

14. A particle of mass $2m \text{ kg}$ rests on a rough plane inclined to the horizontal at an angle of $\tan^{-1}(3\mu)$, where μ is the coefficient of friction between the particle and the plane. A particle is acted upon by a force of P Newtons.

(a) Given that the force acts along a line of greatest slope and that the particle is on the point of sliding up, show that the maximum force possible to maintain the particle in equilibrium is $P_{\max} = \frac{8\mu mg}{\sqrt{1+9\mu^2}}$.

(b) Given that the force acts horizontally in a vertical plane through a line of greatest slope and the particle is on a point of sliding down the plane, show that the minimum force required to maintain the particle in equilibrium is $P_{\min} = \frac{4\mu mg}{1+3\mu^2}$

(12 marks)

✓ 15. The table below gives the points awarded to eight schools by three judges J_1, J_2 and J_3 during a music competition. J_1 was the chief judge.

J_1	$\overset{2.5}{72}$	$\overset{5.5}{50}$	$\overset{5.5}{50}$	$\overset{4}{55}$	$\overset{8}{35}$	$\overset{7}{38}$	$\overset{0}{82}$	$\overset{2.5}{72}$
J_2	$\overset{4}{60}$	$\overset{5}{55}$	$\overset{2.5}{70}$	$\overset{7}{50}$	$\overset{7}{50}$	$\overset{7}{50}$	$\overset{1}{73}$	$\overset{2.5}{70}$
J_3	$\overset{5}{50}$	$\overset{40}{7.5}$	$\overset{62}{4}$	$\overset{70}{1}$	$\overset{40}{7.5}$	$\overset{48}{6}$	$\overset{67}{2.5}$	$\overset{67}{2.5}$

(a) Determine the rank correlation coefficient between the judgments of;

(i) J_1 and J_2

(ii) J_1 and J_3

(10 marks)

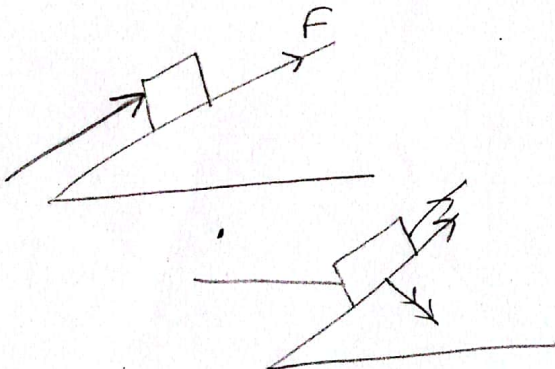
(b) Who of the two other judges had a better correlation with the chief judge? Give a reason.

(02 marks)

✓ 16. (a) Three forces of $(-3\mathbf{i} + b\mathbf{j})\text{N}$, $(2b\mathbf{i} + 3\mathbf{j})\text{N}$ and $(3\mathbf{i} - 4\mathbf{j})\text{N}$ act on a plane at the points $A(-3, 3)$, $B(4, 1)$ and $C(-3, -3)$ respectively. The sum of moments of forces about the origin is 32Nm clockwise. Find the value of b .

(b) ABCD is rectangle in which $AB = 4\text{m}$ and $BC = 3\text{m}$. Forces of 16N , 12N , 4N , 9N and 10N act along AB, BC, CD, AD and DB respectively, their directions given by the order of letters. Find the magnitude and direction of the resultant force.

(12 marks)



END