

# AN ROINN OIDEACHAIS

(Department of Education)

## BRAINSE AN MHEÁN-OIDEACHAIS

(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1961.

### APPLIED MATHEMATICS.—Honours.

MONDAY, 19th JUNE.—MORNING, 10 TO 12.30.

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

Mathematical Tables may be obtained from the Superintendent.

1. ABC is a triangle in which  $BC=8''$ ,  $\cos B=\frac{1}{2}$ ,  $\cos C=\frac{1}{4}$ . Forces of 3, 12, 7 lb. wt. act along BA, BC, CA, respectively. How far from B does the line of action of their resultant cut BC ?

Find the magnitude of the resultant in lb. wt., correct to one place of decimals, and find the angle which its line of action makes with BC, correct to the nearest degree.

2. Explain the terms "limiting friction," "coefficient of friction."

When a truck is ascending an incline of 28 in 100 with a uniform acceleration of 1.6 ft. per sec. per sec., a box on the floor of the truck is just about to slide backwards. Show by diagram the forces acting on the box, and find the coefficient of friction between the box and the floor of the truck.

3. A man is cycling at 10 m.p.h. in a steady wind. When he cycles in a direction  $30^\circ$  north of east the wind appears to him to blow directly from the east. When he cycles due east the wind appears to him to blow from the south-east. Find the velocity of the wind in magnitude and direction.

4. Two bodies, of mass 50 gm. and 350 gm. respectively, are lying on a smooth horizontal bench which is  $10\frac{1}{2}$  feet high. The 50 gm. body is at the edge of the bench and the 350 gm. body is 4 feet away in a direction perpendicular to the edge, the bodies being connected by a light inextensible string 8 feet long. If the 50 gm. body is pushed gently over the edge, find how many seconds later it will reach the ground.

5. Derive an expression for the total time of flight of a projectile in terms of its initial velocity and angle of projection.

A, B, C, are three collinear points on a horizontal plane. A projectile fired from A passes over B at a height of 21 feet and reaches its greatest height as it passes over C. If  $BC=48$  feet and the total time of flight of the projectile is  $2\frac{1}{2}$  seconds, find its initial velocity.

6. A mass of 4 lb. suspended from a fixed point by a light inextensible string 2 feet long acts as a conical pendulum, the mass describing a horizontal circle at a uniform rate of 60 revolutions per minute. Find the tension in the string, in lb. wt., and the inclination of the string to the vertical.

7. A particle is moving along a straight line so that its distance  $x$  (cms.) from a fixed point  $O$  at time  $t$  (secs.) is given by the formula

$$x = 5 \sin 2t.$$

Show that the motion is simple harmonic and find the periodic time and the maximum velocity.

If the velocity of the particle at  $P$  is 6 cm. per sec., find its acceleration at  $P$ , and find the least time the particle takes to travel to  $P$  from  $O$ . [See Tables, p. 30].

8. A triangular lamina  $ABC$  is immersed in liquid of specific gravity 0.9 so that the vertex  $A$  is at the surface and the side  $AC$  is vertical. If  $AB=5''$ ,  $BC=3''$ ,  $CA=4''$ , find the thrust of the liquid on  $ABC$  in ounces.

$P$  is a point on  $AC$  such that the thrust of the liquid on  $ABP$  is five-ninths of the thrust on  $ABC$ . Find the length of  $AP$ .

[A cubic foot of water weights  $62\frac{1}{2}$  lb.]

9.  $ABCD$  is a quadrilateral lamina in which  $AB=10''$ ,  $AC=6''$ ,  $BC=8''$ ,  $AD=DC=5''$ . Find the perpendicular distance of the centre of gravity of  $ABCD$  from  $AC$ .

Find, also, the perpendicular distance of the centre of gravity of  $BCD$  from  $AB$ .