

perch, &c.) and by measuring distances. Bring the inch, foot, yard, and perch measure into the class-room before the pupils in order that they may examine them, and form a correct idea of the length of an inch, foot, &c. A yard measure divided into feet and inches will not do to teach the inch and foot by; as each would require to be seen separately so that no incorrect impressions may be made. After the measures have been examined make a pupil take the inch rule and measure any number of inches on the black-board, say 7, 9 or 11 inches &c., placing a mark at the end of every inch, and go through the same process with the foot rule and yard stick. The yard stick and rod-pole should be used for measuring in the play-ground or other suitable place.

It is surprising what a vague idea the majority of boys and girls (especially girls) have of the distance of say 35 feet, 45 yards or 11 rods, &c. Pupils must be made to understand that 7 inches means 7 lengths of the inch measure, and 13 feet, thirteen lengths of the foot rule, &c.

After the lineal unit is understood, take up the square unit (square inch, square foot, square yard, &c.) in connection with the area of surfaces. Cut the square inch, foot, and yard, out of paper or pasteboard and bring them before the class. Show that they are necessary for the measurement of surfaces, (e.g.) if you were to say that a wall was large or small, we would have a very imperfect idea of its size, but if on the other hand you were to say that its area was a certain number of yards we could form an idea of its exact size. The square rod and square acre should be measured in some field or other suitable place.

The square and oblong should be the first figures taught. Send a pupil to the black-board with the inch measure and have say 7 inches measured off in a horizontal line, with a small point at the end of every inch, and through each point draw a perpendicular line. Show that whenever you measure across these lines that they are one inch apart. Next have 5 or 7 inches measured off on a perpendicular drawn from one extremity of the horizontal line, and through each point draw horizontal lines. Now ascertain from the class the number of squares in the top line, Ans. 7. How many in the second line? Ans. 7. How many in the two lines? Ans. 14, &c.

You can now get the rule from them that the length multiplied by the breadth gives the area. Show that the area is the product of two factors, one of them the length and the other the breadth. By their arithmetic, when one factor is given and the product of the two, the other may be found by division. When both factors are equal, as in the square, and neither given, a knowledge of square root will be required. The length of a floor and the width being given to find the number of yards of carpet of a certain width that will cover it. It may be shown how to find the area of the floor, and the area of the floor being known, the area of the carpet is known, and the width, one of the factors being given the other may be found.

Examples.—(1.) How many acres in a field 32 rods wide and 40 rods long?

(2.) Find the number of square feet in a wall 10½ feet high and 42 feet long?

(3.) Find the number of square yards in the walls of a room 9 feet high, 14 feet wide and 18 feet long?

(4.) How many inches would you require to cut off a board 14 inches wide to have 3½ square feet?

(5.) A city lot is 144 feet in depth, how many feet front must it have to contain a quarter of an acre?

(6.) A farmer wants to run a fence across a field 30 rods wide so as to enclose 2½ acres, how far from the end of the field must he put the fence?

In the 4th, 5th and 6th questions the area or product of two factors is given, and the one factor to find the other.

THE PARALLELOGRAM.

Geometrical proof (i. 86.) Euclid.

The area of a parallelogram is the same as the area of a rectangle which is the same length as the parallelogram, and having the same perpendicular width.

Mechanical proof:—

Cut the parallelogram ABCD out of a piece of paper, then cut off ABH so that AH will be per-



pendicular to HC, and make it occupy the position of DCM. Now the pupils can very easily see that you have the same piece of paper, and that it must contain the same area as before, as it is neither smaller nor larger, and it is now in the form of a rectangle, having the same length and perpendicular width as the parallelogram.

Ques.—Find the area of a parallelogram whose base is 22 feet and perpendicular 9 feet 6 in.

The area of a parallelogram varies according to its perpendicular width.

Mechanical proof:—

Take four pieces of lath or stick and lay down one piece as AD, two other pieces as AH and DM, with the ends on A and D; then lay the fourth piece on the ends of AH and DM as HM, and drive only one tack through each corner. Take hold of two opposite corners, as A and M, and draw them apart so that there will be no space enclosed; then push them in opposite directions until no space is enclosed.

Pupils can now see that the area varies with the perpendicular distance, and is the greatest when the figure is right-angled.

Right-angled triangle.

Geometrical proof: (i. 47) Euclid.

Mechanical proof:—

Draw a right-angled triangle so that the sides will be in the proportion of 3, 4 and 5, or 5, 12 and 13, and describe squares on it as in the figure. Now show that the area or number of squares in the large square is equal to the area of the two small ones, and that the



difference between the area of the large square and the area of one of the small ones is equal to the area of the other small one. Now it can be easily seen that when the perpendicular and base are given, we can find the area of the square described on each, and add them together to find the area of the square on the hypotenuse; find the side of this square and we have the length of KE the hypotenuse.

In a right-angled triangle if a perpendicular be drawn from the right angle on the hypotenuse, the segments may be found.

Euclid (i. 47) or (vi. 8).

(i. 47.) Find the area of the square on AE, and that is the area of the rectangle BCDE, and one factor ED or KE is given to find the other.

Mechanical proof:—

Take a piece of paper the size of the square AEHG and cut it so that one piece of it will be the width of the rectangle, and lay