

ENGR 122 EXAM 1 Name: _____

- Closed book, closed notes.
- You must show all of your work, with units, to receive credit.
- Credit will not be given for multiple choice questions that have the correct answer circled but do not have matching work that leads to the answer.

Honor Statement: On my honor, I promise that I have not received any outside assistance on this quiz (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student). I also promise not to discuss the exam with students in other sections until after all sections have taken the exam.

_____signature

1. (2 points) RFID stands for _____.
2. (2 points) The output of the PING sensor goes HIGH when a short burst of ultrasonic sound is emitted from its speaker and then goes LOW when _____.
3. (4 points) Explain how an accelerometer can be used to measure the angle of tilt; we are not looking for any equations, just some words explaining why accelerometers can be used to measure angle.

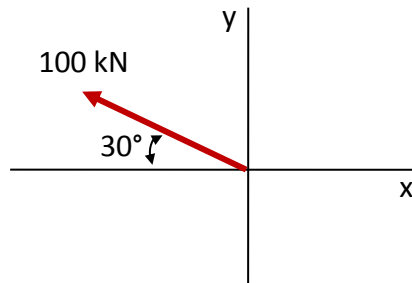
4. (2 points) If you want to bend a sheet of metal like we did in class, you would use a _____.
5. (2 points) If you wanted to cut a sheet of metal like we did in class, you would use a _____.
6. (2 points) The image below shows a collection of _____.



7. (2 points) To collect your ideas in one diagram, we discussed drawing a _____.
8. (2 points) To organize concepts in one diagram, we discussed drawing a _____.
9. (2 points) If gear A causes gear B to spin at a higher RPM, then the torque transmitted by gear B will be (HIGHER or LOWER) than the torque transmitted by gear A. *circle the correct answer*

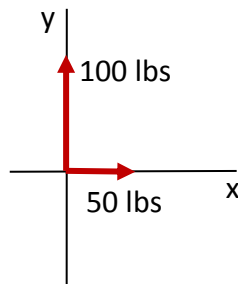
10. (5 points) The y-component of the force depicted below is closest to . . .

- a. 9.8 kN
- b. 26.3 kN
- c. -26.3 kN
- d. 34.2 kN
- e. 50 kN
- f. 100 kN



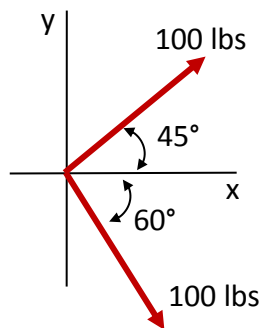
11. (5 points) The resultant of the system of two forces shown below is closest to . . .

- a. 92 lbs
- b. 102 lbs
- c. 112 lbs
- d. 122 lbs
- e. 132 lbs
- f. 150 lbs



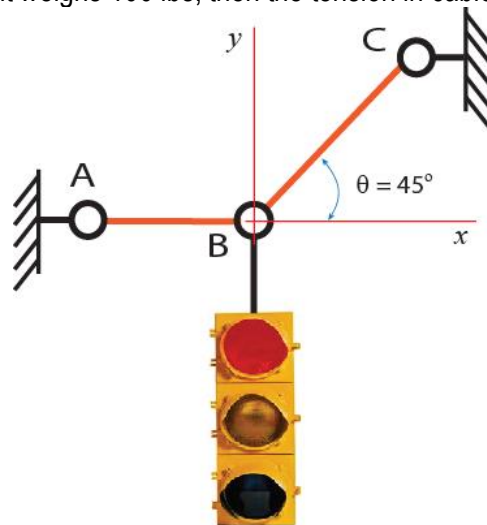
12. (5 points) The resultant of the system of two forces shown below is closest to . . .

- a. 112 lbs
- b. 122 lbs
- c. 145 lbs
- d. 176 lbs
- e. 200 lbs



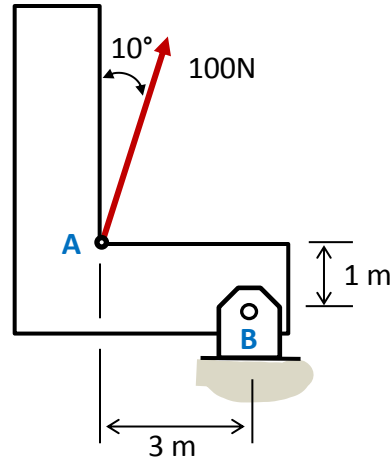
13. (5 points) If the traffic light weighs 100 lbs, then the tension in cable BC is closest to . . .

- a. 80 lbs
- b. 98 lbs
- c. 113 lbs
- d. 129 lbs
- e. 141 lbs



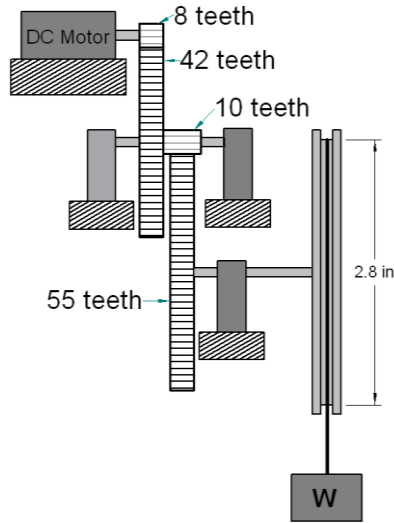
14. (5 points) The moment of the 100N force about the pinned connection at point B is closest to . . .

- a. 212 N-m
- b. 290 N-m
- c. 313 N-m
- d. 341 N-m
- e. 418 N-m
- f. 534 N-m



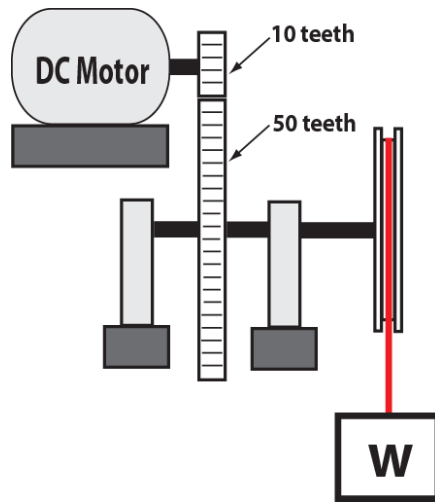
15. (5 points) If the gear with 55 teeth spins at 200 RPM, then the rate of rotation of the gear with 10 teeth is closest to . .

- a. 40 RPM
- b. 200 RPM
- c. 255 RPM
- d. 890 RPM
- e. 1100 RPM
- f. infinite RPM



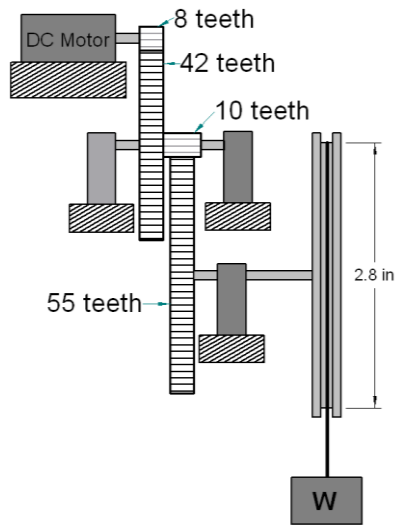
16. (5 points) A weight W of 10 Newtons moves upward at 1 meter per second as the cord to which it is attached winds around a pulley. If the efficiency of the motor / gearbox system is 80%, then the current that the 12V DC motor draws is closest to . . .

- a. 1.04 A
- b. 1.59 A
- c. 1.91 A
- d. 2.34 A
- e. 4.99 A
- f. 19.1 A



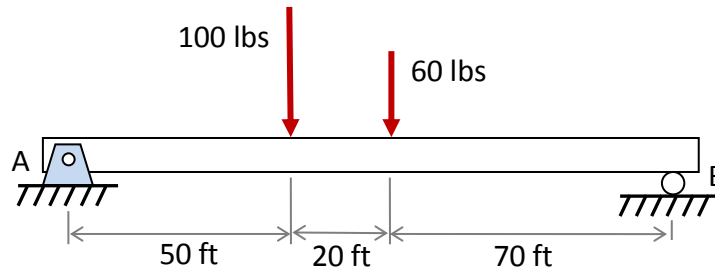
17. (5 points) If the gear train below lifts a weight W of 100 lbs and any frictional losses in the gear train are neglected, then the torque delivered by the DC motor is closest to . . .

- a. 1.2 in-lbs
- b. 4.8 in-lbs
- c. 6.8 in-lbs
- d. 8.8 in-lbs
- e. 10.8 in-lbs
- f. 44.8 in-lbs



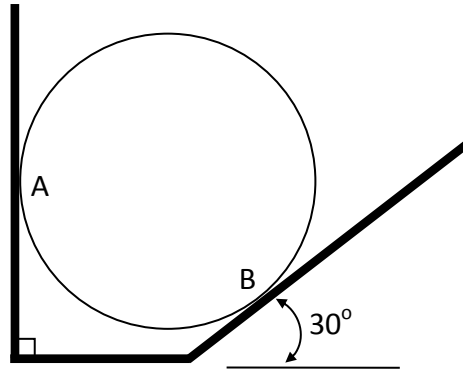
18. (5 points) The reaction at point B is closest to . . .

- a. 50.0 lbs
- b. 65.7 lbs
- c. 72.1 lbs
- d. 90.0 lbs
- e. 160 lbs



19. (5 points) Assume frictionless contact at points A and B for the problem below. If the circular barrel weighs 100 lbs, then the force applied at point B is closest to . . .

- a. 50 lbs
- b. 57.7 lbs
- c. 82.8 lbs
- d. 91.8 lbs
- e. 115 lbs
- f. 200 lbs

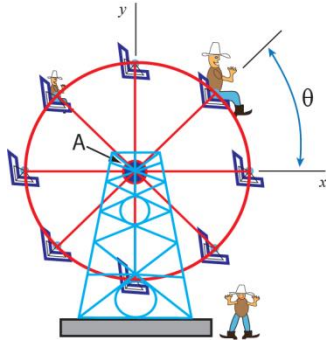


20. (5 points) A 120 lb tightrope walker stands at the center of the rope. If the rope can withstand a maximum tension of 1000 lbs, then the minimum angle the rope can make with the horizontal is closest to . . .

- a. 0.4°
- b. 1.4°
- c. 2.4°
- d. 3.4°
- e. 4.4°
- f. 5.4°

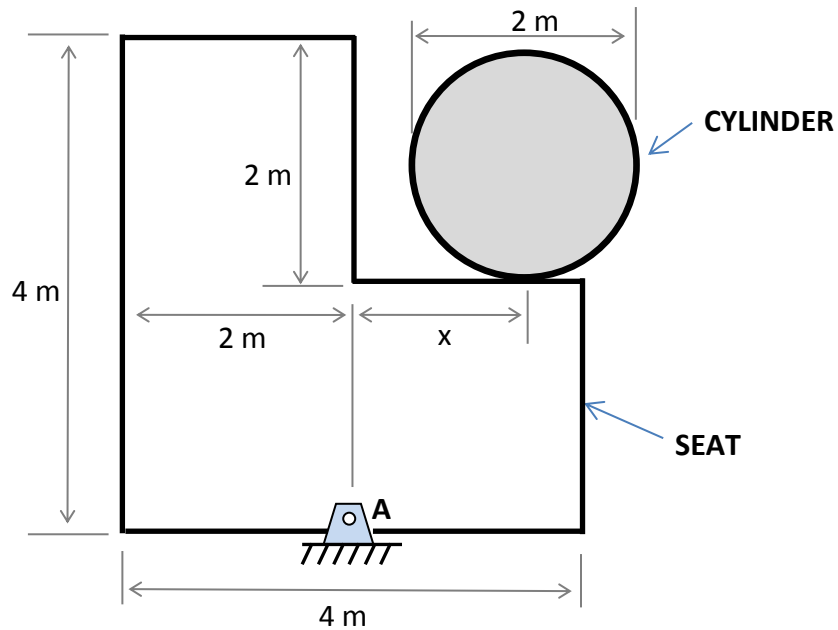
21. (5 points) If Uncle Fred weighs 250 lbs and the radius of the Ferris wheel is 25 ft, then the moment that Uncle Fred makes about the center of rotation of the Ferris wheel when $\theta=20^\circ$ is closest to . . .

- a. 250 ft-lbs
- b. 3800 ft-lbs
- c. 4281 ft-lbs
- d. 4890 ft-lbs
- e. 5110 ft-lbs
- f. 5870 ft-lbs
- g. 6250 ft-lbs

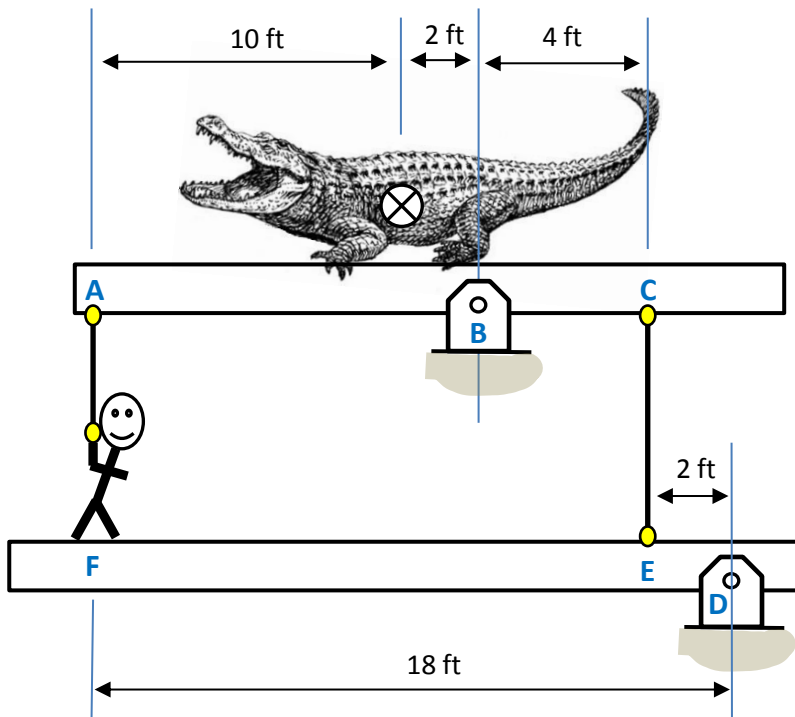


22. (5 points) A 2m diameter cylinder and a seat with the dimensions shown are balanced on a pinned connection at A. If both bodies have a density of 5000 kg/m^3 and a depth into the paper of 1m, the distance x required for the two bodies to perfectly balance on the pinned connection at A is closest to . . .

- a. 1.07m
- b. 1.17m
- c. 1.27m
- d. 1.37m
- e. 1.47m
- f. 1.57m



23. (5 points) A 140 lb engineering student standing on beam DEF pulls vertically downward on a rope attached to beam ABC. A second rope is attached vertically between points C and E. If the alligator weighs 1,000 lbs and the center of gravity of the alligator (the place where the weight can be lumped) is 2 ft. to the left of the pinned connection at point B, then the pulling force of the student is closest to . . .



TIPS:

- neglect the weight of the beams
- draw 2 FBDs, one for each beam
- initially treat this as two separate beam problems, and then combine the resulting equations to solve for the rope tension at A
- the force in a rope is always in tension (can't push with a rope)

- 10 lbs
- 33 lbs
- 44 lbs
- 52 lbs
- 63 lbs
- 109 lbs

Computer Portion: Allowed materials include calculator and computer, pen or pencil.

Honor Statement: On my honor, I promise that I have not received any outside assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, my network connectivity was not turned on, . . .).

_____ signature

Please raise your hand after finishing each problem.

Solve the following equations using Mathcad. **You must utilize a solve block in your solution.**

$$3x^3 + 3y^2 + z = 8$$

$$2x - y + z^2 = 1$$

$$x + y + z = 0$$

Write down your answers here:

x = _____ y = _____ z = _____

- (5 points) The equations are correctly entered into Mathcad in a way that "should" work.
- (5 points) The answers are correct.