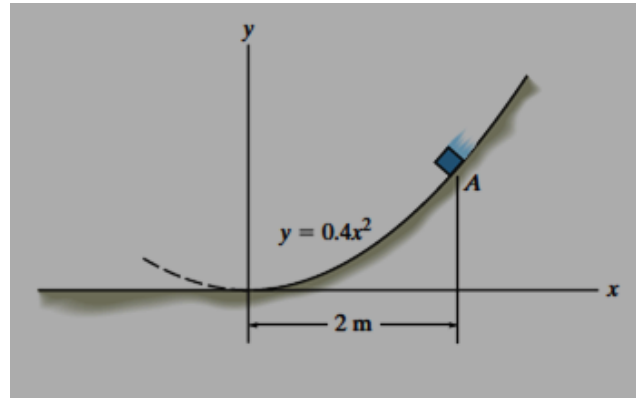
- a. $+7.5\text{ rad/s}$; -12.5 rad/s^2
- b. $+12.5\text{ rad/s}$; -12.5 rad/s^2
- c. -7.5 rad/s ; $+12.5\text{ rad/s}^2$
- d. None of the above

6. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2\text{ m}$, $y_A = 1.6\text{ m}$), the speed is $V = 8\text{ m/s}$ and the increase in speed is $dv/dt = 4\text{ m/s}^2$. The **radius of curvature** of the path is most nearly:



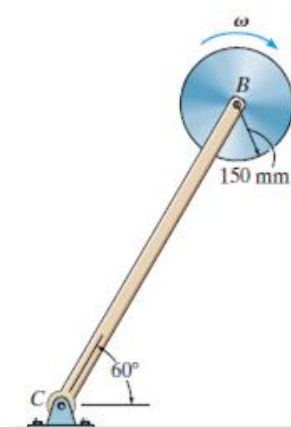
- a. 8 m
- b. 10 m
- c. 20 m
- d. 15 m

7. Determine the **normal acceleration** of the box at the instant shown. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2$ m, $y_A = 1.6$ m), the speed is $V = 8$ m/s and the increase in speed is $dv/dt = 4$ m/s².



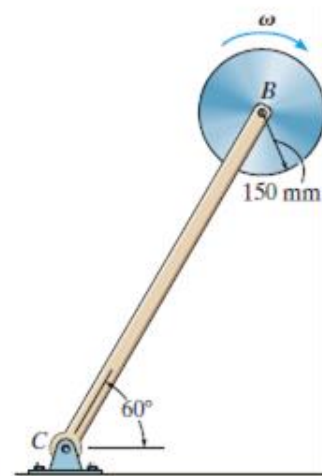
- a. 10.0 m/s²
- b. 14.2 m/s²
- c. 7.6 m/s²
- d. 13.4 m/s²

8. The disk has a mass of 20kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60$ rad/s. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$. The **force in strut BC** is most nearly:



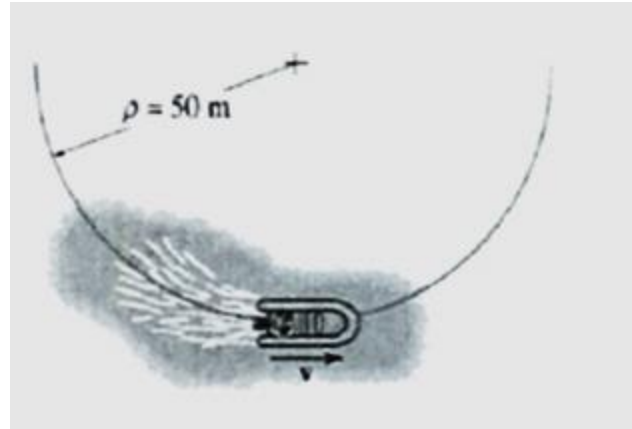
- a. 123 N
- b. 133 N
- c. 173 N
- d. 193 N

9. Determine the **angular acceleration** of the disk shown. The disk has a mass of 20kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60$ rad/s. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$.



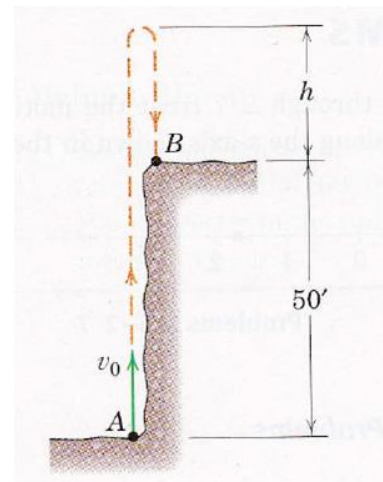
- a. 19 rad/s²
- b. 52 rad/s²
- c. 120 rad/s²
- d. None of the above

10. Starting from rest, a motorboat travels around a circular path of $\rho = 50$ m at a speed that increases with time, $v = 0.2t^2$ m/s. The **tangential acceleration** of the boat at the instant $t = 3$ seconds is most nearly:



- a. 12 m/s^2
- b. 0 m/s^2
- c. 1.2 m/s^2
- d. None of the above

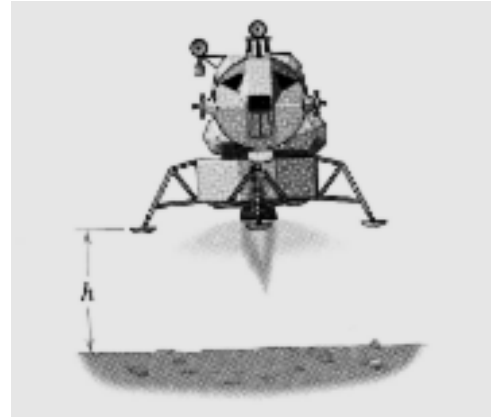
11. A ball is thrown vertically upward with an initial speed of 80 ft/sec from the base A of a 50-ft cliff. The distance h by which the ball clears the top of the cliff is most nearly:



- a. 45 ft
- b. 25 ft
- c. 50 ft
- d. None of the above

12. In the final stages of a moon landing, the lunar module descends under retrothrust of its descent engine to within $h = 5$ meters of the lunar surface where it has a *downward* velocity of 2 m/s. If the descent engine is cut off abruptly at this point, the impact velocity of the landing gear with the moon is most nearly:

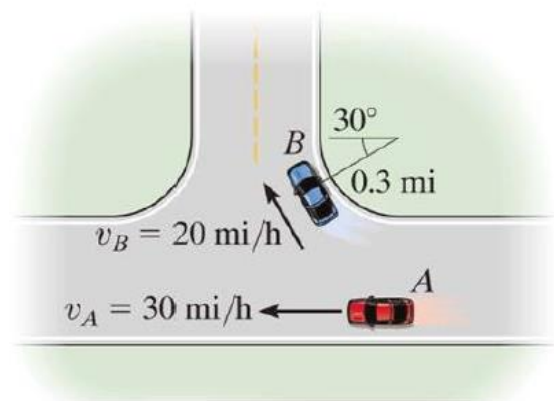
[Note: Lunar gravity is $1/6$ of the earth's gravity]



- a. 2.5 m/s
- b. 4.5 m/s
- c. 1.2 m/s
- d. None of the above

13. Note that the Car B is on a curved path while turning the corner at the instant shown in the figure. The tangential acceleration of Car B is 1200 mi/h^2 . The velocity of Car A is constant as given. The **velocity of Car B with respect to Car A** is most nearly:

[Work with the given *mph* unit]



- a. 16.5 mph
- b. 60.2 mph
- c. 26.5 mph
- d. 40.0 mph

14. A boy throws a ball (from rest) straight up from the top of a 12-m high tower. If the ball falls past him 0.75 seconds later, the initial velocity at which it was thrown is most nearly:
[A sketch may help]

- a. 10.0 m/s
- b. 4.0 m/s
- c. 7.0 m/s
- d. 2.0 m/s

15. In *Kinetics*, Newton's second law applies.

- a. True
- b. False

ABOVE AVERAGE

08/15

Department of Civil & Environmental Engineering
CVEG 3102: Professional Engineering I
DYNAMICS TEST (CLOSED Books/Notes; OPEN NCEES Formula Sheets)
February 1, 2022 (IN-CLASS Proctored 2-Hour Test)
Dr. I. Ahmed

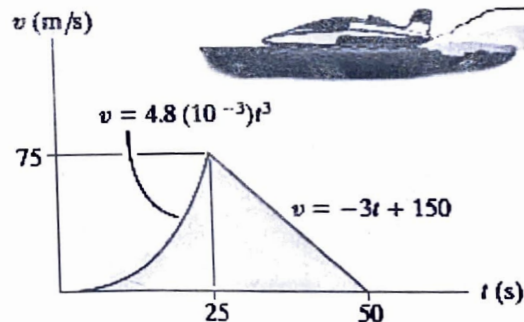
Name: Michael LeBlanc

1. A baseball leaves a bat with a velocity of 35 m/s at an angle of 32° above horizontal. There is a billboard at centerfield, 8.0m tall above the field. (A sketch may help). The highest point in its Path is nearly:

- a. 17.5 m
- b. 16.0 m
- c. 55.0 m
- d. None of the above

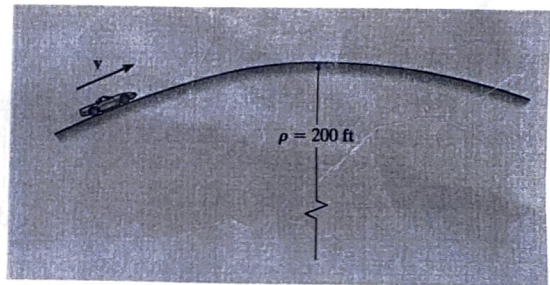


2. The $v-t$ graph for the motion of a jet-powered boat is shown. The $s-t$ relationship in the time domain $0 \leq t \leq 25$ is:



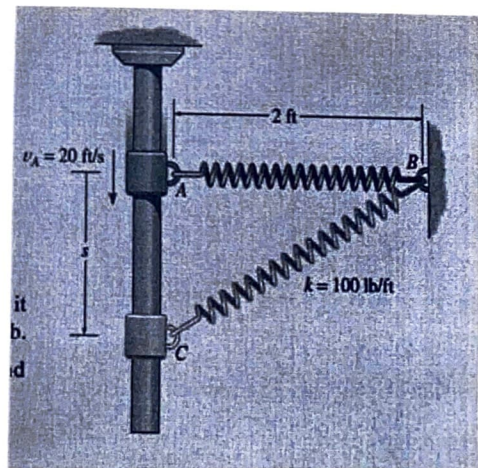
- a. $s = 1.2 \times 10^{-3} t^4$
- b. $s = 1.2 \times 10^{-3} t^6$
- c. $s = 1.2 \times 10^{-3} t$
- d. $s = 0.82987 \times 10^{-3} t$

3. If the crest of the hill has a radius of curvature $\rho = 200$ ft, The maximum constant speed at which the car can travel over it without leaving the surface of the road is nearly what? Neglect the size of the car in the calculation. The car has a weight of 3500 lb. Free Body Diagram may help!



- a. 90 ft/s
~~b. 45 ft/s~~
 c. 80 ft/s
 d. None of the above

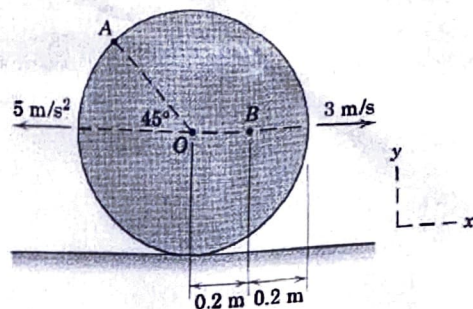
4. The 2-lb collar is given an initial velocity of 20 ft/s when it is at A . The collar falls to position C , one foot below A . If the spring has an un-stretched length of 2 ft and a stiffness of $k = 100$ lb/ft, the Spring Force at position C is most nearly:



- a. 28 N
 b. 35 N
 c. 12 N
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5. The center O of the rigid disk has the linear velocity and linear deceleration shown in the figure. The disk rolls *without slipping* on the horizontal surface. The angular velocity and angular acceleration of the disk respectively are most nearly:

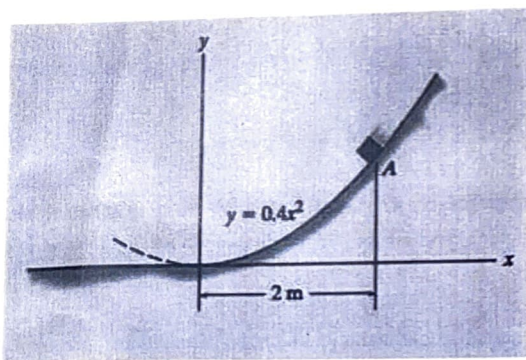
[Hint: Assume counterclockwise rotation as positive; keep track of signs!].



$\omega =$

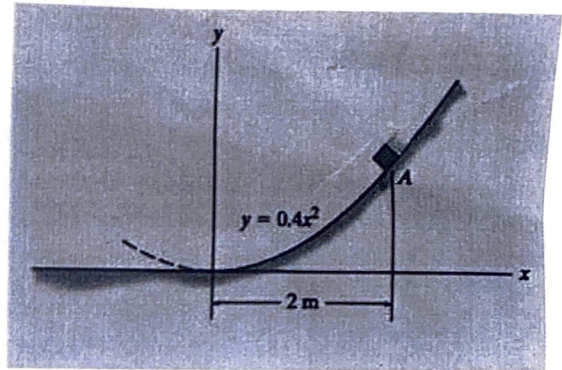
- a. +7.5 rad/s; -12.5 rad/s²
- b. +12.5 rad/s; -12.5 rad/s²
- c. -7.5 rad/s; +12.5 rad/s²
- d. None of the above

6. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2$ m, $y_A = 1.6$ m), the speed is $V = 8$ m/s and the increase in speed is $dv/dt = 4$ m/s². The **radius of curvature** of the path is most nearly:



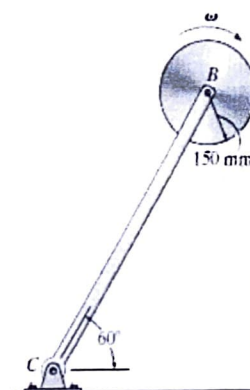
- a. 8 m
- b. 10 m
- c. 20 m
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7. Determine the **normal acceleration** of the box at the instant shown. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2$ m, $y_A = 1.6$ m), the speed is $V = 8$ m/s and the increase in speed is $dv/dt = 4$ m/s².



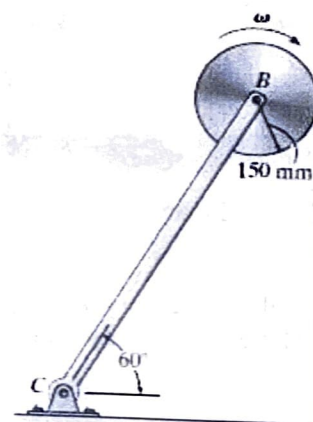
- a. 10.0 m/s²
- b. 14.2 m/s²
- c. 7.6 m/s²
- d. 13.4 m/s²

8. The disk has a mass of 20 kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60$ rad/s. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$. The **force in strut BC** is most nearly:



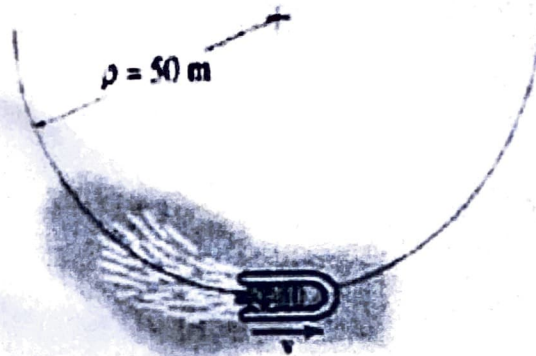
- a. 123 N
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- c. 173 N
- Ⓐ 193 N

9. Determine the **angular acceleration** of the disk shown. The disk has a mass of 20 kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60 \text{ rad/s}$. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$.



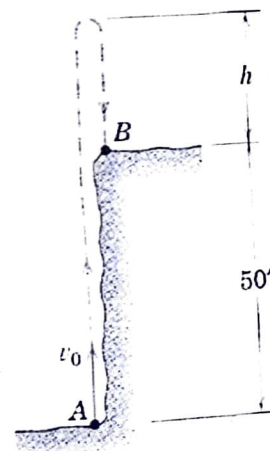
- Ⓐ 19 rad/s^2
- b. 52 rad/s^2
- c. 120 rad/s^2
- d. None of the above

10. Starting from rest, a motorboat travels around a circular path of $\rho = 50 \text{ m}$ at a speed that increases with time, $v = 0.2t^2 \text{ m/s}$. The **tangential acceleration** of the boat at the instant $t = 3$ seconds is most nearly:



- ☒ a. 12 m/s^2
- ☐ b. 0 m/s^2
- ☐ c. 1.2 m/s^2
- ☐ d. None of the above

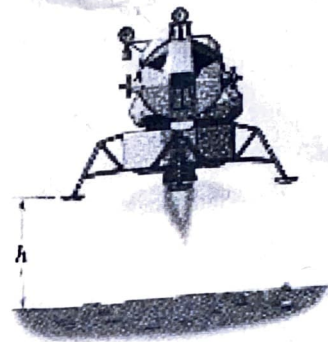
11. A ball is thrown vertically upward with an initial speed of 80 ft/sec from the base A of a 50-ft cliff. The distance h by which the ball clears the top of the cliff is most nearly:



- ☒ a. 45 ft
- ☐ b. 25 ft
- ☐ c. 50 ft.
- ☐ d. None of the above

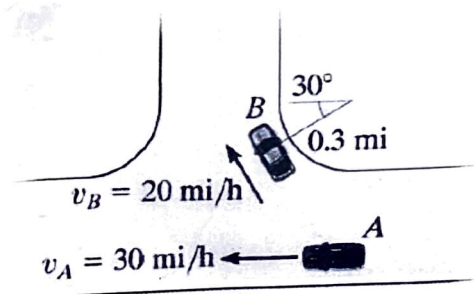
12. In the final stages of a moon landing, the lunar module descends under retrothrust of its descent engine to within $h = 5$ meters of the lunar surface where it has a *downward* velocity of 2 m/s. If the descent engine is cut off abruptly at this point, the impact velocity of the landing gear with the moon is most nearly:

[Note: Lunar gravity is $1/6$ of the earth's gravity]



- ☒ a. 2.5 m/s
☐ b. 4.5 m/s
☐ c. 1.2 m/s
☐ d. None of the above

13. Note that the Car B is on a curved path while turning the corner at the instant shown in the figure. The tangential acceleration of Car B is 1200 mi/h^2 . The velocity of Car A is constant as given. The **velocity of Car B with respect to Car A** is most nearly:
 [Work with the given *mph* unit]



- ☒ a. 16.5 mph
b. 60.2 mph
c. 26.5 mph
d. 40.0 mph

14. A boy throws a ball (from rest) straight up from the top of a 12-m high tower. If the ball falls past him 0.75 seconds later, the initial velocity at which it was thrown is most nearly:
[A sketch may help]

- a. 10.0 m/s
☒ b. 4.0 m/s
c. 7.0 m/s
d. 2.0 m/s

15. In *Kinetics*, Newton's second law applies.

- ☒ a. True
b. False

AVERAGE

05/15

Department of Civil & Environmental Engineering
CVEG 3102: Professional Engineering I
DYNAMICS TEST (CLOSED Books/Notes; OPEN NCEES Formula Sheets)
February 1, 2022 (IN-CLASS Proctored 2-Hour Test)
Dr. I. Ahmed

Name: Jerral T. Walker

Equation
① $u \cos \theta = v \cos \theta$

1. A baseball leaves a bat with a velocity of 35 m/s at an angle of 32° above horizontal. There is a billboard at centerfield, 8.0m tall above the field. (A sketch may help). The highest point in its Path is nearly:

- a. 17.5 m
b. 16.0 m
c. 55.0 m
d. None of the above
- ② - $V^2 = u^2 + 2gh$
 $(v \sin \theta)^2 = u \sin \theta - 2 \cdot 9.81 \times 8$

2. The $v-t$ graph for the motion of a jet-powered boat is shown. The $s-t$ relationship in the time domain $0 \leq t \leq 25$ is:

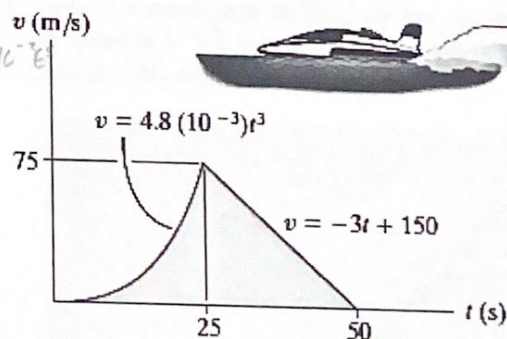
$$v = \frac{ds}{dt} \text{ so } ds = v dt$$

$$t = 0 \text{ to } 25$$

$$s = \int v dt = \int 4.8 \times 10^{-3} t^3 dt$$

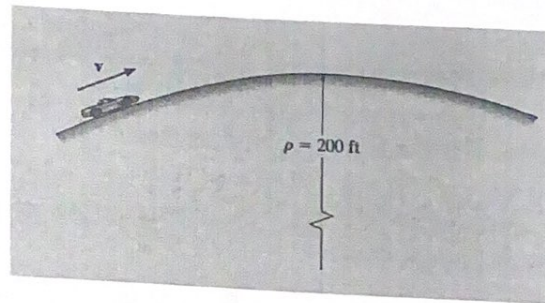
$$4.8 \frac{10^{-3}}{4} t^4 + C = 0 \quad \text{①}$$

$$s = 1.2 \times 10^{-3} t^4 \quad v=0$$



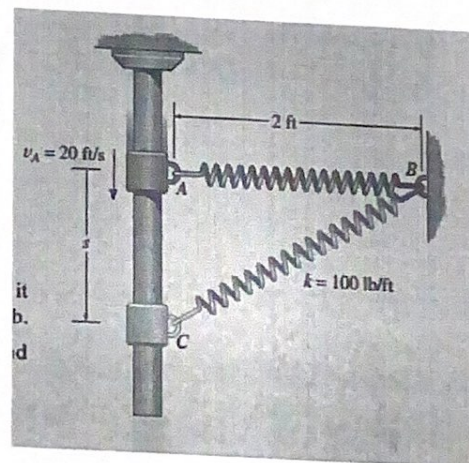
- a. $s = 1.2 \times 10^{-3} t^4$
b. $s = 1.2 \times 10^{-3} t^6$
c. $s = 1.2 \times 10^{-3} t$
d. $s = 0.82987 \times 10^{-3} t$

3. If the crest of the hill has a radius of curvature $\rho = 200$ ft. The maximum constant speed at which the car can travel over it without leaving the surface of the road is nearly what? Neglect the size of the car in the calculation. The car has a weight of 3500 lb. Free Body Diagram may help!



- a. 90 ft/s
b. 45 ft/s
c. 80 ft/s
d. None of the above

4. The 2-lb collar is given an initial velocity of 20 ft/s when it is at A. The collar falls to position C, one foot below A. If the spring has an un-stretched length of 2 ft and a stiffness of $k = 100$ lb/ft, the Spring Force at position C is most nearly:



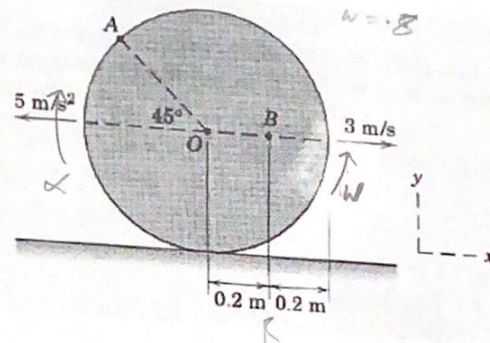
- a. 28 N
b. 35 N
c. 12 N
d. 24 N

5. The center O of the rigid disk has the linear velocity and linear deceleration shown in the figure. The disk rolls without slipping on the horizontal surface. The angular velocity and angular acceleration of the disk respectively are most nearly:
[Hint: Assume counterclockwise rotation as positive; keep track of signs!].

$$V_O = r\omega$$

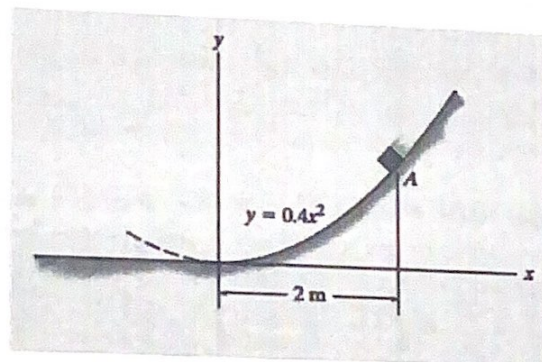
$$= 0.4 \times 8 = 3.2$$

Velocity of O



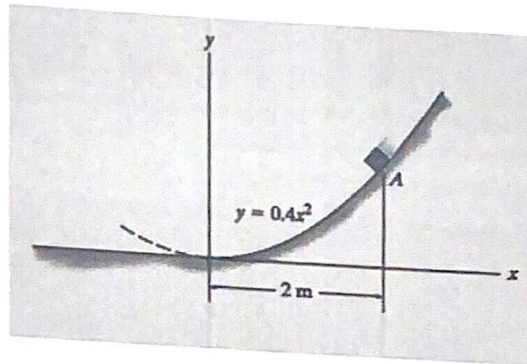
- a. +7.5 rad/s; -12.5 rad/s²
 b. +12.5 rad/s; -12.5 rad/s²
 c. -7.5 rad/s; +12.5 rad/s²
 d. None of the above

6. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2$ m, $y_A = 1.6$ m), the speed is $V = 8$ m/s and the increase in speed is $dv/dt = 4$ m/s². The **radius of curvature** of the path is most nearly:



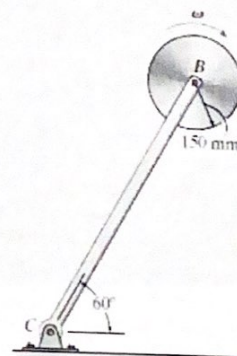
- a. 8 m
 b. 10 m
 c. 20 m
 d. 15 m

7. Determine the **normal acceleration** of the box at the instant shown. The box of negligible size is sliding down along a curved path defined by the parabola $y = 0.4x^2$. When it is at A ($x_A = 2$ m, $y_A = 1.6$ m), the speed is $V = 8$ m/s and the increase in speed is $dv/dt = 4$ m/s².



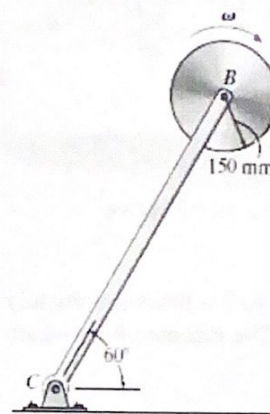
- a. 10.0 m/s^2
- b. 14.2 m/s^2
- c. 7.6 m/s^2
- d. 13.4 m/s^2

8. The disk has a mass of 20 kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60$ rad/s. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$. The **force in strut BC** is most nearly:



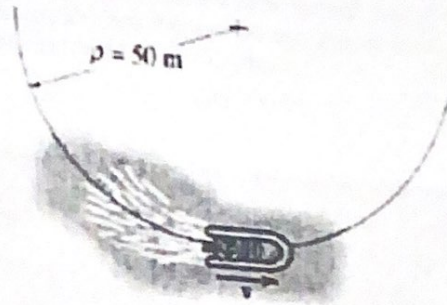
- a. 123 N
- ☒ b. 133 N
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- d. 193 N

9. Determine the **angular acceleration** of the disk shown. The disk has a mass of 20 kg and is originally spinning at the end of the strut with an angular velocity of $\omega = 60$ rad/s. It is then placed against the vertical wall, where the coefficient of kinetic friction is $\mu_k = 0.3$.



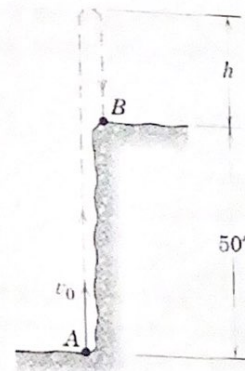
- a. 19 rad/s²
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10. Starting from rest, a motorboat travels around a circular path of $\rho = 50$ m at a speed that increases with time, $v = 0.2t^2$ m/s. The **tangential acceleration** of the boat at the instant $t = 3$ seconds is most nearly:



- a. 12 m/s^2
- b. 0 m/s^2
- c. 1.2 m/s^2
- d. None of the above

11. A ball is thrown vertically upward with an initial speed of 80 ft/sec from the base A of a 50-ft cliff. The distance h by which the ball clears the top of the cliff is most nearly:

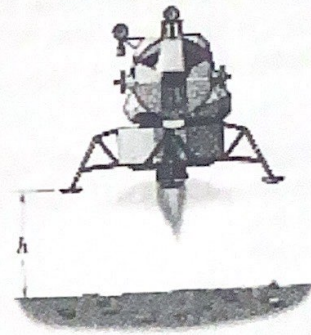


- a. 45 ft
- b. 25 ft
- c. 50 ft
- d. None of the above

12. In the final stages of a moon landing, the lunar module descends under retrothrust of its descent engine to within $h = 5$ meters of the lunar surface where it has a *downward* velocity of 2 m/s. If the descent engine is cut off abruptly at this point, the impact velocity of the landing gear with the moon is most nearly:

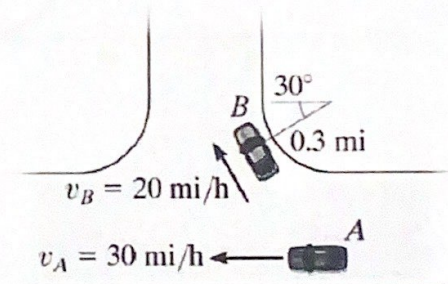
[Note: Lunar gravity is $1/6$ of the earth's gravity]

$$\begin{aligned} \text{height} &= 5 \text{ meters} \\ \text{Velocity} &= 2 \text{ m/s} \\ \text{Lunar gravity} &= \frac{9.81}{16} = 58.85 \end{aligned}$$



- ☒ a. 2.5 m/s
- ☒ b. 4.5 m/s
- ☒ c. 1.2 m/s
- ☐ d. None of the above

13. Note that the Car B is on a curved path while turning the corner at the instant shown in the figure. The tangential acceleration of Car B is 1200 mi/h^2 . The velocity of Car A is constant as given. The **velocity of Car B with respect to Car A** is most nearly:
[Work with the given *mph* unit]



- ☒ a. 16.5 mph
- ☐ b. 60.2 mph
- ☐ c. 26.5 mph
- ☐ d. 40.0 mph

14. A boy throws a ball (from rest) straight up from the top of a 12-m high tower. If the ball falls past him 0.75 seconds later, the initial velocity at which it was thrown is most nearly:
[A sketch may help]

- ☒ a. 10.0 m/s
- ☐ b. 4.0 m/s
- ☐ c. 7.0 m/s
- ☐ d. 2.0 m/s

15. In *Kinetics*, Newton's second law applies.

- ☒ a. True
- ☐ b. False

BELOW AVERAGE

**Student sample work could not be
collected on request**