

# AN ROINN OIDEACHAIS

(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1948.

## APPLIED MATHEMATICS.—Honours.

THURSDAY, 24th JUNE.—AFTERNOON 4 TO 6.

Not more than six questions may be answered. All questions are of equal value.

Mathematical Tables may be obtained from the Superintendent.

1. A liner proceeding on a course  $25^\circ$  North of East appears to be moving N.E. as seen from a tug moving at 10 knots in an easterly direction. Find the speed of the liner.

How much must the tug increase its speed so that the liner will now appear to be moving due North?

2. A piece of uniform wire is bent so as to form three sides AB, BC, CD of a square ABCD. Find the position of the centre of gravity.

If a particle of mass equal to that of the wire is attached at the point D, and the whole is freely suspended at A, find the inclination of AB to the vertical.

3. An engine pulls a train at a uniform speed of 30 miles per hour up an incline of 1 in 100. If the couplings between the train and the engine break, how far will the train continue to run up the incline, if the resistance to its motion is 20 lb. wt. per ton?

4. A football is kicked from a spot on the ground with a velocity of 60 feet per second and strikes a vertical wall 60 feet away at a point 12 feet above the ground. Find the two possible angles of projection.

Using the same initial velocity, what angle of projection will give the greatest height up the wall?

5. A body of mass  $W$  lb. is resting on a rough plane inclined to the horizontal at an angle  $\alpha$ , the coefficient of friction being  $\mu$ . Find an expression for the force acting along the line of greatest slope which will just drag the body up the plane.

Find also an expression for the least force required (when applied in the most suitable direction) to drag the body up the plane, and find the value of this force when  $W=2$ ,  $\alpha=30^\circ$ ,  $\mu=0.5$ .

6. Two masses of 3 and 5 lb. are connected by a light inextensible string of length 2 ft. Both masses rest on a smooth horizontal table, the 3 lb. mass being one foot from the edge of the table and from the 5 lb. mass which is resting at the edge. If the 5 lb. mass is pushed gently over the edge, find the speed of the 3 lb. mass (i) when it is jerked into motion, and (ii) when it reaches the edge of the table.

7. A triangular lamina ABC is immersed in a vertical position in water with its vertex A at the surface and its base BC parallel to the surface. If BC=4 inches and the height of the triangle is equal to 3 inches, find the thrust on ABC due to the water. If D, E are the middle points of AB, AC, respectively, compare the total thrusts on ADE and DECB.

In what ratio must a parallel to BC cut the other sides of the triangle ABC so that the thrusts on the two portions of the triangle may be equal?

[1 cubic ft. of water=62½ lbs.]

8. A mass of 2 lb. fastened to a string 4 ft. long revolves as a conical pendulum, the mass moving in a horizontal circle with a speed of 12 feet per second. Find the tension of the string and its inclination to the vertical.

9. What is Simple Harmonic Motion? What is meant by the period, amplitude, and frequency of a S.H.M.?

A particle is moving in S.H.M. of period 6 seconds and amplitude 5 cm. Find the displacement, speed and acceleration of the particle 1 second after it reaches its maximum positive displacement.