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Simple Methods
for
Measurement and Calculation
of Field Areas

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Simple Methods for Measurement and Calculation of Field Areas

This booklet is written for the purpose of assisting farmers in calculating areas of land. Every farmer should know the acreage of each and every plot of land on his farm in order that he may calculate his labor, seed, and fertilizer. In addition to this, the cotton acreage reduction program calls for measuring cotton fields very accurately and it is hoped that the methods herein contained may help do the job more satisfactorily for all concerned.

UNITS OF MEASURE:

3 feet = 1 yard
16½ feet = 1 rod
5,280 feet = 1 mile
1,760 yards = 1 mile
320 rods = 1 mile
One acre contains 43,560 square feet.
A square acre is approximately 208 feet and 8 inches on each side.

Measuring Instruments

The steel tape is the standard measuring instrument. Metallic tapes may be used very satisfactorily. Be careful in selecting cloth tapes because the cheaper ones will contract and expand with changes in weather.

NOTE: Any memoranda you care to preserve may be placed on pages 12 to 16.

1

The surveyor's chain, which consists of 100 links totalling 66 feet, is sometimes used by surveyors. However, since this type of chain is not in common use at present, it will not be discussed in this booklet.

A Homemade Chain

By using telephone wire, a measuring chain can be made which will be very satisfactory if properly constructed. This chain is best made in one-yard links and is practical up to 20 links or 60 feet. The links for the chain are made by setting two ½" bolts exactly 3 feet apart in a 2" x 4" plank or on a work bench. The loop is made in one end and slipped over one of the bolts. The other end is then pulled around the other bolt and wrapped back on the wire three or four times, then cut off and clinched down. The first loop made on each link must be made onto the previous link.

By placing aluminum chicken leg bands (numbered from 1 to 20) in the loops you may designate the various yards. For instance, the number 1 band is placed at the loop of the first link, and so on up to twenty.
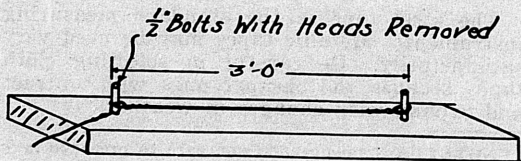

½" Bolts With Heads Removed

3'-0"

FIGURE 1

Measuring Distances

These rules should be followed carefully in measuring distances:

1.—Always travel in straight line.

2.—Use some kind of stake or pin to designate the end of the chain. Small steel rods with rings on top are best because they will penetrate any kind of soil and can be of sufficiently small diameter to aid in accuracy. The front-chain man should carry the pins and the rear-chain man can take them up and thereby keep account of the number of chain or tape lengths. A very satisfactory pin can be made of Number 6 or Number 9 wire. These pins should be about 14 inches long with a ring at the top about two or two and one-half inches in diameter. A red strip of cloth tied in this ring will cause them to be easily seen.

3.—All land measurements should be made horizontally. This means that the chain should be held level and tight when the measurement is taken. By placing a good raw hide strap, or ring, on the end of the tape or chain it can be held tight and level and the marking pin can be dropped from the chain to the ground where it should be pushed into the soil.

On very sloping lands where it is desirable to measure along the surface or up and down the hill, it is found that corrections must be made. As an illustration in measuring down a hill, it is found that when the chain is held

level it will be 5 feet above the ground to make the measurement correct, but if it is laid on the ground the measurement will be short. This means that the chain on the ground is the hypotenuse of a right triangle and, therefore, is greater than the horizontal leg of a right triangle.
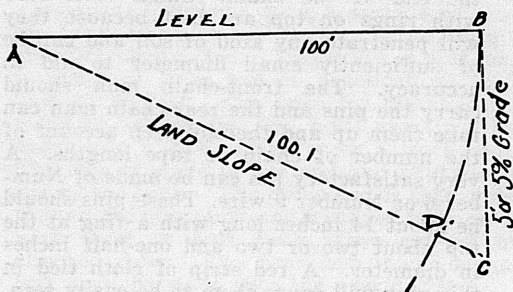

FIGURE 2

This table will give corrections to be made according to the slope of the land.

Percent of Grade	Surface Distance	Percent Correction
5	100.1 ft.	.1
10	100.5 ft.	.5
15	101.1 ft.	1.1
20	102.0 ft.	2.0
25	103.1 ft.	3.0
30	104.4 ft.	4.2
40	107.7 ft.	7.2

From this table it will be concluded that up to 10 per cent grade no appreciable error will occur, but above 10 per cent grade corrections should be made.

EXAMPLE.—On a slope of 20 per cent a measurement of 1,680 feet is made on the ground. By referring to the table we find that 100 feet horizontally equals 102 feet down the slope. So to get the correct horizontal distance take 2 per cent less than 1,680, or— 1,680 ft. less 33.6 ft. = 1,646.4 ft. horizontally.

Hence the line measured on the ground, 1,680 ft., should be calculated as 1,646.4 ft.

Calculating Field Areas

TABLE.—The universal unit of land in Alabama is the acre.

1 Acre = 43,560 sq. ft.
      = 4,840 sq. yds.
      = 160 sq. rods.

To find the area of a field it is necessary to find the number of square units in the field. This may be done in feet, yards, or rods. Since there are 43,560 square feet in an acre, the total number of square feet in the field may be divided by 43,560 to give the number of acres, or the total number of square yards in a field may be divided by 4,840 to find the number of acres.

Or, the number of square rods in a field divided by 160 will give the number of acres in the field.

No. acres = sq. ft. ÷ 43,560 or
sq. ft. × .00002296

No. acres = sq. yds. ÷ 4,840 or
sq. yds. × .0002066

No. acres = sq. rods ÷ 160 or
sq. rods × .00625

Areas of Different Shapes of Fields

1.—A square and a rectangle are measured
and calculated the same way because all
angles are right angles and the area is
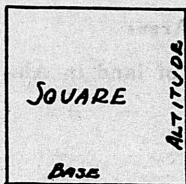equal to length multiplied by the width.

FIGURE 3   FIGURE 4

a × b = area
or base × altitude = area

EXAMPLE.—The width of a field is 140 feet.
The length is 860 feet. Find the number of
acres.

860 × 140 = 120,400 ÷ 43,560 = 2.7 acres

2.—The area of a triangle is equal to the base
times one-half the altitude.
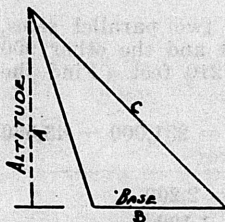
FIGURE 5　　　　**FIGURE 6**
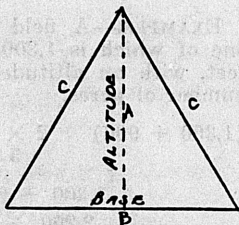
Base × altitude ÷ 2 = area

EXAMPLE.—The base of a triangular field is 620 feet and the altitude is 204 feet. How many acres are there in this field?

620 × 204 ÷ 2 = 63,240 ÷ 43,560 = 1.4 acres

3.—Two sides parallel.

The area of a field with two sides parallel is found by measuring the lengths of the two parallel sides, adding them together, dividing by 2 to determine the average length, and then multiplying this by the altitude or width to obtain the area.
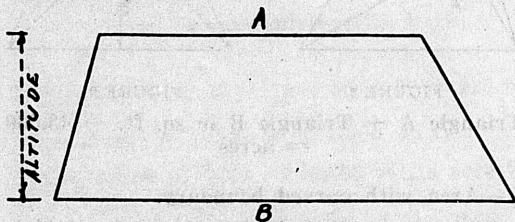

FIGURE 7

(A + B) ÷ 2 × altitude = area

EXAMPLE.—A field has two parallel sides, one of which is 1,300 feet and the other 900 feet, with an altitude of 210 feet. Find the number of acres.

$(1{,}300 + 900) \div 2 \times 210 = 231{,}000 \div 43{,}560$
$= 5.3$ acres

$$1{,}300 + 900 = 2{,}200$$
$$2{,}200 \div 2 = 1{,}100$$
$$1{,}100 \times 210 = 231{,}000 \text{ sq. ft.}$$
$$231{,}000 \div 43{,}560 = 5.3 \text{ acres}$$

4.—Four or more sides none of which are parallel.

To find the area of a field having four or more sides, divide it up into triangles, figure each triangle separately, and then add them together.
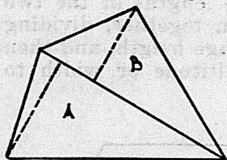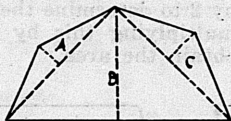

FIGURE 8   FIGURE 9

Triangle A + Triangle B in sq. ft. ÷ 43,560
= acres

5.—Area with curved boundary.

In case a part of the boundary of a field is an irregular curved line, one or more straight lines such as A-B in Figure 10 should be laid
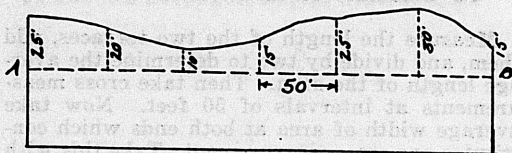
FIGURE 10

off. Offsets perpendicular to AB, as shown by the short dotted lines at uniform intervals, should be measured. The area between lines AB and the curved boundary is measured as follows: Take the sum of the two end offsets and divide by 2. To this add the sum of all the other offsets and multiply by the uniform distance between the offsets.

EXAMPLE.—Assume that the line AB in Figure 10 is 300 feet long and the lengths of the offsets are 25, 20, 10, 15, 25, 30, and 15 feet as shown. The uniform spacing between offsets is 50 feet.

Sum of the two end offsets (25 + 15) ÷ 2 = 20 ft.

Then, 20 + 20 + 10 + 15 + 25 + 30 = 120 ft.

Area = 120 × 50 = 6,000 sq. ft.

No. acres = 6,000 ÷ 43,560 = .13 acre

The area of the remainder of the field is calculated, according to its shape, by one of the methods already explained.

To Calculate Area Between Terraces

Measure the length of the two terraces, add them, and divide by two to determine the average length of the area. Then take cross measurements at intervals of 50 feet. Now take average width of area at both ends which constitutes one cross measurement. Take this with other widths, add together, and divide by average length to get area.
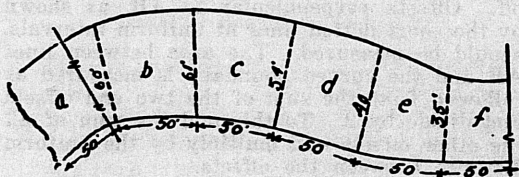

FIGURE 11

EXAMPLE.—

Upper terrace length 600 feet.

Lower terrace length 560 feet.

(600 + 560) ÷ 2 = 580 ft. average length.

(50 ft. width of one end + 30 ft. width of other end) ÷ 2 = 40 ft. average width at ends.

Then, (40 + 60 + 61 + 54 + 40 + 35) ÷ 6 = 48.3 ft. average width.

Then, 580 × 48.3 = 28,014 sq. ft.
28,014 ÷ 43,560 = .64 acres.

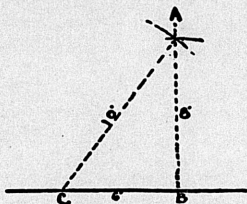## To Erect a Perpendicular to a Given Line

FIGURE 12

On a line CB (Fig. 12) measure off 6 feet, C and B, and drive stakes at these two points. Take 8-foot section of tape and place one end on stake at B. Then take 10-foot section of tape and place one end at C. Hold both sections tight to find point A. Drive stake at A. Now the line AB is the perpendicular to CB, and is at right angles to line CB.

Good engineers find that careful checking of their work is time well spent. Be sure you are right and then go ahead.

MEMORANDA