

AN ROINN OIDEACHAIS  
(Department of Education.)

BRAINNSE AN MHEADHON-OIDEACHAIS  
(Secondary Education Branch).

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LEAVING CERTIFICATE EXAMINATION, 1940.

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PASS.

APPLIED MATHEMATICS.

THURSDAY, 20th JUNE.—AFTERNOON 4 TO 6 P.M.

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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. If two forces  $P$  and  $Q$  act at a point, show that the magnitude of the resultant is equal to  $\sqrt{P^2+Q^2+2PQ \cos\alpha}$ , where  $\alpha$  is the angle between the directions in which the forces act.

Calculate, in lb. wt. to one decimal place, the value of the resultant in the case when  $P=2$  lb. wt.,  $Q=3$  lb. wt., and  $\alpha=50^\circ$ .

2. A uniform bar 12 feet long rests horizontally on two pegs which are 3 feet apart. A weight of 25 lb. suspended from one end, or a weight of 10 lb. suspended from the other end, will just tilt the bar up. Find the weight of the bar.

3. A uniform rod  $AB$  of weight 10 lb. rests with one end  $A$  on a smooth horizontal plane and with the other end  $B$  on a smooth plane which is inclined to the horizontal at an angle of  $60^\circ$ . The rod is inclined to the horizontal at an angle of  $30^\circ$  and is kept in equilibrium by a horizontal force applied at  $A$ . Find the magnitude of this horizontal force.

4. What is meant by "conservation of momentum"?

A block of wood of mass one kilogramme is suspended by a string. A bullet of mass 10 grammes is fired at a velocity of 500 metres per second into the block and becomes embedded in it. Find the velocity with which the block moves immediately after the impact.



5. A rectangular sheet of cardboard 8 in. by 6 in. has a circular piece of one inch radius cut out of it. The centre of the circle is on a diagonal 3 in. from one corner. Find, to the nearest tenth of an inch, the distance of the centre of gravity of the remainder from that corner.

6. Prove the formula  $s=ut+\frac{1}{2}ft^2$ , for motion in a straight line with constant acceleration  $f$ .

From a balloon which is ascending vertically at 16 feet per second a stone is let fall and reaches the ground in 20 seconds. How high was the balloon when the stone was dropped?

7. An aeroplane flies at 150 miles per hour in still air. The wind is blowing from the South-West at 20 miles per hour. In what direction should the aeroplane steer in order that it may actually go North-West and what will be its velocity in this direction?

[A graphical solution will be accepted.]

8. A bullet is projected with an initial velocity of 1,280 feet per second at an angle of  $15^\circ$  with the horizontal. Find the time of flight and the range on the horizontal plane.

9. Two masses of 7 and 9 ounces respectively are connected by a light inextensible string which passes over a light smooth pulley. Find the resulting motion of the system and the tension of the string.

Show that during the motion the pressure on the axle of the pulley (ignoring the weight of the pulley) is less than the sum of the weights of the particles.