Candidate's Index Number
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B.ED)
FOURTH YEAR, END-OF-SECOND SEMESTER EXAMINATION, NOVEMBER 2023

10ᵀᴴ NOVEMBER 2023   VECTORS AND MECHANICS   2:40 PM – 4:00 PM

SECTION B
[40 MARKS]

Answer any TWO questions from this Section.
Please, note that if you answer more than two questions, only the first two will be marked.

1.

   a. $ABCD$ is a quadrilateral, with G and H as the midpoints of DA and BC respectively. Show that $\overrightarrow{AB} + \overrightarrow{DC} = 2\overrightarrow{GH}$ **(8 marks)**

   b.   A body weighing 14 N is attached to one end of a light, inextensible string. The other end of the string is fixed to a vertical wall. A horizontal force F holds the body in equilibrium when the measure of the angle between the wall and the string is 60^0. Find:

       i.   T, the tension in the string   **(6 marks)**

      ii.   F, the horizontal force   **(6 marks)**

2.

   a.   If the vectors $a = 2i + 3j$ and $b = mi - 6j$ are perpendicular, find the value of m.   **(5 marks)**

   b.   A car accelerates uniformly from rest to a speed of 40 m/s in 20 seconds. It continues to move at a constant speed of 40 m/s for 30 seconds and then accelerates uniformly from 40 m/s to 60 m/s in 20 seconds. It suddenly applies brakes and comes to rest in 10 seconds.   **(4 marks)**

       i.   Draw a velocity-time graph for the car.   **(3 marks)**

      ii.   Calculate the:

            α.   acceleration of the car for the first 20 seconds.   **(2 marks)**

            β.   total distance the car travelled.   **(4 marks)**

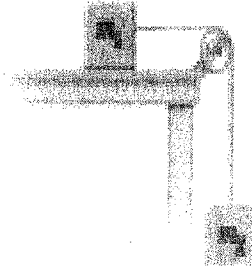   γ.   deacceleration of the car   **(2 marks)**

3.

a. *A, B,* and *C* are the vertices of a triangle with position vectors:

$a = 3i - 4j - 4k, b = 2i - j + k$ and $c = i - 3j - 5k$ respectively.

   i. Show that the vertices *A*, *B* and *C* form a right-angled triangle. **(4 marks)**

   ii. Hence, calculate the area of the triangle *ABC*. **(3 marks)**

b. An object of mass $m_1 = 2.5$ kg placed on a frictionless, horizontal table is connected to a string that passes over a pulley and then is fastened to a hanging object of mass $m_2 = 5.5$ kg as shown in the figure below.

   i. Draw free-body diagrams of both objects. **(3 marks)**

   ii. Find the magnitude of the acceleration of the objects. **(5 marks)**

   iii. Find the tension in the string. [Take $g = 10$ ms^{-2}] **(5 marks)**