Mechanical and Civil Engineering Department

Purdue University Northwest

ME/CE 271 -Basic Mechanics– Fall 2023

Exam #1

Instructor: Dr. Kimia Mortezaei

Student name:

Time: 75 minutes

Important Notes:

1- The exam is closed book, closed notes.

2- You may use a formula sheet and calculator.

3- Turn in your formula sheet with your exam.

4- Clearly show your calculation steps and underline/box your final answers.

5- Carefully read each problem and its pertinent questions. Make sure that you exactly answer to what you are asked for.

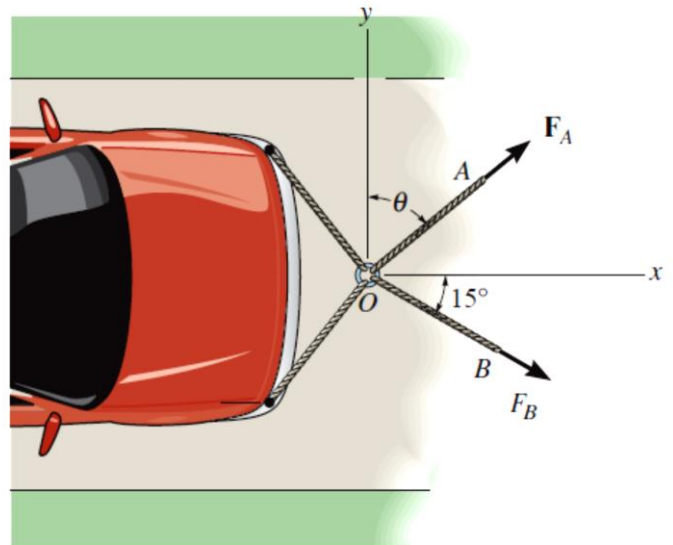6- Present your equations and drawings as clean and clear as possible. *Neatness* matters.

Grade:

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Problem 1:	…….……..	out of 30
Problem 2:	…….……..	out of 30
Problem 3:	…….……..	out of 30
Problem 4:	…….……..	out of 10
Total:	…….……..	**out of 100**

Problem 1)

a) Determine the magnitude of the two towing forces $\mathbf{F}_A$ and $\mathbf{F}_B$ if the resultant force has a magnitude $\underline{F_R = 10 \text{ kN and is directed along the positive } x \text{ axis}}$. Set $\theta = 70°$.

Problem 2)

Determine the unstretched length of *DB* to hold the 40-kg crate in the position shown. Take $k =$ 180 N/m. $\theta = 40°.g = 9.81$ N kg^{-2} m^2
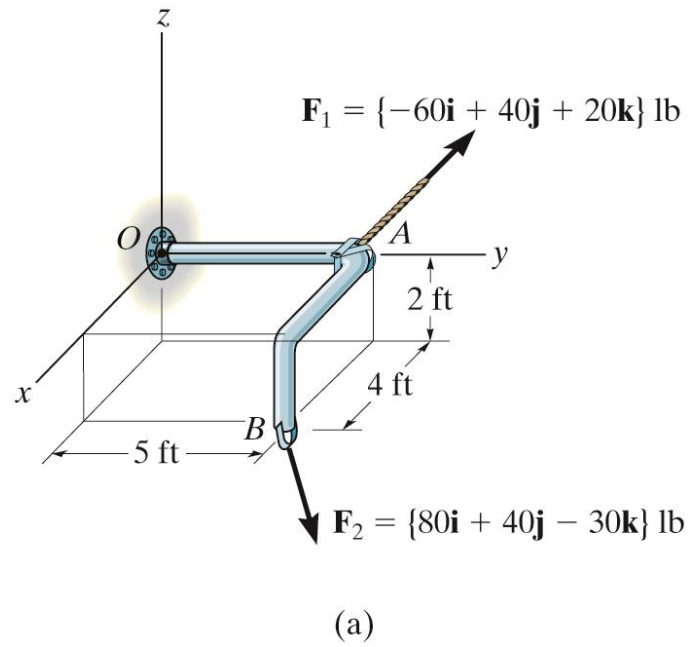
(Draw the FBD for the system.)
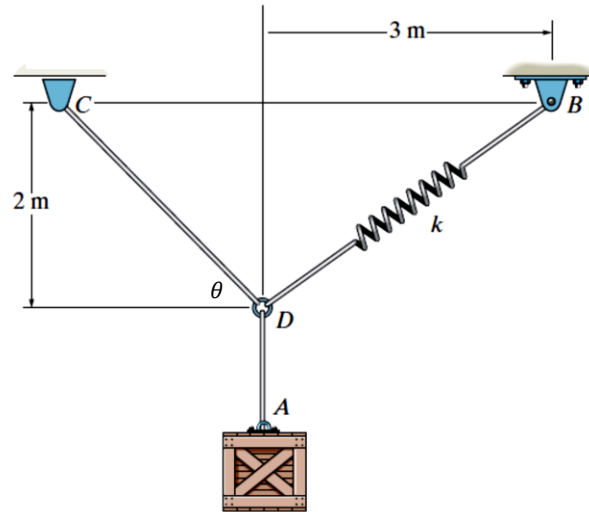
Problem 3)

Find the resultant moment (ΣM) about O for the two forces on the bracket.

Ignore the reactions at O.

$F_1 = \{-60i + 40j + 20k\}$ lb

$F_2 = \{80i + 40j - 30k\}$ lb

(a)

Problem 4) (10 points)

1) The magnitude of a unit vector is _____

2) The dot product of two vectors results in a _____ quantity.

3 If you know only u_A, you can determine the _____ of A uniquely.

    a) Magnitude

    b) angles $(\alpha, \beta \text{ and } \gamma)$

    c) components of A

    d) All of the above.

4) If a dot product of two non-zero vectors is 0, then the two vectors must be _____ to each other.