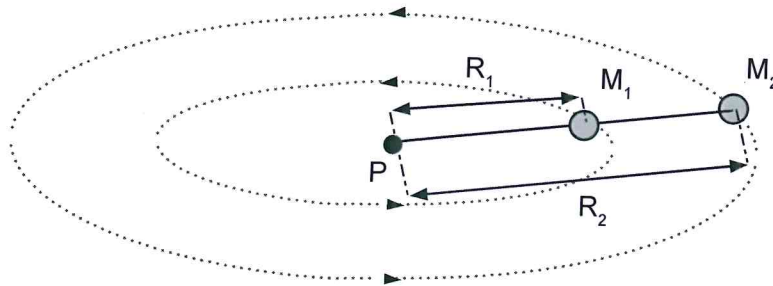


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Question 1

(10 marks)

A string linking two balls M_1 and M_2 , (shown in the figure below) allows them to revolve in circular motion on the horizontal plane with radii R_1 and R_2 . The periods of revolution of M_1 and M_2 are the same and equal to T . Ignore gravitational force and air resistance force.

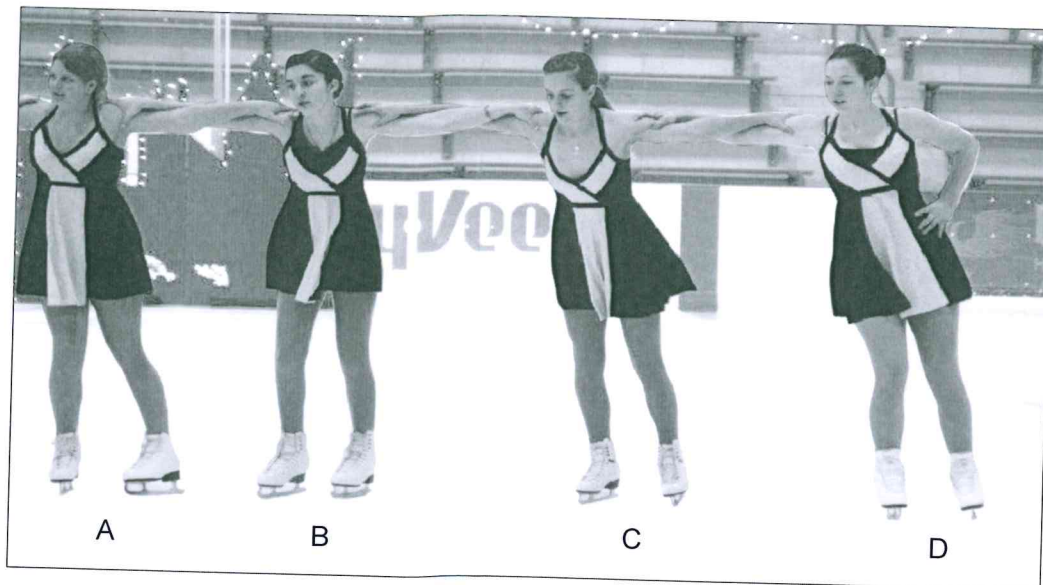


- Draw a free body diagram for M_1 . (3 marks)
- Complete the following for M_1 and M_2 .
 - Write an appropriate expression for the tangential velocity v_1 of M_1 in terms of R_1 , R_2 and T . (2 marks)

Question 2

(3 marks)

Four ice skaters are skating in a line at constant speed, as shown on the picture below.



Use the stick figure below to draw a free body diagram which clearly shows the forces acting on skater C.



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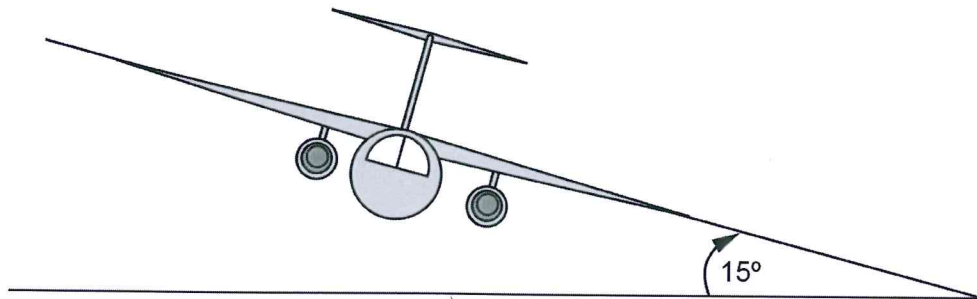
Question 3

page 2

(12 marks)

An aircraft is flying horizontally with a constant speed of 600 km h^{-1} at an altitude of 5000 m . The upward (lift) force provided by the wings that is necessary to keep the aircraft in level flight is $9.80 \times 10^4 \text{ N}$.

- (a) Show that the mass of the aircraft must be $1.00 \times 10^4 \text{ kg}$. (3 marks)
- (b) The pilot begins a turn by tilting the aircraft so that its wings are at 15.0° to the horizontal as shown. Assume that the airspeed does not change, and that the size and angle to the wing of the lift force remain constant.



Draw a free body diagram below labelling the forces acting on the aircraft. Ignore drag/friction and thrust forces directed into and out of the page. (2 marks)

Question 4

(4 marks)

The photograph below shows a cat called Hamish accelerating to catch a feather blowing in the wind. At this point, Hamish has one foot in contact with the ground. Draw vector arrows of the appropriate length on the photograph to show clearly the forces acting on Hamish.

