

أجب عن الأسئلة التالية

**Question 1:**

a. If  $5\mathbf{A}-4\mathbf{B}=5\mathbf{C}$ ,  $3\mathbf{A}+2\mathbf{B}=3\mathbf{C}$ , then find  $\mathbf{A}$ ,  $\mathbf{B}$  in terms of  $\mathbf{C}$ .

معطى المعادلتين أوجد  $\mathbf{A}$ ,  $\mathbf{B}$  بدلالة  $\mathbf{C}$ .

b- Find the unit vector in the direction of  $\mathbf{A} = 3\mathbf{i} + 4\mathbf{j} - 12\mathbf{k}$ .

أوجد متجه الوحدة في اتجاه  $\mathbf{A}$ .

c- Find the projection of  $\mathbf{A} = 5\mathbf{i} - 9\mathbf{j} + 10\mathbf{k}$  on the line from  $P(4,5,13)$  to  $Q(1,1,1)$ .

أوجد مسقط  $\mathbf{A}$  على الخط الواصل من  $P$  إلى  $Q$ .

**Question 2:**

a- Solve the equation  $\mathbf{r} \times \mathbf{F} = \mathbf{b}$  to find the general solution of  $\mathbf{r}$ , given  $\mathbf{F}$ ,  $\mathbf{b}$ .

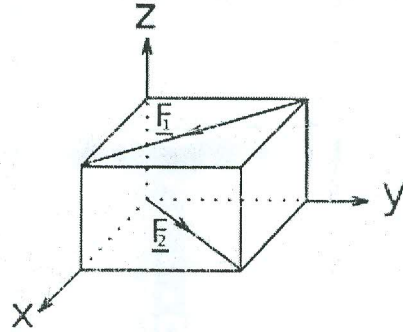
حل المعادلة إذا أعطيت  $\mathbf{F}$ ,  $\mathbf{b}$ .

b- If the force  $\mathbf{F} = 4\mathbf{i} - 8\mathbf{j} + 3\mathbf{k}$  acts at  $P(-3,8,2)$ , find its moment about  $A(2,8,-1)$  and about the axis  $\overline{OA}$ .

القوة  $\mathbf{F}$  تؤثر عند  $P$  أوجد المنحني حول  $A$  وكذلك حول المحور  $\overline{OA}$ .

c- Two forces each of magnitude  $F$  act on the diameters of a cube with side  $a$  as shown. Find the equivalent wrench.

قوتان مقدار كل منهما  $F$  تؤثران على معكب طول ضلعه كما بالشكل. أوجد اللولبية المكافئة  $F$ ,  $P$ .



**Question 3:**

a- A ladder is hold between the floor and a vertical wall. If the coefficient of friction between the ladder and both of the floor and the wall is  $\mu$  find the angle it makes with the floor if it is about to slip.

يرتكز سلم على أرض وحائط رأس. إذا كان معامل الاحتكاك  $\mu$  أوجد الزاوية التي يصنعها مع الأرض إذا كان على وشك الإنزلاق.

## Part (2) Answer the following questions

- b- A particle is moving with simple harmonic motion and while making an excursion from one position of rest to the other, its distances from the middle point of its path at three consecutive seconds are observed to be  $x_1, x_2, x_3$ , prove that the time of a complete revolution is  $2\pi/\cos^{-1}\left(\frac{x_1 + x_3}{2x_2}\right)$ .

### Question four:

- a- A particle is projected from a point  $O$  in a vertical plane with a velocity  $u$  in a direction making an angle  $\alpha$  with the horizon, prove that the path of the particle is given by:  $y = x \tan \alpha - \frac{gx^2}{2u^2 \cos^2 \alpha}$ .
- b- A particle is thrown over a triangle from one end of a horizontal base and grazing the vertex falls on the other end of the base. If  $\theta, \phi$  be the base angles and  $\alpha$  the angle of projection, prove that,  $\tan \alpha = \tan \theta + \tan \phi$ .

### Question five:

One end of an elastic string is fixed and to the other end is fastened a particle heavy enough to stretch the string to double its natural length  $a$ . The string is drawn vertically drawn till it is four times its natural length and then let go. Show

that the particle returns to this point in time  $\sqrt{\frac{a}{g}}\left(2\sqrt{3} + \frac{4\pi}{3}\right)$ .