Pearson Edexcel A Level Mathematics 9MA0

Mechanics – Forces At An Angle

Time allowed: 45 **minutes**

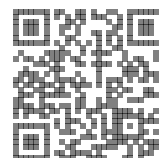**School:** www.CasperYC.club

Name:

Teacher:

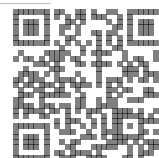| Question	Points	Score
1	9	
2	3	
3	14	
4	9	
5	15	
Total:	50	

How I can achieve better:

-
-
-

1. An object rests on a rough surface and is pushed horizontally with force of 6 N.

   The mass of the object is 5 kg and the coefficient of friction between the object and the surface

   is 0.3.

   (a) Draw a diagram showing all the forces acting on the object. Describe each of the forces [6]
   using words and calculate their values.

   (b) The horizontal force acting on the object is increased to P N. Find the largest value of P [3]
   for which the object does not slip.

   Total: 9

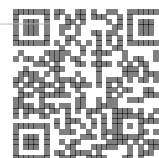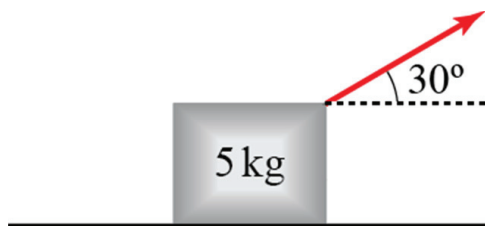2. An object has three different forces F_1 N, F_2 N and F_3 N acting on its centre of mass. [3]

$$F_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad \text{and} \quad F_2 = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$$

The object is in equilibrium. Find F_3.

3. An object resting on a rough surface is attached to a rope angled at 30° to the horizontal. The rope is pulled with a force of P N. The mass of the object is 5 kg.
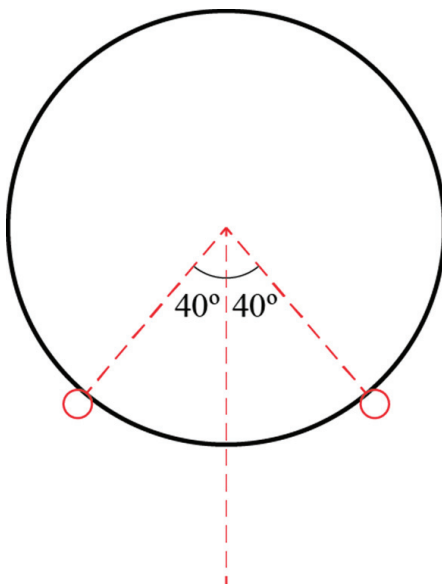

(a) Draw a diagram showing all the forces acting on the object. Describe the origin of each force using words. [4]

(b) By resolving forces in the horizontal and vertical directions, calculate the magnitude of each force in the diagram, giving your answers in terms of P where appropriate. [4]

(c) If $P = 20$, the object does not slip. Use this information to give a bound on μ in the form of an inequality. [6]

Total: 14

(Q3 continued . . .)
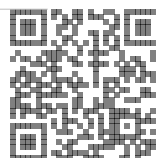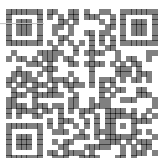
4. A cylindrical object with mass 8 kg rests on two cylindrical bars of equal radius. The lines connecting the centre of each of the bars to the centre of the object make an angle of 40° to the vertical.
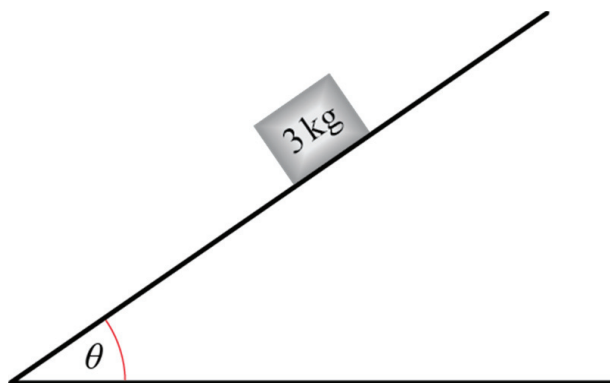

(a) Draw a diagram showing all the forces acting on the object. Describe each of the forces using words. [2]

(b) Calculate the magnitude of the force on each of the bars due to the cylindrical object. [7]

Total: 9

(Q4 continued . . .)
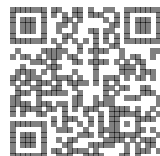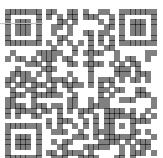
5. An object of 3 kg sits on a plane inclined at an angle θ to the horizontal. The coefficient of friction between the object and the plane is μ. The system is in limiting equilibrium.

(a) Draw a diagram showing all the forces acting on the object. Describe the origin of each force using words.   [3]

(b) By resolving forces in two perpendicular directions, show that.   [6]

(c) Hence, determine whether or not the object slips if $\mu = 0.3$ and $\theta = 30°$.   [4]

(d) As θ approaches 90°, state whether an object of any mass could remain in equilibrium. Explain your answer.   [2]

Total: 15

(Q5 continued . . .)