AN ROINN OIDEACHAIS

(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1946.

APPLIED MATHEMATICS.—Honours.

SATURDAY, 22nd JUNE.—AFTERNOON 2 TO 4.

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

Mathematical Tables may be obtained from the Superintendent.

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1. A train travelling at 44 feet per second is brought to rest, its speed after t secs. being given by the table :

t secs.	0	5	15	25	35	40	50
v ft./sec.	44	36	24	14.5	8	5	0

Draw the velocity-time graph. Find, approximately, (i) how far the train travelled in the 50 secs., (ii) the retardation when $t=25$.

2. A gate weighing 240 lb. has its centre of gravity $3\frac{1}{2}'$ from the line of hinges which are $3'$ apart. A boy weighing 100 lb. stands on the gate so that his weight acts at a distance of 4 ft. from the line of hinges. If the force on the upper hinge is horizontal, find its magnitude and the reaction at the lower hinge in magnitude and direction.

3. A uniform beam AB of weight 100 lb. and of length $16'$ rests with the end A on a rough horizontal plane, the end B being connected by means of a light wire with a point C $20'$ vertically above A. The beam is inclined at an angle θ to the vertical. By taking moments about B and C find the horizontal and vertical components of the reaction at A. If the coefficient of friction is $\frac{1}{3}$, find the greatest value of θ so that slipping may not occur at A.

4. A uniform rectangular board ABCD has $AB=12''$, $AD=8''$. A square hole of side $2''$, the distances of whose centre from AB and AD are $4''$ and $3''$ respectively, is cut in the board. The hole is filled to the same thickness as the original board with metal whose specific gravity is 10 times that of the material of the board. Find the position of the centre of gravity.

5. A coach is slipped from a train travelling at 60 m.p.h. The resistance due to brakes, etc., being 60 lb. per ton, find what distance it travels before coming to rest and the time taken.

6. A man projects a ball from a height of 3 ft. above the ground at an angle of 30° with the horizontal and with a velocity of 64 ft./sec. The ball is caught by another man when it is at a height of 1 ft. from the ground. How far apart are the two men ? Find also the magnitude and direction of the velocity of the ball when caught by the second man.

7. A ship A is sailing due North at a speed of 12 miles per hour. A ship B, 8 miles due west of A, is sailing due East at the rate of 9 miles per hour. Find (i) the relative velocity of B with respect to A, (ii) how far the ships are apart when B is due South of A, (iii) after what time the ships are closest to one another.

8. An engine which weighs 9 tons passes round a curve of radius 3,000 ft. with a speed of 30 miles per hour. What horizontal pressure in lb. wt. must be exerted by the outer rail if both rails are on the same level ? If the distance between the rails is 5 ft. find to the nearest inch the height of the outer rail above the inner so that the lateral thrust may be avoided.

9. A body is moving in a straight line with simple harmonic motion, the amplitude being 6″ and the period 3 secs. Find the velocity and the acceleration 1 sec. after passing the mid-position.