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LEAVING CERTIFICATE EXAMINATION, 1953.

APPLIED MATHEMATICS—PASS.

WEDNESDAY, 17th 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.

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1. Forces of 4 and 3 lb. wt. act along the lines OP and OQ respectively, the angle POQ being 40°. Find the magnitude of their resultant in lb. wt., correct to one place of decimals.

Find, correct to the nearest degree, the angle which their resultant makes with OP.

2. A uniform beam AB is 2 feet long and weighs 20 lb. The beam rests horizontally on two supports, one at the end A and the other at the end B. A mass of 10 lb. is placed on the beam at a point 6 inches from A. Find the pressure on each support.

At what point should the mass of 10 lb. be placed so that the pressure at B may be 6 lb. greater than the pressure at A ?

3. Explain the term "coefficient of friction."

A block weighing 5 lb. is resting on a plane making an angle of 30° with the horizontal. A force of 6 lb. wt. acting along the line of greatest slope will just cause the block to move up the plane. Find the coefficient of friction between the block and the plane.

What force acting along the line of greatest slope would just cause the block to move down the plane ?

4. A stone is thrown vertically upwards from ground level with an initial velocity of 100 ft. per sec. Find

(i) the greatest height reached ;

(ii) the time the stone takes to return to ground level ;

(iii) the times after projection at which the stone is at a height of 100 feet.

5. Two stations A and B are 10 miles apart. A train starts from rest at A with a constant acceleration and attains a speed of 30 m.p.h. in 5 minutes. It continues at a steady speed of 30 m.p.h. for a further 12 minutes, and is then retarded uniformly so that it comes to rest at B. Find the uniform retardation, in ft. per sec.^{2}, and find the average speed of the train for the journey from A to B.

6. A piece of uniform wire is bent so as to form a right angle, the arms being three inches and four inches long, respectively. Find the distance of the centre of gravity from each of the arms.

If the wire is suspended at the vertex of the right angle so that it hangs freely, what angle will the longer arm make with the vertical ?

7. A car weighing 25 cwt. is travelling at 45 m.p.h. on a level road. If the frictional resistances to motion are equivalent to 50 lb. wt. per ton, find the horse-power at which the car is working.

Working at the same horse-power, at what speed could the car ascend an incline of 1 in 140, frictional resistances being the same as on the level road ?

8. Prove Lami's theorem, i.e., if three forces acting at a point are in equilibrium, then each force is proportional to the sine of the angle between the lines of action of the other two.

A mass of 5 lb. is supported at O by two strings OA and OB which are attached to fixed pegs A and B. If OA and OB are inclined to the vertical at 30° and 40°, respectively, find the tensions in the strings, graphically or otherwise.

9. A rectangular trough, 3 feet long and 2 feet wide, is filled to a depth of 4 feet with a liquid of specific gravity 0·7. Find the total thrust of the liquid on the base of the trough.

A block of wood of specific gravity 0·4, having a volume of 1·2 cubic feet, is then allowed to float on the liquid. Find (i) the increase in the total thrust on the base, (ii) the increase in height of the level of the liquid.

[A cubic foot of water weighs 62·5 lb.]