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Mathematics and Geometry (1st Year): Technical School Examinations 1934

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COURSE IN BUILDING.

AN ROINN OIDEACHAIS.
(Department of Education.)

BRAINSE AN CHEARD-OIDEACHAIS.
(Technical Instruction Branch.)

TECHNICAL SCHOOL EXAMINATIONS.
1934.

MATHEMATICS AND GEOMETRY.
(First Year.)

Thursday, May 17th—7 to 10 p.m.

Examiner—F. W. WARWICK, ESQ., B.A., B.E., A.R.C.SC.I.
Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.C.SC.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. Find the values of the following :—

(*a*) $(3\frac{1}{8}+2\frac{1}{16}+\frac{3}{32}+\frac{1}{4}+1\frac{7}{32}+\frac{5}{16})$

(*b*) $\{(5-4{\cdot}7)\times 1{\cdot}4-(7{\cdot}4-6{\cdot}9)\times 0{\cdot}54\}$

(*c*) $$\frac{6{\cdot}2\times 3{\cdot}7\div 4{\cdot}2}{4{\cdot}1\times 7{\cdot}5}$$

2. From the formula :—

$$\frac{2A}{bh}=\frac{h}{H-h}\cdot\frac{E_s}{E_c}$$

obtain the area, A, of reinforcement required for a concrete beam when $b=12$ inches, $h=9{\cdot}2$ inches, $H=22$ inches and $\frac{E_s}{E_c}=15$.

3. For making a cubic yard of concrete the following quantities of materials are specified :—

Cement, 520 lbs. Sand, 0·43 cubic yard.
Shingle, 0·86 cubic yard.

If cement weighs 90 lbs. per cubic foot, in what proportions, by volume, are they mixed, taking the volume of cement as unity.

4. What is the total internal volume in cubic yards of a building with gabled roof whose internal dimensions are :— Length, 50 feet ; width, 30 feet ; height of side walls 24 feet ; height from floor to ridge, 32 feet. Give the answer correct to three significant figures.

5. Water flows through a pipe whose internal diameter is 2 inches, into a tank at a speed of 3 feet per second. What quantity of water enters the tank per minute (*a*) in cubic feet, (*b*) in gallons ?

(One Cubic foot $=6\frac{1}{4}$ gallons.)

6. A plot of ground ABCD is bounded by four straight fences AB, BC, CD and DE whose lengths are respectively 250, 200, 200 and 150 yards. The angle DAB is 90°.

(*a*) Draw a plan of the plot to a scale of 1 inch=50 yards.

(*b*) Find the area of the plot in square yards.

7. In a saw tooth roof whose span is 28 feet and rise 10 feet, the rafters on one side are inclined to the horizontal at an angle whose tangent is 0·5. Find the length of these rafters. Find also the length of the rafters on the other side and their inclination to the horizontal.

Section II.

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

8. On a drawing a line, whose length is given as 2 feet, is found to be 5 inches long. Draw a scale which can be used to obtain, correct to $\frac{1}{4}$ inch, all the dimensions of the drawing up to 2 feet.

9. Draw the section of a sill of the form shown on the sketch (Fig. 9) to the following dimensions :—AB$=4\frac{1}{2}''$, BC$=\frac{1}{2}''$, DE$=1''$, EA$=2''$. The angles E, A and B are each 90° and the angle C=108°. The figure is completed by an arc of a circle of one inch radius passing through D and tangential to CC^1. Find the position of the centre of this circle, explaining your construction.

10. The projections of a tusk tenon are shown to scale at Fig. 10. Draw an elevation to the same scale projected on to the vertical plane *vth*.

11. A triangular roof ABC covering the angle between two vertical walls is shown by its projections at Fig. 11. Find the inclination of the roof to the horizontal.

12. Figure 12 gives the vertical projection a' b' of the centre line of a supply pipe which lies in the vertical plane whose horizontal trace is *ht*. Find the true length of the pipe and its inclination to the horizontal.

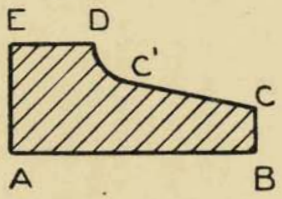
13. A beam resting on two supports A and B 20 feet apart carries loads of 3 and 5 tons at distances of 8 and 15 feet respectively from A. Calculate the reactions at the supports.

14. What do you understand by the "Force Triangle." A ladder 25 feet long rests against a smooth vertical wall, the bottom of the ladder being 10 feet from the base of the wall. When a man weighing 180 lbs. is half way up the ladder what is the reaction of the wall (assumed to be horizontal) ? Find also the magnitude and direction of the reaction of the ground.

Course in Building, 1934.

Mathematics & Geometry, (First Year).

Note:—The diagrams are numbered to correspond with the questions to which they refer.



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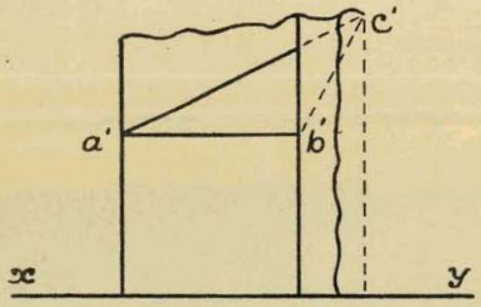

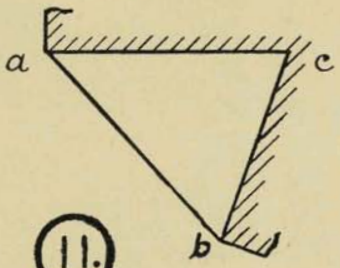

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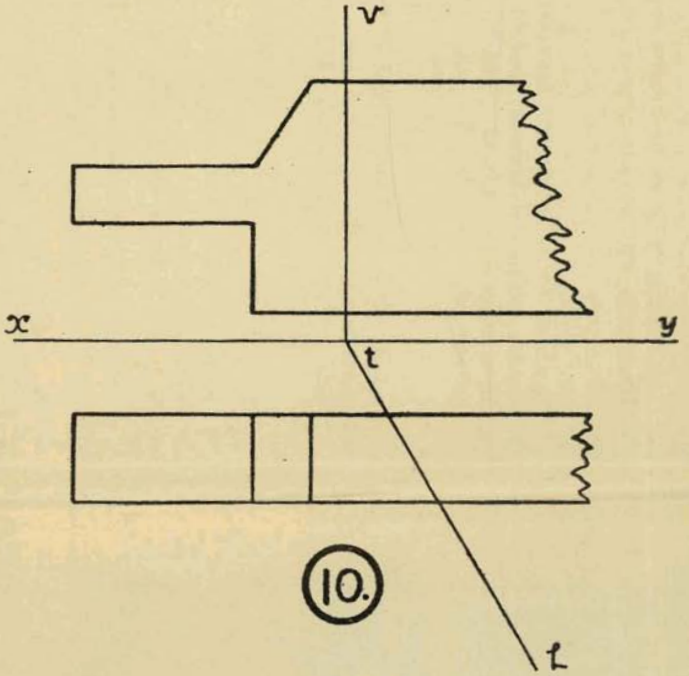

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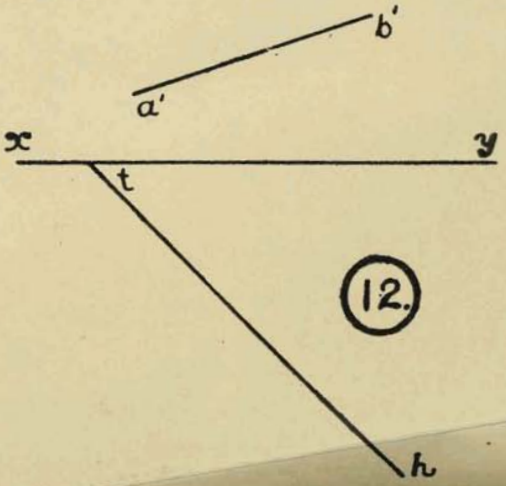

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