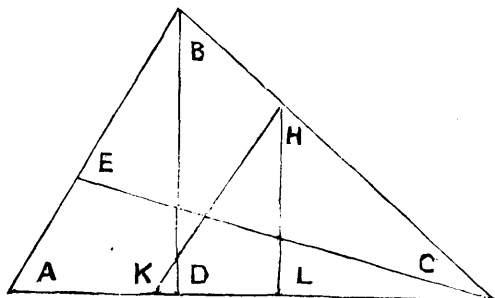


9. In a given triangle, the base $AC = 100$; $AB = 70$; $BC = 90$.

(I.) What is the length of a line parallel to the base?

(II.) Perpendicular to the base?

(III.) Inclined to the base at a given angle 15° , so as to cut off $\frac{7}{11}$ of the area?



(III.) Bisect the triangle by a line whose length is 49.32 perches. $AC = 100 = a$; $BC = 90 = b$; $HK = 49.32 = c$; $CD = 66$; $CK = x$; $HL = 43.7$; $KL = 22.864$; $CH = 64.276$; area = 3059.41 ; $BD = 61.1882$.

(I.) Let x = length of the line parallel to the base; then by similar triangles, or similar figures are to one another as the squares of their like sides. $\therefore 100^2 : x^2 :: 3059.41 : \frac{7}{11}$ of 3059.41 . $\therefore x = 79.77$, length of the line parallel to the base.

(II.) Area of triangle $BDC = 61.1882 \times \frac{2}{3} = 2019.2106$.

Let x = the required perpendicular.

As $BD^2 : x^2 :: \triangle BDC : \frac{7}{11}$ of 3059.41 ; $\therefore x = 60.082$ perches.

(III.) Angle $A = 60^\circ 56' 27''$; angle $ACE = 15^\circ$. $\therefore$ by trigonometry, AE is found = 26.68 , and $EC = 90.11$.

$\triangle AEC = 1166.03$; and $EBC = 1893.38$. From $\triangle AEC$ cut off $\frac{4}{11}$ of the area of the whole by a line parallel to EC ; the remainder will be $\frac{7}{11}$ of the whole.

$EC^2 : x^2 :: 1166.03 : \frac{4}{11}$ of 3059.41 ; or, $8119.812 : x^2 :: 1166.083 : 1112.512$; $\therefore x = 88.0176$.

(III.) $AC \times BC = 2KC \times HC$ or $ab : 2x :: CH : \frac{ab}{2x}$.

By similar triangles, $b : d :: \frac{ab}{2x} : \frac{abd}{2bx} = CL$.

$KL = KC - CL = x - \frac{abd}{2bx} = \frac{2bx^2 - abd}{2bx}$; but

$$\therefore \frac{4b^2c^2x^2 - 4b^2x^2 - a^2b^2d^2 + 4ab^2dx^2}{4b^2x^2} = \frac{a^2b^4 - a^2b^2d^2}{4b^2x}$$

$$\therefore 4b^2x^4 - 4b^2c^2x^2 - 4abd^2x^2 = -a^2b^4 \therefore x = 70.$$

10. The rafters of a house are each 18 feet long, and tied by a wrought iron rod, 30 feet long and section $\frac{1}{4}$ square inch: what weight must be suspended from the vertical angle so as to break the rod?

Let the direction of the weight W bisect the base BC in D , and A representing the vertical angle; then we have, $W \times 30 \div 4AD$ = horizontal pressure; $AD = 9.95$

$$\therefore \frac{W \times 30}{39.8} = \frac{67200}{4}, \text{ or, } W \times 30 = 39.8 \times 16800$$

$\therefore W = 39.8 \times 560 = 22288$ lbs, the required weight sufficient to break the rod.

11. A bar of wrought iron suspended vertically breaks by its own weight, what is its length?

The tenacity of iron = 67200 lbs; let x = length of the bar, and n the area of its section; then $67200n$ = the breaking weight of the bar. Specific gravity of wrought iron = 7.788 , $\therefore \frac{7788}{144 \times 16} \times nx$ = weight of the bar.

$$\therefore \frac{7788}{2304} \times nx = 67200n; 7788x = 67200 \times 2304;$$

therefore $x = 19880$ feet, the length of the bar.

IV. Papers on Science and Natural History.

MARVELS IN TELEGRAPH.

A new telegraphic machine has been exhibited at the Signal Bureau, in Washington, which promises to effect a remarkable revolution in telegraphy. It is called a "multiplex telegraph," invented by Merritt Galley, and covered by several patents both in Europe and America. The object of the invention is to enable a number of instruments to be operated simultaneously on a single wire, in either or both directions, and at different stations along

the line, without conflict, each instrument to do as much as the Morse key or any other instrument in common use. It has long been known to telegraphers, that a telegraph wire is capable of transmitting scores of electric pulsations, where only one is now sent, for the reason that the human organs cannot keep pace with the flow of electric discharges. The "multiplex" instruments, however, are fitted with apparatus in the nature of "switches," which turn the messages off from the main wire to the branch offices. Whether the operator is transmitting to sounder or printer, he makes but one stroke for any letter of the alphabet. The transmitter is entirely original in construction; it is a single key, with a short printed alphabetical index, and but little practice is required to use it.

THE SIGNAL SERVICE FOR 1873.

We see by the Signal Report that the percentage of verifications is considerably larger this year than last. For New England it was, 81.50 ; for the Middle States, 81.17 ; for the South Atlantic, 79.92 ; for the Lower Lakes, 78.90 ; for the Eastern Gulf, 77.16 ; for the Ohio Valley, 76.42 ; for the Western Gulf, 74.40 ; for the Upper Lakes, 75.25 ; and for the Northwest, 74 . The general average given in last year's report was 76.8 . Reports are regularly received from ninety-two stations, seventy-eight of which are in the United States; eleven are in Canada, and three in the West Indies. The regular telegraphic reports from Havana, Cuba, began on August 6th; from Kingston, Jamaica, on September 18th, and from Santiago de Cuba, on September 29th. Three other points in the islands of Porto Rico, Guadeloupe, and Barbadoes, will be equipped soon. Arrangements have been made with Russia and Turkey, to commence on January 1st, the exchange of one daily report, taken simultaneously at the different stations throughout the great territorial extent of the Russian and Turkish empires, and the United States. It is expected that other nations will soon co-operate with us in this service.

The practical benefit derived from these reports can hardly be overestimated. Great pains have been taken to benefit the farmers, and arrangements have been made for daily posting the reports at $4,491$ post-offices, throughout the country. To protect the business interests from injury along the rivers, a large number of reports have been made daily, giving the state of the weather, and the results are gratifying.

During the year eighty-eight warnings of storms have been made, seventy of which proved to be serious. The mistakes, if any, have been on the side of caution. While on some occasions the signals ordered may have proved unnecessary, and are so reported unverified, on the other hand no extensive storms have occurred in the regions included in the system of cautionary signals without warning of its approach having been displayed in at least part of its course.

It is estimated that at least one-third of the people of this country, through these various sources, have the benefit of the weather observations. — *American Educational Monthly*.

SPARE THE INSECTIVOROUS BIRDS.

We would point out to our indefatigable police authorities that a number of young scamps are making havoc among the birds with slings and india-rubber "catapults." The law is stringent on this point, and a few examples made of the class referred to and their seniors, to whom years have not brought common sense or decency, who wander over the fields shooting the robins, grey-birds, &c., which enliven the country, would have a most salutary effect. Naturalists who have given the subject much time and attention, assert that the increase of slugs, spiders, &c., the pests of the gardener and farmer, is caused by the wholesale destruction of the small birds, and it was to remedy this miserable slaughter that the act protecting these birds was passed.

HOW LONG ANIMALS LIVE.

According to some naturalists the length of life of animals is as follows, though it is really puzzling to see how they can tell all this, especially about those that live a hundred years or more:

The Rabbit lives from 6 to 7 years.

The Squirrel from 7 to 8.

The Fox from 14 to 15.

The Cat from 15 to 16.

The Dog from 16 to 18.

The Bear and the Wolf from 18 to 20 years.

The Rhinoceros from 20 to 22. The Horse from 22 to 25.

The Hen from 25 to 30. The Crow and the Camel 100.

The Tortoise 110. The Eagle 120. The Swan 160.

The Elephant 40. The Whale, according to Cuvier, 100 years.