don markets, It has ſeveral rivers, abounding with fiſh, the chief of which are the Wye, the Mole, and the Wandle.

SURSOLID, or Surdesolid, in arithmetic, the fifth power of a number, or the fourth multiplication of any number, conſidered as a root.

SURVEYING, the art of meaſuring land ; that is, of taking the dimenſions of any tract of ground, laying down the ſame in a map or draught, and finding the content or area therof. See Geometry.

SURVEYOR, a perſon who has the overſight and care of conſiderable works, lands, or the like.

Surveyor, likewiſe denotes a gauger ; as alſo a perſon who ſurveys lands, and makes maps of them.

SURVIVOR, in law, signifies the longest liver of joint tenants, or of any two perſons jointly intereſted in a thing.

SURVIVORSHIP, is that branch of mathematics which treats of reverſions payable provided one or more particular perſons ſurvive certain others. By reverſions are meant pay­ments not to take place till ſome future period. Survivor- ſhip forms one of the moſt difficult and complicated parts of the doctrine of reverſions and life-annuities. It has been very fully treated of by Mr Thomas Simpſon in his" Select Exerciſes ; and brought to a ſtate of very great perfection by Dr Price and Mr Morgan, who have bellowed a great deal of attention on this ſubject.

The calculations are founded on the expectation of lives at different ages, deduced from tables formed from bills of mortality, of which see ſeveral examples under the article B*ills of* Mortality. By the expectation of life is meant the mean time that any ſingle or joint lives at a given age is found to continue ; that is, the number of years which, ta­king one with another, they actually enjoy, and may be con­ſidered as sure of enjoying ; thoſe who survive that period enjoying as much more time in proportion to their number as thoſe who fall ſhort of it enjoy leſs. Thus, suppoſing 46 perſons alive all 40 years of age, and that one will die every year till they are all dead in 46 years, half 46 or 23 will be the *expectation* of each of them. If Μ. de Moivre’s hypo­theſis were true, that men always decreaſe in an arithmeti­cal progreſſion, the expectation of a ſingle life is always half its complement @@(A), and the expectation of two joint lives one- third of their common complement. Thus, ſuppoſing a man 40, his expectation would be 23, the half of 46, his com­plement; the expectation of two joint lives, each 40, would be 15 years 4 months, or the third part of 46.

The number expreſſing the expectation, multiplied by the number of ſingle or joint lives (of which it is the expecta­tion), added annually to a ſociety, gives the whole number living together, to which ſuch an annual addition would in time grow. Thus, since 19, or the third of 57, is the ex­pectation of two joint lives, whoſe common age is 20, twen­ty marriages every year between perſons of this age would in 57 years grow to 20 times 19 or 380 marriages, always exiſting together. And since the expectation of a ſingle life is always half its complement, in 57 years 20 ſingle perſons add­ed annually to a town will increaſe to 20 times 28.5, or 570 ; and when arrived at this number, the deaths every year will just equal the acceſſions, and no farther increaſe be poſſible. It appears from hence, that the particular proportion that becomes extinct every year, out of the whole number constantly exiſting together of ſingle or joint lives, muſt, where­ver this number undergoes no variation, be exactly the ſame with the expectation of thoſe lives, at the time when their exiſtence commenced. Thus, was it found that a 19th part of all the marriages among any bodies of men, whoſe numbers do not vary, are diſſolved every year by the deaths’ of either the husband or wife, it would appear that 19 was, at the time they were contracted, the expectation of theſe marriages. In like manner, was it found in a ſociety, limit­ed to a fixed number of members; that a 28th part dies an­nually out of the whole number of members, it would ap­pear that 28 was their common expectation of life at the time they entered. So likewiſe, were it found in any town or diſtrict, where the number of births and burials are equal, that a 20th or 30tl1 part of the inhabitants die annually, it would appear that 20 or 30 was the expectation of a child juſt born in that town or diſtrict. Theſe expectations, therefore, for all ſingle lives, are easily found by a table of observations, showing the number that die annually at all ages cut of a given number alive at thoſe ages ; and the general rule for this purpoſe is, to divide the ſum of all the living in the table, at the age whoſe expectation is required, and at all greater ages, by the ſum of all that die annually at that age and above it ; or, which is the ſame, by the number (in the Table) of the living at that age ; and half unity ſubtracted from the quotient will be the required expecta­tion. Thus, in Dr Halley’s table, given in the article An­nuity, the ſum of all the living at 20 and upwards is 20,724, which, divided by 598, the number living at the age of 20, and half unity ſubtracted from the quotient, gives 34.15 for the expectation of 20.

In calculating the value of expectation of joint lives, Mr de Moivre had recourſe to the hypotheſis, that the proba­bilities of life decreaſe in a geometrical progreſſion ; belie­ving that the values of joint lives, obtained by rules derived from it, would not deviate much from the truth. But in this he was greatly miſtaken ; they generally give reſults which are near a quarter of the true value too great in find­ing the preſent value of one life after it has ſurvived ano­ther in a ſingle payment, and about 7/5ths too great when the value is sought in annual payments during the joint lives. They ought therefore to be calculated upon the hy­potheſis (if they are calculated on hypotheſis at all), that the probabilities of life decreaſe in arithmetical progreſſion, which is not very far from the truth. Even this hypotheſis never corresponds with the fact in the firſt and laſt periods of life, and in ſome ſituations not in any period of life. Dr Price and Mr Morgan therefore have given tables of the value of lives, not founded on any hypotheſis, but deduced from bills of mortality themſelves. Some of theſe we ſhall give at the end of this article. Mr Morgan has likewiſe given rules for calculating values of lives in this manner.

Μ. de Moivre has alſo fallen into miſtakes in his rules for calculating the value of reverſions depending on ſurvivor- ſhip : theſe have been pointed out by Dr Price in the third effay in the firſt volume of his Treatiſe on Reversionary Payments ; who has alſo given proper rules for calculating theſe values, the moſt important of which are comprehend­ed in the following paragraphs.

Suppoſe a set of married men to enter into a ſociety in order to provide annuites for their widows, and that it is limited to a certain number of members, and conſtantly kept up to that number by the admiſſion of new members as the old ones are loſt ; it is of importance, in the firſt place, to know the number of annuitants that after ſome time will come upon the eſtabliſhment. Now ſince every marriage produces either a widow or widower ; and ſince all marri­ages taken together would produce as many widows as Wi­dowers, were every man and his wife of the ſame age, and the chance equal which ſhall die firſt : it is evident, that the

@@@(a) By the complement of a life is meant what it wants of 86, which Μ. de Moivre makes the boundary of human life. Thus if a man be 30, the complement of his life is 5*6.*