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Geometry and Mechanics (2nd Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

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COURSE IN BUILDING.

(33)

AN ROINN OIDEACHAIS.

(Department of Education.)

BRAINSE AN CHEARD-OIDEACHAIS.

(Technical Instruction Branch.)

TECHNICAL SCHOOL EXAMINATIONS.

1933.

GEOMETRY AND MECHANICS.

(Second Year.)

Monday, May 22nd—7 to 10 p.m.

Examiner—JOSEPH GANNON, ESQ., B.SC., B.E.

Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.C.S.C.I.

GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any book, notes or scribbling-paper, except the book of logarithms supplied to you.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate; and no explanation of the subject of the examination may be asked for or given.

You must remain seated until your Answer Book has been taken up, and then leave the examination-room quietly. You will not be permitted to leave before the expiration of twenty minutes from the beginning of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means, you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

Three hours are allowed for this paper. Answer Books, unless previously given up, will be collected at 10 p.m.

INSTRUCTIONS.

Read the General Instructions on page 1.

(a) The working of the questions and the answers must be in *ink*.

(b) Diagrams and drawings must be made in *pencil*.

(c) Full credit cannot be obtained for any question unless all the calculations are shown clearly, and construction-lines definitely indicated.

Where calculations are made with the aid of the slide-rule, a note should be made in the margin thus—(S.R.).

(d) Not more than *seven* questions in all may be attempted, of which not more than *four* may be taken from either Section. Equal values are assigned to the questions.

(e) Write the number of the question before the answer.

NOTE.—You are expected to make neat and correct diagrams. Books of logarithmic and trigonometrical tables (four places) are provided. You may use a slide-rule and drawing instruments.

SECTION I.

(Not more than four of the seven questions you may attempt may be taken from this section).

1. Draw the box shown in Figure 1 to a scale of half-inch to one foot. Find:—

(a) true shape of side;

(b) angle between two adjacent sides.

2. An elliptic arch has a span of 18 feet and a rise of 6 feet. Construct the arch to scale and draw a tangent and normal at a point midway between the centre and one end.

3. The box in Question 1 is lined with 7 lb. lead. Find the weight of the lead used.

4. Draw a stress diagram for the truss shown in Figure 2; assume trusses to be 10 feet apart and the load to be 40 lbs. per sq. foot.

5. Figure 3 represents the plan and elevation of a cone cut by a plane AB. Draw development of ABC.

6. A rectangular house 20 feet long and 15 feet wide has a slated roof with hipped ends, slope 30 degrees and eaves 9 inches. Find:—

(a) cost of slating at £30 per mille;
(120 slates will cover 100 sq. feet. 1 mille=1,200 slates.)

(b) length of ridge and hip tiles required.

7. Figure 4 is a plan of a factory floor supported by girders at 10 feet centres. The floor consists of 6-inch concrete (150 lbs. per cubic foot) and is to support a load of 200 lbs. per sq. foot. Find the load on each girder.

SECTION II.

(Not more than four of the seven questions you may attempt may be taken from this section.)

8. Find stress in AB in Figure 5.

9. A steel girder 20 feet long and weighing 100 lbs. per foot lineal, is lifted to the top of a building 40 feet high. Find:—

(a) section of cable required assuming working stress to be 3 tons per sq. inch;

(b) H.P. of crane motor if lift is accomplished in 10 seconds.

10. Figure 6 is a section of a house. Find pressure per sq. foot on ground in foundation. (Neglect weight of ground floor.)

Concrete—150 lbs. per cubic foot.

First floor load—80 lbs. per sq. foot.

Roof load—30 lbs. per sq. foot.

11. Figure 7 represents a winch lifting load W. If a man exerts a force of 40 lbs. at the end of the handle, assuming an efficiency of 70%, find:—

(a) W;

(b) the velocity ratio.

12. A tree trunk 10 feet long tapers fairly uniformly from end to end. Its cross sectional area at the thick end is $4\frac{1}{2}$ sq. feet and at the thin end 2 sq. feet. It is sawn into ten one-foot lengths and the areas, in square feet, of the nine sections are 2, 2, $2\frac{1}{2}$, $2\frac{1}{2}$, $2\frac{1}{2}$, 3, 3, 4, $4\frac{1}{2}$. Calculate the volume of the trunk.

13. Five forces, A, B, C, D, E, act towards the point O. Force A acts vertically upward and the directions of the others are inclined to that of A at angles (measured clockwise) of 45° , 135° , 180° and 240° respectively. The magnitudes of the forces are $A=10$ lbs., $B=12$ lbs., $C=20$ lbs., $D=15$ lbs., $E=5$ lbs. Determine the resultant of these forces.

14. State what you understand by "centre of gravity." Why is a stool with legs tapering outwards from the seat more stable than one with vertical legs? Find the centre of gravity of the section shown in Figure 8.

Geometry and Mechanics.

Fig. 2.

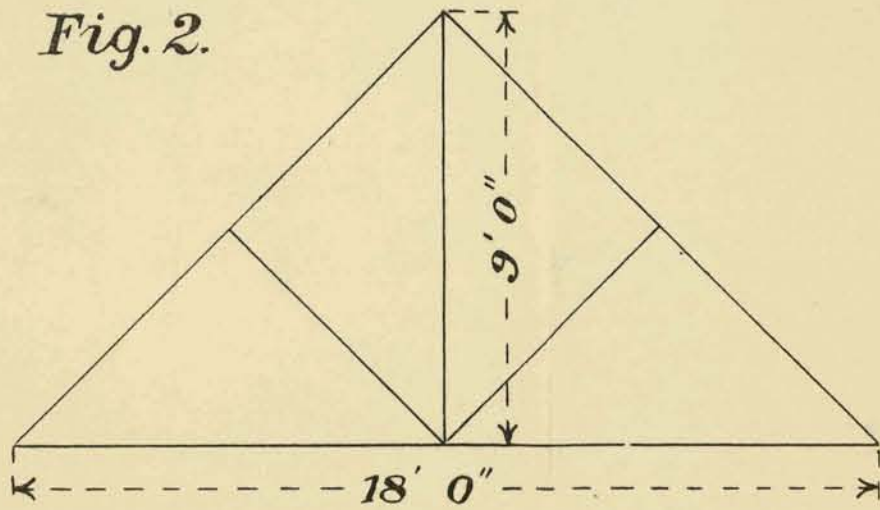


Fig. 1.

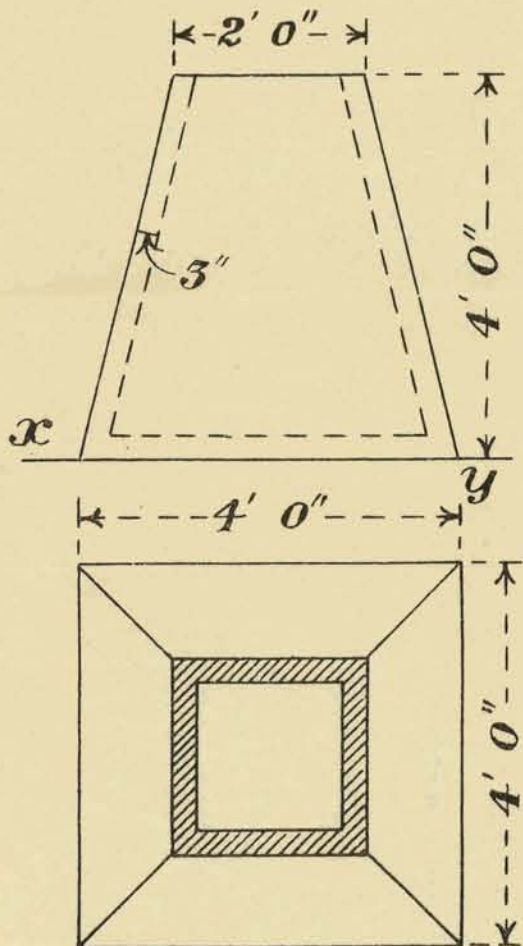


Fig. 3.

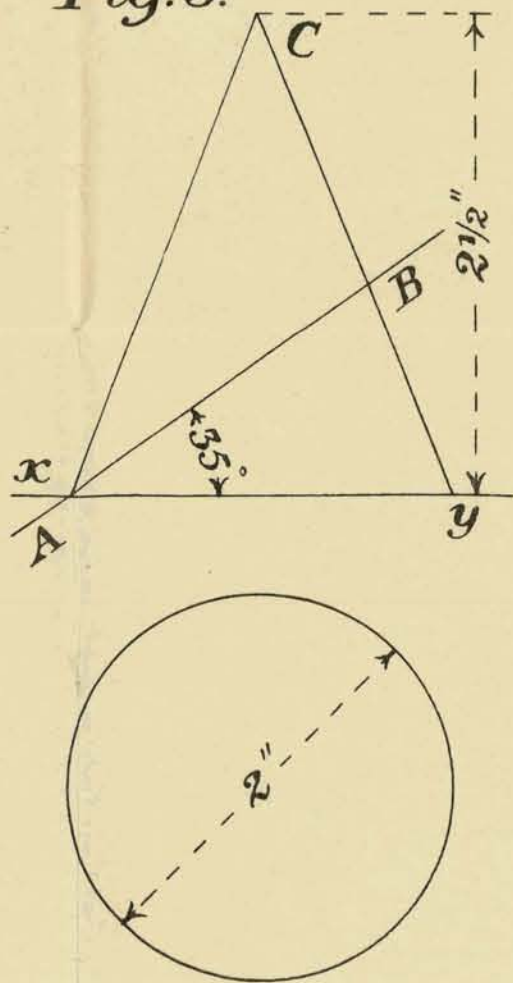


Fig. 4.

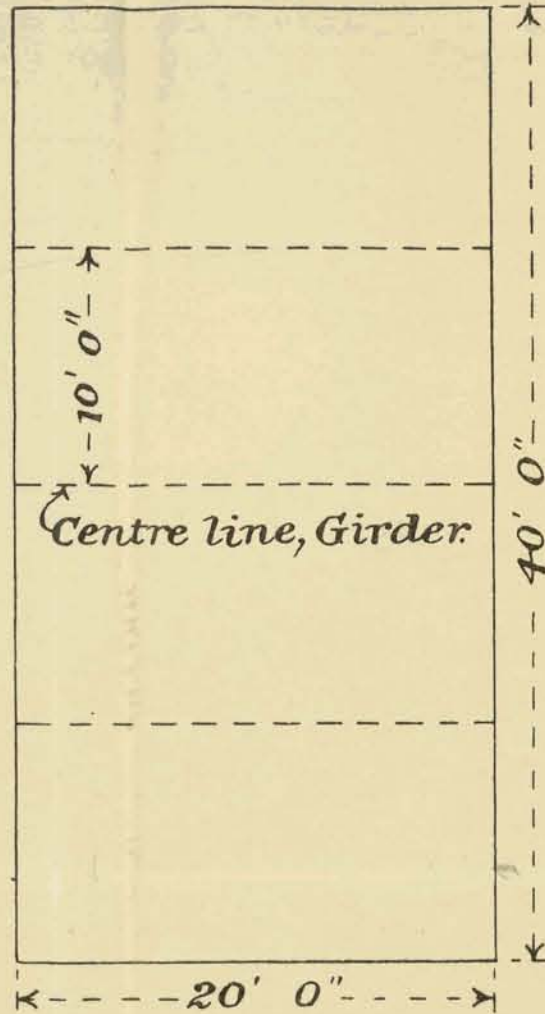


Fig. 6.

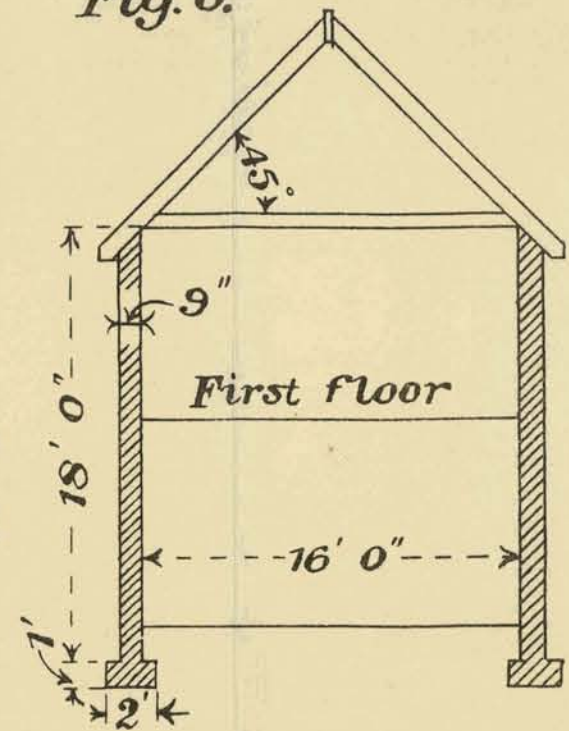


Fig. 5.

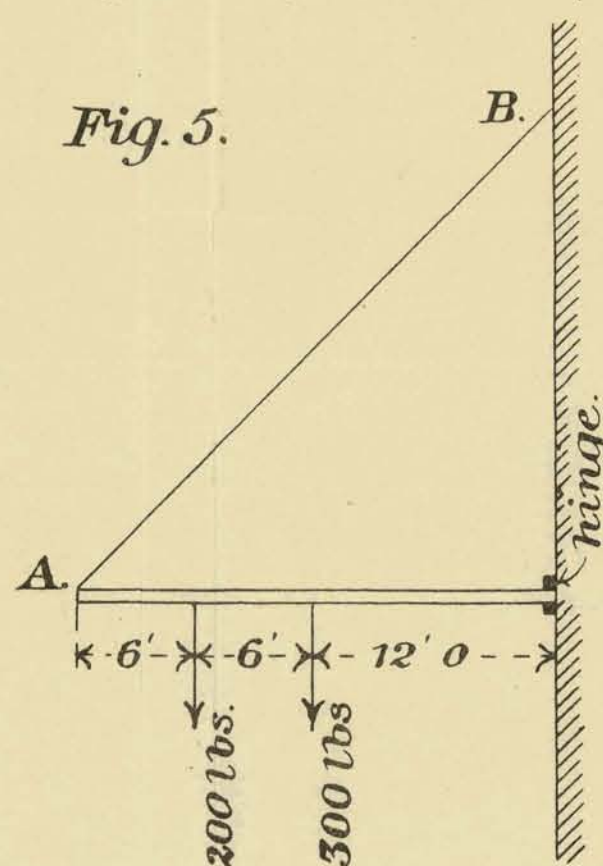


Fig. 7.

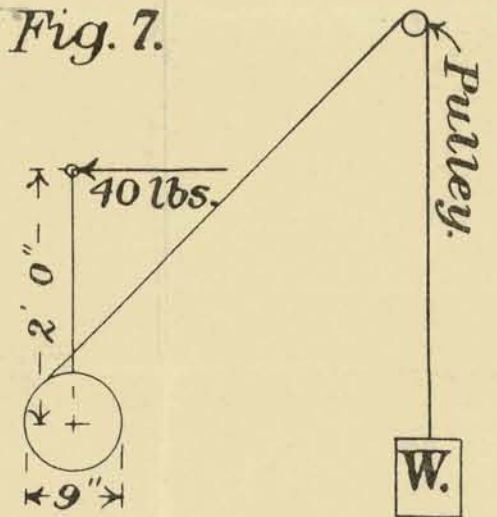


Fig. 8.

