and form their ranks and files. He receives the orders from the adjutant, which he communicates to his officers. Each company has generally two sergeants.

SERGEANTY *(serjeantia)* signifies, in *Law,* a service that cannot be due by a tenant to any lord but the king ; and this is either grand sergeanty or petit. The first is a tenure by which the one holds his lands of the king by such services as he ought to do in person to the king at his co­ronation, and may also concern matters military, or services of honour in peace. Petit sergeanty is where a man holds lands of the king to furnish him yearly with some small thing towards his wars, and in effect payable as rent.

Though all tenures are turned into soccage by the 12th Car. II. cap. 24, yet the honorary services of grand-sergeanty still remain, being excepted in that statute.

SERIES, in general, denotes a continual succession of things in the same order, and having the same relation or connection with each other. In this sense we say, a series of emperors, kings, bishops, and the like.

In natural history, a series is used for an order or subdi­vision of some class of natural bodies ; comprehending all such as are distinguished from the other bodies of that class, by certain characters which they possess in common, and which the rest of the bodies of that cast have not.

SERIES.

(1.) Series, in *Arithmetic* or *Algebra,* a rank or progres­sion of quantities which succeed one another according to some determinate law. For example, the numbers

3, 5, 7, 9, 11, 13, 15, &c.

constitute a series, the law of which is, that each term ex­ceeds that before it by a given number, viz. 2. Again, the numbers

3, 6, 12, 24, 48, 96, 192, &c.

constitute a series of a different kind, each term being the product of the term before it, and the given number 2.

(2.) As the law according to which the terms of a series are formed may be infinitely varied, there may be innu­merable kinds of series. We shall enumerate a few of the most common.

1. *Arithmetical Series.* The general form of a scries of this kind is

*a, α -I- d, a + 2d, α -f- 3d, α -j-4d, &c.* and its law is, that the difference between any two adjacent terms is the same quantity, viz. *d.* The first of the two preceding examples is a series of this nature.

2. *Geometrical Series.* Its general form is

*a, ar, ar,, ar3, at\*,* &c.

In this kind of series each term is the product of that which precedes it and a constant number r, which is called the common ratio of the terms. The second of the above examples is a particular case of a geometrical series.

3. *Harmonic Series* is that in which the first of any three of its consecutive terms is to the third, as the difference be­tween the first and second to the difference between the second and third ; hence we readily find, that putting *a* and *b* for its first two terms, its general form will be

*, ab ab ab α °, b, 2^∑b'* **So —25’ ⅛"-30’ \*c∙**

If we suppose *a —* 1 and *b* s= ∣, we get

b ⅛> i> i> ⅛> «’ ^ic∙

as a particular example of a harmonic series.

4. *Recurring Series.* Let its terms be denoted by

A, B, C, D, E, F, &c.

Then we shall form a recurring series if, *m* and *n* being put for given quantities, we take

C = mA -f- ∏B, E = *mC* + ∏D,

D ~ mB -f- nC, F — mD + nE.

For example, let us suppose A = l, B *= 2x, rn=* 4x\*, *n=3x;* then C = 10z\*, D = 38zs, E = 154ar\*, F = 6l4zt, so that the first six terms of the series are

1, *2x,* l(λrs, 38x5, 154αr4, 6l4x5.

We have here supposed each term to be formed from the two which come immediately before it ; but the name *re­curring series* is given to every one in which the terms are formed in like manner from some assigned number of the terms which precede that sought. Thus, putting, as be­

fore, A, B, C, D, &c. for the terms of the series, and *m*, *n*, *p, q,* for given quantities, we shall have another recurring series, if we suppose them so related that

mA -{- nß -p *ρC* -p çl) = 0, mB -j- ∏C + pD -f- çE = 0, mC -∣- ∏D + pE -(- <7 F = 0.

The two series of quantities sin. *a,* sin. *2a,* sin. 3a, &c. and cos. *a,* cos. 2a, cos. 3o, &c. are both recurring, as is mani­fest from the law which connects the quantities one with another. (See Algebra, § 251.)

(3.) As in general it is the sum of the terms of a series which is the object of investigation, it is usual to connect them by the sign + or —, and to apply the name *series* to the expression thus formed. Accordingly,

. l+S + 5 + 7+9∙∙∙ +{l+2(n-l)}

(where *n* denotes the number of terms) is called an arith­metical series ; and in like manner

**l+i + i + i∙ ∙∙+g⅛i** is a geometrical series.

(4.) A series may either consist of a definite number of terms, or their number may be supposed greater than any that can be assigned, and in this case the series is said to be *infinite.* The number of terms of a series may be infi­nite, and yet their sum finite. This is true, for example, of the series

**⅛ + i + ⅛ +** T⅛+∙ \*c∙ which is equivalent to unity, or 1.

(5.) We have already treated of several branches of the doctrine of series in the articles Algebra, Fluxions, and Logarithms ; and, in particular, we have given four differ­ent methods for expanding a quantity into a series, viz.

1. By *Division* or *Evolution.*

2. By *the Method of Indeterminate Co-efficients.*

3. By *the Binomial Theorem.* (Algebra, sect, xvii.)

4. By *Taylor’s Theorem.* (Fluxions, § 28.)

We shall here treat briefly of another branch of the theo­ry, namely, how to find the sum of any proposed number of terms of certain series, or the sum of their terms conti­nued *ad infinitum,* when that sum is finite.

(6.) There is a great analogy between the terms of a se­ries and the ordinates of a curve which are supposed to stand upon the axis at equal distances from one another, the first ordinate reckoned from the extremity of the axis being analogous to the first term of the series, the second ordi­nate to the second term, and so on. From this analogy it follows immediately, that like as the nature of a curve is indicated by an equation expressing the value of an inde­finite ordinate in terms of its corresponding abscissa, so also the nature of a series may be shown by an equation which shall express the relation between any term, and the num-