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(Department of Education)

BRAINSE AN MHEÁN-OIDEACHAIS
(Secondary Education Branch)

LEAVING CERTIFICATE EXAMINATION, 1961.

APPLIED MATHEMATICS—PASS.

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.

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1. Forces of 4, 3, 5 lb. wt. act along the lines OA, OB, OC, respectively, where $\angle AOB=60°$, $\angle BOC=90°$, $\angle AOC=150°$. Find the components of their resultant along OB and along OC.

Find, also, the angle which the line of action of the resultant makes with OB.

2. A non-uniform beam AB is 10 feet long and weighs 150 lb. When it is suspended horizontally by means of two light vertical ropes, attached to it at A and B, respectively, the tension in the rope at A is 60 lb. wt. Find how far the centre of gravity of the beam is from A.

If a mass of 100 lb. is then placed on the beam at a point P, the tension in the rope at A will then be 130 lb. wt. Find the length of AP.

3. Explain the terms "limiting friction," "coefficient of friction." A 10 lb. block is lying at rest on a rough plane inclined to the horizontal at an angle of 30°, the coefficient of friction between the block and the plane being 0·8. What force, acting along the line of greatest slope, would just cause the block to move up the plane ?

4. State the theorem of the Triangle of Forces. A uniform bar XY which weighs 3 lb. is supported by two strings XZ, YZ attached to a fixed peg Z. XZ=8″, YZ=6″, and ZL=6″ where L is the middle point of XY. By joining L to the middle point of YZ, or otherwise, find the tensions in the strings.

5. Explain the terms work, energy, power.
Find the horse-power at which an engine is working if it raises nine tons of soil through $5\frac{1}{2}$ feet in an hour.

Find, in ft. lbs., the kinetic energy of a body of mass 3 lb. moving with a uniform velocity of 8 ft. per sec.

6. A ship is travelling at 15 knots in a direction 30° north of east. To an observer on that ship another ship appears to be travelling at 7 knots in a direction 30° north of west. Find the actual velocity of the second ship in magnitude and direction, graphically or otherwise.

7. An engine, pulling a carriage, is travelling at a steady speed. At a point A the carriage is slipped from the engine and is uniformly retarded so that it comes to rest at B, where AB=100 yards. If the engine travels at the same steady speed throughout, show that it will be 100 yards beyond B when the carriage stops.

8. A stone is thrown vertically downwards from the top of a tower, 420 ft. high, with an initial velocity of 4 ft. per sec. Find how long it will take to reach the ground and find at what height above the ground its velocity will be 100 ft. per sec.

9. A rectangular trough, 2 feet long and 1 foot wide, contains water to a depth of 18 inches. Find the total thrust on the base due to the water.

A plane lamina of area 19·2 sq. ins. is immersed horizontally in the water at a depth of 9 inches. Find the thrust on the lamina.

[A cubic foot of water weighs 62½ lb.].