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(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS

(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1952.

APPLIED MATHEMATICS.—Honours.

THURSDAY, 19th JUNE.—MORNING, 10 TO 12.

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

Mathematical Tables may be obtained from the Superintendent.

1. A light string ABCD hangs from two fixed points A, D which are in the same horizontal line. The string carries a weight of 10 lb. at B and a weight of W lb. at C. The angles DAB, ABC, BCD are 45° , 150° , 120° , respectively. Find, graphically or otherwise, the value of W .

2. A uniform ladder, of weight W lb. and length l ft., rests with one end in contact with a smooth vertical wall and the other end in contact with a rough horizontal plane, the inclination of the ladder to the horizontal being 30° . A man of weight $2W$ lb. can ascend just $\frac{1}{3} l$ ft. up the ladder without causing the ladder to slip. Find μ , the coefficient of friction between the ladder and the plane.

3. A uniform wire, weighing 2 ounces, is bent so as to form an isosceles triangle ABC in which $AB=AC=5$ inches, and $BC=6$ inches. Find the position of the centre of gravity.

What weight must be attached at A so that AC will be horizontal when the triangle is suspended at B?

4. A train which is being uniformly retarded covers two successive stages, each $\frac{1}{4}$ mile in length, in 20 seconds and 30 seconds, respectively. Find the uniform retardation and find how much farther the train will travel before it comes to rest.

5. A car weighing one ton is ascending an incline of 1 in 160 and is accelerating uniformly at the rate of 2 feet per sec.² If the frictional resistances to motion are equivalent to 35 lb. weight, find the horse-power at which the car is working when its speed is 20 m.p.h.

6. A railway engine weighing 40 tons travels at 30 m.p.h. round a curve of 200 yards radius on a level track. The distance between the rails is 5 feet, and the centre of gravity of the engine is 6 feet above the rails and midway between them. Find the vertical pressure upon each of the rails.

What is the maximum speed at which the engine could travel round the curve without losing contact with one of the rails ?

7. A particle is projected from ground level so as just to clear a vertical tower 96 feet high which is standing on a horizontal plane. As the particle passes over the tower its velocity is 80 feet per second in a direction making an angle of 30° above the horizontal. Find the horizontal distance from the foot of the tower (*a*) to the point where the particle hits the ground, (*b*) to the point of projection.

8. What is Simple Harmonic Motion ?

A particle is moving with Simple Harmonic Motion. When it is 4 feet from its mean position its velocity is $4\frac{1}{2}$ feet per second and its acceleration is 9 feet per second.² Find the amplitude and the period of the motion.

Where would the particle be two-thirds of a second after passing through its mean position ?

9. A rectangular dock-gate is 8 feet in width. The water on one side of it is 10 feet deep and on the other side it is 4 feet deep. Find the resultant thrust on the gate, in tons.

To what height must the level of the water on the lower side be raised so that the thrust on that side may be equal to half the thrust on the deeper side ?

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