# AN ROINN OIDEACHAIS

(Department of Education).

## BRAINSE AN MHEADHON-OIDEACHAIS

(Secondary Education Branch).

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## LEAVING CERTIFICATE EXAMINATION, 1925

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### PASS

### APPLIED MATHEMATICS.

*WEDNESDAY, 24th JUNE.*—AFTERNOON, 4 *to* 6 P.M.

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[*Six* questions may be answered, and the marks will be awarded on the first six answers left uncancelled.]

[Tables of measures and constants, and of logarithms may be obtained from the Superintendent.]

1. A force of 14·54 units makes an angle of 52° 25′ with a line $OX$. Find the rectangular components of the force along, and perpendicular to, $OX$. If another force of 12·25 units acts along $OX$, what is the resultant of the two forces?

2. Define 'moment of a force.'

A uniform plank $AB$, 20 feet long and weighing 180 lbs., rests horizontally on two supports, one at $A$ and the other at $C$ 15 feet from $A$. A weight of 300 lbs. can be moved along the plank. Find expressions for the pressures on the two supports when the weight is $x$ feet from $A$. Draw a rough diagram showing how the pressure on $A$ varies as the weight is moved from $A$ towards $B$, as long as equilibrium is maintained. Find the position of the weight when the plank just lifts off the support at $A$.

3. A body is projected upwards at 45° to the horizontal with a velocity of 62 miles per hour. Neglecting air resistance, find its velocity in magnitude and direction after 1·5 seconds.

4. What do you understand by the acceleration due to gravity? How can it be measured practically?

A mass of $w$ lbs. rests on a smooth inclined plane. It is connected by a string passing over a small smooth pulley at the top of the inclined plane to a mass of $W$ lbs. which hangs vertically.

If the plane is inclined at an angle $A$ to the horizontal, find the acceleration of the mass on the plane and the tension in the string.

5. The velocity of a point is graphed against the time. Show generally that the space described in time $t$ is represented by the area under the curve bounded by the axes and the ordinate at $t$. Hence establish the formula $s = ut + \frac{1}{2}ft^2$ for uniformly accelerated motion.

A body projected vertically downwards described 720 feet in $t$ seconds and 2240 feet in $2t$ seconds; find $t$ and the velocity of projection.

6. Define 'centre of gravity.'

A body has one point only fixed. Show that it cannot remain permanently at rest unless its centre of gravity occupies the lowest possible position.

From a circular disc of metal of radius 9 inches a circular piece having its centre 3 inches from that of the disc is cut out. If the radius of this piece is 4 inches, find the centre of gravity of the remaining portion.

7. An engine and tender weigh $w$ tons; the rest of the train weighs $W$ tons. The average resistance to motion is $R$ lbs. per ton. The train starts from rest and in $t$ minutes attains a speed of $v$ feet per second. What was the average pull on the draw-bar between the tender and the first carriage? Find also the horizontal force exerted by the *engine wheels* on the rails.

Work out your answers for the case: $w = 80$, $W = 200$, $R = 16$, $t = 2$, $v = 13\frac{5}{7}$.

8. Explain 'relative velocity.' What is the direction of the relative motion of the extremities of a rigid rod?

In the diagram $OB$ is a crank revolving about $O$, the speed of $B$ being 40 feet per second. A rod $AB$ is freely jointed to $OB$ at $B$ and $A$ moves along $OA$. If $OB = 1{\cdot}5$ feet and $AB = 4$ feet, find the velocity of $A$ when $\angle AOB = 30°$.