The gentleman's steward and tenants of manors instructed. Containing rational, easy, and familiar rules and tables for finding the value of estates of freehold, copyhold, or leasehold, as well on lives as for years absolute, &c.; With an enquiry into the nature of the annual disbursements, precariousness of the tenure, and casualties, that estates are charged with, and how they are to be accounted for in the valuation. The tables being founded on Dr. Halley's hypothesis, and calculated by the method laid down by Abr. de Moivre / To which is added an appendix, containing the description and use of an instrument for discovering the number of feet contained in any timber-trees, by inspection only.

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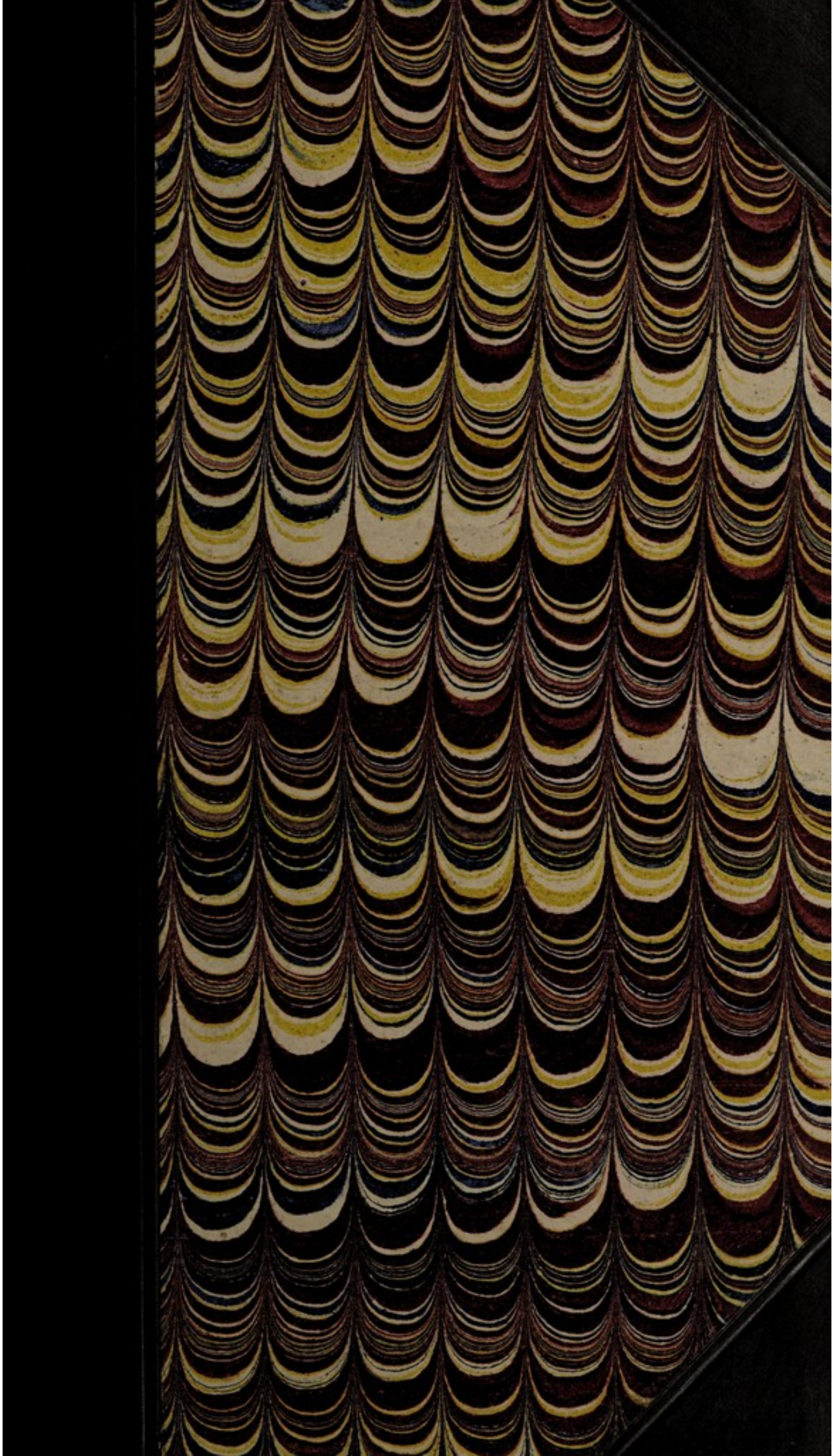

THE Gentleman's Steward AND TENANTS of MANORS INSTRUCTED.

CONTAINING

Rational, Eaſy, and Familiar RULES and TABLES for finding the Value of Eſtates of Freehold, Copyhold, or Leaſehold, as well on Lives as for Years abſolute, &c.

WITH

An ENQUIRY into the Nature of the Annual Diſburſements, Precariouſneſs of the Tenure, and Caſualties, that Eſtates in Fields or Houſes, or both, are charged with, or liable to; and how they are to be accounted for in the Valuation.

Wherein the ERRORS and ABSURDITIES of all the common Methods of Valuation, and the Diſadvantages thence accruing, ſometimes to the Landlord and ſometimes to the Tenant, are juſtly expos'd.

The TABLES for valuing Eſtates on Lives being founded on Dr. HALLEY's Hypotheſis, and calculated by the Method laid down by Mr. ABR. DE MOIVRE, to 4, 5, 6, 7, and 8 *per Cent.*

To which is added,

An APPENDIX:

Containing the DESCRIPTION and USE of an Inſtrument for diſcovering the Number of Feet contained in any Timber-Trees before they are cut down, by Inſpection only.

By *JOHN RICHARDS* of EXON.

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PREFACE.

HE Inducements that led me to this Undertaking are ſufficiently ſuggeſted in the Introduction; *and hence all that is neceſſary by way of Preface, is to ſhew the Method in which I have treated the Subject, and in what manner the following Tables were computed; that thereby the Reader may be able to gueſs what Degree of Accuracy may be expected in them.*

I have then firſt of all defined the Term Annuity, *and ſhewn in what Senſe I*

make use of the Word; and proceed to shew how far, and to what degree of Certainty the Value thereof in Cash may be found; and have, I think, fairly represented the Difficulties and Intricacies with which such a Computation is involv'd.

In the next place, I have treated of the divers Kinds of Tenures of Lands; and these are reduced to four Heads, viz. 1st, *Fee-Simple;* 2dly, *Leaseholds for Years absolute;* 3dly, *Copyholds; and,* 4thly, *Leases for Life or Lives. And here I have likewise shewn, how each of these may be consider'd and valued as an Annuity; and altho' there may be, and doubtless are, divers Manors wherein the Holdings do not properly come under either of these Heads; yet I believe a Person throughly acquainted with these, and the manner of their Valuation, will find no great Difficulty in reducing any other to some of the aforesaid Forms.*

I next

I next consider the Errors that the commonly practis'd Methods of Valuation are liable to; and these are so many, and in some Cases so enormous, that tho' this Chapter is drawn out into a pretty great Length, yet is it necessary to say something more here, in order to clear up, and in some measure to account for, the preposterous Practice of renewing Leases of Church and College Lands.

In Chap. 3. *is demonstrated, that the accepting of one Year's Value for renewing of seven that are lapsed in a Lease for one and twenty Years, is compounding for two Fifths of the* real Value *thereof at the rate of legal Interest. By* real Value, *I mean the Value of the Tenure absolutely consider'd: for I have there likewise shewn, that the renewing such a Lapse, on the probability that a Person of* 50 *Years old will live to enjoy it so long, is not worth more than one Year's Value; which are the Terms generally agreed on. And hence the Conduct of the Lessor, as far as relates*

lates to his private Advantage, is accounted for.

But then if the Leſſees be at any time charg'd with the Guilt of the Oppreſſion; or if upon their Application to the Proprietors for a Renewal, they meet with a Landlord that is not ſo willing to give away the Right of his Succeſſor; in ſuch Caſe their only Argument is, That they, their Father or Grandfather, &c. *did, for the firſt Purchaſe, give a valuable Conſideration for this Privilege of renewing.*

And indeed if this be the Caſe, the greateſt Share of the Guilt will devolve on thoſe, who by this Practice evade and fruſtrate the Deſign of thoſe Laws, which reſtrain the Poſſeſſor from alienating, or granting long Leaſes of thoſe Lands; and would themſelves tell another Perſon, that the Crime was no leſs than that of Sacrilege, thus to alienate God's Inheritance: For by this Privilege of renewing (if the Succeſſor cannot break through it) a Part of the Church's Patrimony is granted away in Perpetuo. *In*

In the Chapter of Copyholds, *Example* 1. *I have ſhewn how much ought to be given for the firſt Purchaſe of an Eſtate, when this Privilege of renewing at certain Periods for a ſtated Sum is a Condition in the Leaſe. By which Example, and a due Computation, it will appear that the Leſſor receives near one Year's Produce of the Eſtate more than he could expect, were the Leaſe to be abſolutely terminated in one and twenty Years; and if it be conſider'd that he enjoys that Overplus, which is the Right of his Succeſſor, for twenty-one Years, the Amount thereof at the End of that Term will be little leſs than three times as much.*

But this is ſtill making the beſt of the Matter; for very often the Septennial Sum reſerv'd, and which is called one Year's Value, is not more than half the Produce of the Eſtate; and this is another Aggravation.

But no more of this.

In Chap. 4. *are laid down ſome previous Conſiderations neceſſary to the adjuſting the Value of Eſtates; ſuch as are the Nature of the Tenure, and Term of its Continuance; the Caſualties, Incumbrances, and Impoſitions that go along with it; the Quality of the Eſtate as to Repairs,* &c. *the yearly Value, and the Rate of Intereſt that the Purchaſer may expect for the Money he lays out. Each of theſe Particulars are pretty largely diſcuſs'd; and I believe the Reader will here meet with ſome Obſervations that are entirely new, and which he'll think deſerve his Notice.*

After having ſaid ſomething of Reverſions, and of the Queries that will ariſe about them; I proceed to the Tables, which are rang'd in the following Order.

Tab. 1. *Is for finding the Value of an Annuity for a certain Number of Years, in ready Money, at* 4, 5, 6, 7, *and* 8 per Cent. *Intereſt; but this being a Table*

ble that is very common, I had no more Trouble about it than just to transcribe it; for it was ready made to my Hands: As was likewise,

Tab. 2. *Shewing (in ready Money) the Value of* 1 l. *payable after a certain Number of Years, at the same Rates of Interest with the former.*

Tab. 3. *Is to discover the Worth of an Annuity that is to continue* 7, 10, 14, *or* 21 *Years, if a Person of a given Age do live so long; and these are calculated by the Method laid down by Mr.* Abr. de Moivre, *in his Annuities on Lives,* Prob. 2. pag. 21.

Tab. 4. *Shews the Value of an Annuity that is to continue during the Life of a Person of any Age, at* 4, 5, 6, 7, *and* 8 per Cent.

Tab. 5. *Of the Value of two joint Lives of equal Ages. By joint Lives is meant, that the Annuity is to continue*

till one of those Lives is dead, and no longer.

Tab. 6. *Of the Value of two joint Lives of different Ages.*

Tab. 7. *Exhibiting the Value of three joint Lives of different Ages.*

All these five last mention'd Tables are built on the Foundation laid by the great Dr. Halley, *in* Philosophical Transactions, N°. 196. *and the* Calculus *perform'd by the Method set forth by Mr.* De Moivre *in his Tract before-mentioned.*

Having gone thro' with these Tables, (and pretty well surfeited myself on Figures) I proceed in the following Chapters to shew the Use of them by a Variety of Examples; wherein the Reader will find, that I have thoroughly consider'd the Outgoings; such as Rates, Taxes, Tythes, High-Rents and Repairs, as well as the Nature of the Tenure, and the Interest that ought to be reckon'd for the Money

laid out, with regard to the Security that the Purchaſer has for it.

I have likewiſe ſhewn, how from theſe Tables by Addition and Subtraction only, to find the Value of Annuities that are to continue during the Life of the longeſt Liver of two or three Perſons, and have given Examples to that purpoſe.

After this is done, and ſomething ſaid of Reverſions, with two or three Examples to explain the Method of valuing an Eſtate in Poſſe ; *I have laid down ſome Rules of judging the Worth of Timber Trees and Coppice Wood; with a Way of trying how much Timber will increaſe, in any given Number of Years, in a particular Soil and Situation: And under this Head I have hinted at what Cautions ought to be uſed, that a Man do not give too much for growing Timber; and thence what Rate of Intereſt a Purchaſer may inſiſt on, for the Money he lays out in that Commodity.*

Two or three Examples, for valuing of Coppice Wood, bring me to a Conclusion of this Chapter, and was at first the Period to the whole Work: But these Papers having lain by me for above three Years; during which Interval, that Surfeit of making Tables was pretty well worn off; and considering that it would render the Work more useful, if Tables of the Value of an Annuity on the longest Liver of two or three Persons were subjoined to it: In pursuance of this Thought, I have with a pretty deal of trouble perfected such Tables; whereby the Value on such a Tenure (which is the most in Use of any amongst us) may be found for Lives of any Ages, howsoever combined, at one View.

The manner how these Tables were computed, is before hinted; but then the Accuracy of the Work must appear by the Tables themselves. And this I must submit to the Reader's Judgment, after I have told him, that tho' I made use of the most

most expeditious Ways of working that I could think of, I made the Operation for some particular Ages, and so equated for the interminate ones; all the Labour that I sav'd myself in that way, was, that I wrought for the Rates of Intereſt 4, 6, *and* 8, *and by them equated thoſe of* 5 *and* 7; *and that only for the Tables of valuing ſingle Lives, and thoſe for the joint Lives: for as to the Tables at the End of the Book, they were calculated for every particular Age, and to every Rate of Intereſt mention'd in them.*

And tho' I cannot take upon me to ſay they are entirely free from Error, it being next to impoſſible that ſuch a Calculation ſhould be ſo; yet this I believe I may affirm, that the Miſtakes are very ſmall and inconſiderable; for it is hardly poſſible that any great Blunders ſhould eſcape me, ſince the Numbers before and after ſuch a Miſtake would unavoidably diſcover the Error, and direct to your Correction.

Upon the whole, I hope that no Error ſo great as one tenth Part of a Year's Value hath eſcap'd me; and then I believe the candid Reader will be ready to ſay the Tables are as correct as can be expected; for, humanum eſt errare.

A word or two about the Appendix, *and I have done.*

The Inſtrument here deſcrib'd is, for ought I know, a new Invention. The want of ſuch an Inſtrument in the Practice of ſurveying Timber, *put me upon the* Thought *of inventing one; and I have for ſeveral Years made uſe of this, and found it to anſwer my Expectation.*

After all the great Pretenſions of Surveyors, that they can gueſs to the Quantity of Timber *in a growing* Tree *within a very ſmall matter, I have found ſome of the beſt of them very deficient: and if in ſurveying a great Number of* Trees, *a Perſon once falls into an Error*

in

in his Gueſs, the following Trees are very likely to ſuffer the ſame Fate; and without a great deal of Care in correcting the Ideas in the Mind, the Miſtake is likely enough to grow greater, and may increaſe conſiderably before it be diſcover'd.

Now if theſe happy Gueſſers would but be perſuaded to carry one of theſe Inſtruments into the Woods with them, it would be of uſe, or at leaſt muſt be a Satisfaction to them, if they did but try one Tree in twenty, to ſee how juſtly they could pretend to this Accuracy in judging of the Quantity of Timber. And further, it would be uſeful to improve this Faculty, and give them in time a much better Title to what they at preſent with ſuch an ungrounded Air of Aſſurance pretend to.

INTRODUCTION.

IT muſt be acknowledged by every body, that in all manner of Sales or Purchaſes, it is highly juſt and requiſite, that both Buyer and Seller ſhould have a right Underſtanding of the Value of the Commodities that they contract about; for whatever Advantage one Party makes by means of the other's Ignorance, it is ſo far an Act of Fraud and Injuſtice.

But tho' every body will allow this to be true in other Mens Negotiations, where they themſelves are unconcern'd; yet is it too notorious, that many (I fear the moſt) People, when they meet with an ignorant Chap, are willing and ready enough to ſtrike a Bargain with him at the beſt Advantage for themſelves; and (blinded with Self-intereſt) never conſider that it is their Duty to ſet him right in his Judgment, as to the Worth of the Commodity.

How neceſſary is it therefore, that (where the thing will admit of it) the true Worth of Commodities ſhould be by ſome ſtated Rules aſcertained? by the Help whereof ſuch Perſons (who for want of Leiſure or Learning cannot by a Chain of Arguments and Demonſtrations eaſily attain ſo much Judgment or Skill, as is neceſſary for the preſerving their Property, and doing Juſtice to themſelves and Families) may eaſily inform

form themſelves, how much they ought to have or give for the thing that they are going to treat about.

It muſt be confeſs'd, that ſuch a Determination of the Value of Things is in ſome Caſes impoſſible, in others very difficult, and in all ſubject to divers Cautions and Reſtrictions, according as the Profit ariſing by that other Commodity or Species, (*viz.* Money or the like) by which 'tis valued or compared, riſes or falls; or according to the Method or Time of Payment; and the Security for the true Performance of the Agreement on both Sides.

And altho' it be utterly impoſſible, in ſome Caſes, to underſtand the real Value or Worth of the things we are dealing for, on account of the Precariouſneſs of the Tenure, the Accidents they are liable too, or the Uncertainty of their always bearing the ſame Proportion to that by which we value them, as they

do

do at the time of Purchaſe; yet all theſe Uncertainties may, as ſuch, be valued, provided the Likelihood of their happening or not happening be exactly known. Thus for Inſtance: Admit that a Perſon be to win 100*l.* if he at firſt (wholly unskill'd) throws a Duce with a ſingle Dye; here it is plain that he has five Chances to loſe, and but one to win; conſequently the real Value of his Chance before he throws is 100*l.* divided by 6, or 16*l.* 13*s.* 4*d.* And the like may be found of any kind of Uncertainties, where the Ratio of the Likelihood, to the Unlikelihood of their happening, is known.

But then, in ſome Caſes, this Ratio becomes an Uncertainty; as particularly in finding the Worth of Annuities, or Leaſes upon Lives, in ready Money. Here 'tis plain, that ſuch an Annuity is of equal Value to an Annuity for ſo many Years as thoſe Lives ſhall continue in Being; which Number of Years are

unknown; and the Ratio of their living or not living 1, 2, 3, 4, &c. Years, is likewiſe an Uncertainty. The whole Difficulty therefore of valuing this Annuity lies in finding the Ratio of the ſaid Chances; to do which, is Part of the Buſineſs of the following Sheets.

The Want of a ſufficient Judgment in bargaining about things of this Nature, is the Occaſion of great Detriment, ſometimes to the Buyer, and ſometimes to the Seller: And I doubt not to make appear in the following Pages, that all the Rules commonly practiſed in theſe Caſes are falſe and erroneous, ſometimes doing Injuſtice to one, and ſometimes to the other Party; and however a Perſon prejudiced in favour of the ancient Ways of Leaſing, &c. may be prevail'd on to retain them, without troubling himſelf to enquire into the Reaſon of it; yet I perſuade myſelf, that the greater Part of Landlords and Tenants will be ſo juſt to themſelves, as to examine into a Mat-

a Matter that ſo nearly concerns them, and which ſo often falls under their Conſideration; not taking it for granted, that the Rules are good, becauſe always obſerv'd by their Fathers, Grandfathers, &c. in whoſe time the Profit ariſing by Money was (perhaps) as 6 to 5 to what it is now; and alſo whoſe Rules (even as the Caſe was then) contained nothing like Demonſtration.

Neither is the Alteration of the Intereſt of Money the only Blunder they commit by following their old Rules, (ſuppoſing thoſe Rules good then); but as their Predeceſſors reckon'd ſo many Years Value without deducting Rates, Taxes, &c. ſo they continue to do ſtill, notwithſtanding thoſe Outgoings are altered from what they were; perhaps one third, or one quarter Part, which is very conſiderable. Theſe and divers other Reaſons, which I ſhall hereafter ſhew, are ſufficient to apologize for this Performance (poor as it is) and may at leaſt

give

give a Hint, and put the Perſons concern'd upon thinking on the many Errors that ſuch a Method is likely to draw them into.

I don't know of any thing (like a rational Scheme) as yet publiſhed for adjuſting the Values of Leaſes on the ſeveral Tenures in Uſe amongſt us; one Reaſon of which may be perhaps the Difficulty, or rather the ſeeming Perplexities with which ſuch a Computation is involv'd. For although ſeveral Perſons have with good Succeſs endeavour'd to obviate Part of the Difficulties; yet the Application of their Precepts to the Purpoſes before-mention'd, does ſtill remain a Task inſuperable to the Generality of People whom they concern; the Gentleman's Steward and Tenants being (for the moſt part of them at leaſt) as much in the dark as ever.

And indeed as the Foundation of ſuch a Scheme was too noble to be laid by a

leſs Genius than that of the Great Dr. *Halley*, or Mr. *De Moivre*; ſo likewiſe are there ſome porterly Offices neceſſary in carrying on the Structure, (ſuch as making the following Tables, &c.) that are too mean, too ignoble a Drudgery for the World to expect from their Labours.

I am free from the Vanity of aſcribing to myſelf any more than having, with a great deal of Labour, gone through with the numerical Calculation, and of having apply'd the whole to the Valuation of Eſtates on thoſe precarious Tenures. If what I have done herein be of any Uſe, 'tis what I chiefly aimed at; and if not, I have unwittingly miſ-ſpent my Time; and may perhaps receive Blame and Cenſure for taking ſo much Pains to build on an Hypotheſis, which is acknowledged by its Author to be uncertain for want of more Experience as to the Probability of Life. I ſhall only ſay, in Anſwer to thoſe Oppugners, that this

this Hypotheſis was publiſh'd above thirty Years ago; and I don't know of any body that hath yet appear'd againſt it: And further, that the Nature of the thing doth not admit of a certain Concluſion; for what may in this Caſe hold good in one Place at one time, may not in the ſame Place at another time, nor in other Places at any time. It is ſufficient, that in general theſe Tables of Dr. *Halley*'s from Mr. *Juſtell*'s Collections come ſomewhat near the Truth; I ſay ſomewhat near, for ſmall Errors are not to be regarded in theſe Computations.

But ſome may be apt to object to this Performance, that Eſtates of the ſame yearly Value are very commonly leaſed for more Money in one County than in another, and in one Part of the ſame County than another, and that at Places not far diſtant from one another; and hence they conclude, that the Cuſtom of Leaſing in particular Places is the only Rule

for Valuation, at leaſt the only one that will be follow'd: and ſo concern'd they are leſt the Reaſonableneſs of a new Method ſhould prevail, that they tell us, the bare propoſing any Alteration would rather move People to Mirth, than induce them to enquire into the Nature of the thing.

In Anſwer to this Objection, I think that the different Value given for Eſtates of Leaſe in different Places may, in ſome meaſure, ariſe from a prevailing Cuſtom, as the Objector ſuggeſts: But this is ſo far from a Diſcouragement to the Undertaking, that it rather ſhews it neceſſary; for if thoſe Eſtates have a real Value, and that real Value can be diſcover'd and made appear, 'tis requiſite that it ſhould be ſet forth in a proper Light; and if ſome People are ſo abandon'd to Senſe and Reaſon, as to laugh at the Attempt to undeceive them; yet ſome others will doubtleſs give it a hearing, and practiſe it, at leaſt as far as they

they find it uſeful and advantageous to them.

But then I am of Opinion, that the Difference mentioned in the Objection very often ariſes (in Part) from Reaſon rather than common Uſage: For

Where an Eſtate hath been occupied by the Leſſee for a great many Years, and the Leaſe comes to be filled or renewed, the yearly Value, by which the filling up or renewing is generally adjuſted, is taken from the Landlord's Rent-Roll, made perhaps a hundred Years before. Now in that Interval the Eſtate may have been improv'd by good Husbandry, or impoveriſh'd by the contrary to a very great Degree; from whence it comes to paſs, that the preſent yearly Value by which, and which only, the Value of the ſubſequent Tenure is to be had, is far different from that in the Rent-Roll. And this being known

to both Landlord and Tenant, the one exacts, and the other gives, more or leſs *Years Value*, as they call it, for the Leaſe; whereas perhaps the preſent yearly Value being conſider'd, the Difference of the Fine would (in a great meaſure) as indeed it ſhould, be *wholly* accounted for.

And that this Difference of Cuſtom ſhould prevail throughout whole Manors, may ariſe from the Means and Opportunities of Improvement that have of late Years offer'd themſelves to ſome particular Places, by which their Lands have acquired a greater Value; and the ſame Means that thus advances one Part of a County, may and often doth ſink the Value of another Part.

As to the different Values given in the ſame Neighbourhood for renewing of Leaſes, they ſometimes ariſe from the Indigence or Conveniency of one of the Parties; at other times from the Eagerneſs

gerneſs of two Purchaſers, or the like: But theſe Caſes do not alter the real Value; and are only a Reflection on the Party that takes the Advantage.

The Gentleman's STEWARD *and* TENANTS *of Manors Inſtructed.*

CHAP. I.

THE chief Deſign of the following Sheets being to reduce Eſtates of all Kinds (as near as may be) to their Value in Caſh, by comparing them with Annuities to continue a certain Number of Years; it will be neceſſary firſt of all to explain

What an ANNUITY *is.*

And here, in general, by an Annuity, I mean a Sum of Money to be paid yearly; and if the Payment be to be continued a determined Number of Years, then I call it an Annuity for Years certain; but if it be to be

continued as long as One, Two, or Three Perſons (or either of them) ſhall continue in Being, then it is an Annuity for Life or Lives.

And as theſe yearly Payments are ſometimes charged on, and payable out of Eſtates of a greater yearly Value, as a Security for the juſt Payment of them; ſo likewiſe they are, or may be incumber'd with a Part of the Aſſeſsments and yearly Outgoings of ſuch Eſtates. For Inſtance: An Eſtate of an Hundred Pounds *per Ann.* may be bound for the Payment of Fifty or Sixty Pounds a Year; with this Proviſo, that the Annuitant do allow out of the ſaid yearly Sum, a proportionable Part of the Taxes, Tythes, *&c.* Now in ſuch Caſe I would reduce theſe Outgoings to a Certainty as near as poſſible, and deduct the ſame out of the Fifty or Sixty Pounds, calling the Remainder, that is, the Sum that comes in yearly to the Annuitant, clear and free from all manner of Allowances, an *Annuity*.

Having ſhewn what an Annuity is, let us next ſee whether the real Value thereof in ready Money can by any certain Rules be found; that is, in other Words, Can we certainly know how much ready Money (at a given Rate of Intereſt) will, in the Time of the Annuity's Continuance, amount to an Equivalent for the ſaid Annuity.

And here it's plain, that if a Perſon advance a Sum of Money, to receive an Equi-

valent

valent for the ſame at one Year's End, he muſt then receive, over and above the Sum ſo laid out, one Year's Intereſt for it: But the Sum to be receiv'd, and the Intereſt expected, being fix'd, the Money to be laid out may eaſily be found. Again: For the next Year, the Purchaſer muſt lay out no more for this, than a Sum which continued two Years at Compound Intereſt would amount to the ſame Sum or Annuity; and ſo on for the Third, Fourth, Fifth, *&c.* Years, as long as the Annuity is to continue. Hence it appears, that where the yearly Income, the Rate of Intereſt, and the Number of Years are all fix'd, the Value of the Annuity in ready Specie may be eaſily found; the Method of doing which I ſhall ſhew hereafter.

But tho' the Method of computing the Value of an Annuity, when the Terms are thus fix'd, be very eaſy; yet oftentimes the certain fixing of the Terms, as the ſame may become applicable to the valuing of Eſtates, is very difficult, and not always poſſible: For in ſome Caſes the yearly Income of an Eſtate is very hard to be found; in others, the Rate of Intereſt that the Purchaſer ought to be allow'd for the Money he lays out, is ſomewhat uncertain. But laſtly and eſpecially, the Term that the Purchaſer ſhall enjoy the Income, is in ſome kind of Tenures wholly unknown; one or more of theſe Perplexities happen in almoſt every Query of this Kind, according to the Nature of the Tenure by

which the Purchaſer is to hold the Eſtate, *&c.* I ſhall therefore in the next place give ſome Account,

CHAP. II.

Of the divers Kind of Tenures of Lands and Eſtates, and in what Manner they may be reduced to, and valued as Annuities for Years certain.

IT will be impoſſible for me under this Head, to give an Account of all the different Tenures that are amongſt us; the Words, *Secundum conſuetudinem Manerii*, inſerted in the Copies of Court Rolls, refer to Cuſtoms that are different in almoſt every Manor: We are therefore to remark thoſe only which are general; and may, as far as they concern my preſent Deſign, be reduced to theſe following:

1. All Eſtates in Fee, or ſuch as the Purchaſer hath the Property and Diſpoſal of for ever. Under which Head we may likewiſe range thoſe Eſtates that are held by Leaſe for a long Term, as for 200 Years, or more, under very ſmall Rents; for tho' the Nature of the Tenure be different, yet is the real Value of them very near the ſame; as will plainly appear

pear by comparing the preſent Value of an Annuity to continue 200 Years, with the Value of the ſame in Fee at 4, 5, 6, *&c. per Cent.* Intereſt.

As to theſe Eſtates, the Difficulty of valuing them lies, Firſt, In aſcertaining the yearly Income that they are likely to produce, and the yearly Outgoings in Rates, Taxes, Repairs, *&c.* (Aſſeſſment on Lands only excepted, for that is likewiſe chargeable on Money at Intereſt.) And Secondly, The Rate of Intereſt that the Purchaſer may expect for the Money he lays out, according as the Security for the Eſtate and Income are better or worſe than the common Security for Money at Intereſt.

2. Of another Kind are ſuch Eſtates as are held for a Term of Years abſolute, under divers Conditions and Reſervations of Rents, and the like. Theſe are likewiſe reduced to Annuities as the former; only the Reſerved Rent muſt be valued as an Annuity to be deducted, and at a lower Rate of Intereſt than that of the Rack Rent, in regard of the Security for its true Payment being better than that of the other.

3. A third Sort are Copyhold Lands; under which Head I include all Church, College, Dean and Chapter Lands: Some of which are held for Terms of Years, renewable at a certain Period of Years, and for a ſtated

Sum

Sum of Money; others for Life, or Lives abſolute, renewable in like (or ſometimes in different) manner with the former.

Again: It is the Cuſtom of ſome Manors, that the Widow of him that was Tenant for Life, hath a Right of Dower during her Widowhood; ſometimes of the Whole, and ſometimes of only a Moiety of the Eſtate, the other Moiety and Remainder to the Son. Theſe and divers other Cuſtoms there are, which muſt be well conſider'd, in order to find out the real Value of theſe Tenures; and the yearly Income, Rate of Intereſt, and (in ſome Caſes) Time of Continuance being dubious, muſt be fix'd with Judgment and Caution, if we would with any degree of Certainty arrive at the juſt Value.

4. Another Sort of Tenure is for a Term of Years, determinable on the Death of One, Two, or Three Perſons, with Reſervation of Rents, *&c.* Under this Head may be likewiſe included thoſe that hold by Life, or Lives abſolute; for tho' this laſt be in the Nature of a Freehold in Law, yet as to the real Value of ſuch Eſtates, there's little or no Difference betwixt that which is held for 99 Years, if One, Two, or Three Lives, or either of them live ſo long, and that which is held for the ſame Lives abſolute: And the Cautions before-mentioned in Copyhold Eſtates for fixing the Terms, are likewiſe to be obſerv'd in theſe.

Under

Under theſe four general Heads may be comprized all, or the moſt part of Holdings, that are at this time in Uſe amongſt us; and as all theſe may, by a due Caution, be reduc'd to Annuities of a known equal Value; ſo likewiſe may the Reverſion of a Term of Years, or a Life or Lives, after an Eſtate in *eſſe*, be by the ſame Method computed.

It is very juſtly obſerv'd by Mr. *De Moivre*, "That the Method of calculating the Value "of Annuities upon Lives, was never per- "fectly underſtood before Dr. *Halley*'s Rules "came abroad." The Truth of which Obſervation will appear by the following

CHAP. III.

Containing an Account of the common Methods made uſe of in valuing thoſe ſeveral Tenures; with the Errors that they are ſubject to.

AND Firſt, as to Eſtates in Fee-Simple, *&c.* I know but of one vulgar Method made uſe of in finding their Value in ready Money, which is thus: Divide 100 *l.* by the Rate of Intereſt *per Annum*, and take the Quotient for the Number of Years Value of the Purchaſe in ready Money; hence, after the yearly Income is known, (which with

them is the Rack-Rent, excluſive of Tythes, without any Allowance for Out-goings,) there is no more to be done, but to multiply this yearly Income by the Quotient before-mentioned, and the Product is eſteemed to be the Value in Caſh.

The Falacy of this way of Computation will appear, if we duly conſider the Conſequences that flow from it: Thus, for Inſtance: Admit I were to purchaſe an Eſtate of 100 *l.* *per Ann.*, Intereſt of Money being at 5 *per Cent.* Both Parties can expect no other Terms by this Method of reckoning than theſe; 100 divided by 5, the Quotient is 20 Years Value for the Fee, which in Caſh is 2000 *l.* Now, admit that out of this Eſtate I muſt pay, or allow, 12 Pounds *per Ann.* towards the Parochial Aſſeſſments, (excluſive of the King's Tax) and Three Pounds *per Ann.* more for Repairs; then 'tis plain, that I ſhall receive no more than 85 *l.* *per Ann.* clear, for the Income of my 2000 *l.* To find what Rate of Intereſt I have for my Money, let the Rate be = to r; then $\frac{100}{r} \times 85 = 2000$; conſequently, $r = \frac{8500}{2000} = \frac{8,5}{2} = 4,25$; that is, four and a quarter *per Cent.* I know that the common Argument is, that a Man would rather take four and a half *per Cent.* on landed Security, than 5 *per Cent.* on the common Security for Money: And indeed this ſeems to be a pretty plauſible Way of arguing; but

then,

then, to ſhew that this is a wrong Way of computing, let me once more ſuppoſe, that the Eſtate I would purchaſe were of the ſame yearly Rent (*viz.* 100 *l.*) as before, and that the Price that I muſt purchaſe at be likewiſe 2000 *l.*; but then admit, that in this latter, the Out-goings be no more than four Pounds a Year, (as the Caſe may be, in different Pariſhes and Circumſtances:) Upon this Suppoſition, I have 96 *l. per Ann.* Income, for my 2000 *l.* which is above four and three quarters *per Cent.* that is, 11 Shillings *per Cent.* more than in the former Caſe.

Upon the Whole, by this way of Computation, a Man may purchaſe an Annuity in one Place, of $\frac{1}{8}$ yearly Value more than he can in another, for the ſame Sum of Money. And although the Difference of theſe Out-goings be ſometimes made a Ground for Cavil in the Treaty, yet all that is ſaid about it amounts to nothing like a regular Argument on either Side. But,

2. As to ſuch as hold for a certain Number of Years, the common Method, if it be deficient in nothing elſe, is ſo in this reſpect, that no Difference is made in the Security for the Rack-Rent, and of that for the reſerv'd Rent, Rates, Taxes, *&c.* The beſt of the uſual Methods for eſtimating the Value, being to deduct the Out-goings, and value the Remainder as an Annuity, for the Number of Years that the Eſtate is to continue at legal

Intereſt: Whereas a Man may reaſonably expect more Intereſt for laying out his Money on ſuch a Tenure, becauſe he does, by the Agreement, bind and encumber the whole Eſtate for the Payment of an Annuity, (for ſuch is the Out-goings,) thereby taking all Caſualties upon himſelf. Thus, whereas if a Man, for want of Opportunity, keeps his Money by him, he pays nothing out of what it would bring in if it were at Intereſt; it is quite different in this Purchaſe; for here the Out-goings muſt be paid, whether the Eſtate bring in any thing or no.

3. The Valuation of Copyhold Eſtates is ſtill more fallacious than either of the former; for, as to thoſe who hold for Lives, no Regard is had to the Probabilities of Life, (a Matter very conſiderable,) neither is there any Allowance made for the Money paid out in a regular way: I ſhall inſtance in ſome Particulars of this Kind: And firſt, In valuing 3 Lives abſolute, (or 99 Years determinable on 3 Lives, which is the ſame to all intents, as to the Value,) the general Rule was formerly to reckon it as a Leaſe of 21 Years certain; which by the Tables for that purpoſe, at 5 *per Cent.* is worth, in ready Money, 12,82 Years Value, and no more, for 3 Lives; the firſt of which they eſteem'd worth 6 Years, the ſecond 4, and the third 2,82; ſo that to renew 2 Lives in Reverſion of one, would coſt 7 Years, or one in Reverſion of 2, three

Years

Years Value: And this was the conſtant Expectation, what Age ſoever the Life or Lives in *eſſe* were of, at the Time of renewing.

Whether this Eſtimation of the Value of Leaſes aroſe from the Act of the 32 *H.* 8. or was in Uſe before, I know not; but it is there enacted, that a Leaſe for more than 21 Years or 3 Lives is void: By which it ſeems as tho' 3 Lives and 21 Years were reckon'd an equal Duration, the contrary of which was very evident, even before any Experiments were made concerning the Duration of Life; and therefore this way of computing was corrected by another, which is likewiſe in ſeveral reſpects erroneous. For,

By this other Method, (which is ſtill in practice) a Leaſe for one Life may be reckon'd equivalent to one of

	9, 10, 11, or 12 Years, *&c.*
that for two Lives, at	17, 19, 21, or 23 Years, *&c.*
that for three Lives, as a Leaſe of	24, 27, 30, or 33 Years, *&c.*

And tho' this latter Method is a little more plauſible than the former, on account of the Steward's Liberty of chuſing which of theſe Proportions he pleaſes, yet I cannot ſee any Analogy that this bears to the Reaſon of the Thing: For if the different Numbers are to be choſen according to the Age or Goodneſs of the Lives, or the different Value of the Out-goings, or both, I don't ſee how they can bear any Proportion to one another: So that at beſt 'tis but only groping in the dark; and no body can give ſuch a Reaſon for his

Choice, as will convince an unprejudic'd Perſon, that the Value thereby attained is juſt and reaſonable. By this Method, at *6 per Cent.*

One Life is worth	6,8 or 7,4	or 7,9	or 8,4	Years Value.
Two Lives are worth	10,5 --- 11,2	--- 11,8	--- 12,3	Years Value.
Three Lives are worth	12,5 --- 13,2	--- 13,8	--- 14,3	Years Value.

And this is always the Rule, without any regard to the different Ages of the Lives, or the greater or leſs Burden of Poor, *&c.* And hence it appears, that when three Lives are valued at 14 Years, they value one in Reverſion of two, at 2 Years, two in Reverſion of one, at 6 Years, and the one Life in Poſſeſſion, at 8 Years Purchaſe: If ever theſe Numbers agree with the real Value, it is by chance; as will more evidently appear, when I come to conſider the Probabilities of Life, and the Value of the Chances relating thereto.

Another Particular under this Head, is that of renewing Leaſes *for Years*, of Church or College Lands; wherein the Advantage of Leſſees is very evidently made appear, by an anonymous Author, in a Letter lately publiſhed to that purpoſe; at the End of which Letter is a Table for renewing any Number of Years lapſed in a Leaſe for 21 Years.

The cuſtomary Terms of doing this, is, to deduct the Rent reſerv'd out of the Rack-Rent, and then one Year's Value is the Fine for renewing ſeven Years: Now this Method being compared with that uſed by the Laity in ſuch Caſes, will ſtand thus:

A Leaſe

A Leaſe for 7 Years, in Reverſion of another Leaſe of 14 Years, in Church or College Lands, is ſold for } 1 Year's Value.

A Leaſe for the ſame Term, of other Lands, at 6 *per Cent.* is ſold for, and is really worth } 2 ½ Years Value.

Thus it appears that the former Leſſors have not above two Fifths of the Value of what they ſell. The before-mention'd Author hath plainly made appear, that the Tenants in Church-Lands have (when they renew their Leaſes) after the Rate of 11 *l.* 11 *s.* 8 *d.* ¼ *per Cent.* Intereſt for the Money they lay out; which is doubtleſs ſuch an exorbitant Rate, as will fix on them the Guilt of Extortion in a very high Degree.

At firſt View of this prepoſterous way of dealing, I confeſs I was much at a loſs to find what ſhould induce Clergymen, Fellows of Colleges, *&c.* to give away, what they had ſo juſt a Title to, from themſelves and Families.

The reading the afore-mention'd Letter did indeed confirm the Truth of the Matter of Fact; but then it gave me no Light into the Reaſons of its being ſo. The Author very ingeniouſly aggravates the Guilt and Shame of the Oppreſſion; but how the Landlords ſhould be induced to grant ſuch Terms, (if it be in their Power to advance the Fine) here he is ſilent. It's certain, that the keeping

ing the Eſtates in hand would be more advantageous than to leaſe them out for leſs than half the Value; and 'tis as certain, that the Tenants would advance at leaſt a great Part of what is under Value, rather than refuſe a Bargain that would ſtill be better than any the Laity would grant them.

To ſay, that by following the Rules fix'd by their Predeceſſors of 180 Years ago, they think they do themſelves and Succeſſors Juſtice, is to brand them with a degree of Ignorance they cannot be poſſeſs'd with. For the Statute of 37 *Hen.* 8. was made to reduce Intereſt of Money to 10 *per Cent.* which plainly ſuggeſts that it was higher before that Time; and hence if this was the Cuſtom of renewing thoſe Leaſes at that time, it carried Reaſon with it: But why the Cuſtom ſhould continue after the Reaſon of it ceas'd, is ſtill to be accounted for.

In order to explain this ſeeming Paradox, the Deans and Chapters, Fellows of Colleges, *&c.* muſt be conſider'd in a double Capacity: Firſt, as they are a Society, and as ſuch have a Right to divers Lands, with Power to make and renew Leaſes of thoſe Lands for a Term of Years: But then, Secondly, in their private Capacity they have a Right to the Money brought in by theſe Leaſes, to be diſpos'd of at their own Will and Pleaſure.

And now if it can be made appear, that it is for the worldly Advantage of the Members of theſe Societies, in regard to their private

Capacity, to keep the Leaſes fill'd at this low Rate, rather than to let them run out, and thereby hazard their never having an Opportunity to make any Advantage to themſelves; I ſay, if this can be ſhewn, then I doubt not but every one will ſuſpect, that it is this God of the World that tempts them to do a thing ſo prejudicial to themſelves as a Society.

That the Value of renewing or filling up theſe Leaſes is different with reſpect to theſe different Circumſtances, will appear by the Solution of theſe following Queries, *viz.*

Qu. 1. *What is the Value of renewing 7 Years lapſed in a Leaſe for 21 Years, at 5* per Cent.?

The Anſwer will be, About three Years Value.

Qu. 2. *What is the Value of renewing 7 Years lapſed in a Leaſe of 21, to continue, if one Life ſhould ſo long happen to live, at 6* per Cent.?

This, to a Man of about 50 Years of Age, by a rational Computation deduced from the Probabilities of Life, is worth no more than one Year's Value.

Wherefore the Man that receives one Year's Value for renewing ſuch a Lapſe, receives as much as it is worth on the Chance of his own Life, (and he can enjoy it no longer, if it falls into his Hands); but as the Leaſe is good for the Term abſolute, the Leſſor grants

away

away the Right of his Succeſſors; thoſe Succeſſors doing the like by the next, and ſo on, and have nothing for it. And this they chuſe to do only, or chiefly, becauſe the Tenants are obſtinate, and will not break thro' a Cuſtom that is ſo profitable to them, altho' the Reaſon for eſtabliſhing the Cuſtom is ceaſed long ago.

Whether the complying with, and (in ſome Senſe) impoſing ſuch unreaſonable Terms, be doing Juſtice to themſelves and other People, I leave to the Conſideration of the Perſons concern'd. There can be no Hopes of a Reform in this Affair, till the Perſons, in whoſe Power it is, ſhall think fit to exert a publick Spirit, and ſuffer the Good of their Society to thruſt out of their Hearts their own private Intereſt, when they ſtand in Competition with one another.

That this is a Duty on them (in whatever Circumſtances they are) can never be deny'd by thoſe who are ſo often preſſing the ſame on the Laity; they certainly muſt acknowledge, that they *ought* not to be diſcouraged at any Difficulties, nor terrified at any unjuſt Reflections that they are like to undergo, for their vigorous Endeavour to reſcue their own and their Succeſſors proper Inheritance out of the Hands of ſuch as would unjuſtly detain it. A Clauſe added (when our Legiſlators ſhall think fit) by way of Amendment to the Act of 12 *A.* relating to the Intereſt of Money, would effectually ſecure the Property of

theſe Sufferers againſt Extortioners in this reſpect, and do that for them, which they have not Courage to do for themſelves. But this is a Digreſſion from my Subject: I ſhou'd now proceed to give ſome farther Account of the Abſurdities in the common Method of valuing Copyholds; but the Cuſtoms of Manors being ſo various, 'twou'd be endleſs to run thro' them all; I ſhall therefore proceed to the Fourth Sort of Tenures before-mention'd.

4. And in theſe, Eſtates for 99 Years, determinable on the Death of 1, 2, or 3 Lives, the Method of valuing is generally the ſame with thoſe on Lives before-mention'd, and is conſequently liable to the ſame Miſtakes. As this Kind of Tenure is very common, at leaſt in the *Weſtern* Counties; ſo the more Care ought to be taken in adjuſting the Value, and, if poſſible, ſuch Rules laid down as may include all the poſſible Circumſtances, *viz.* all the Incumbrances of Rates, Taxes, Repairs, high Rents, *&c.* and all the Caſualties; which are different, according to the Quality and Situation of the Eſtate. All theſe, I ſay, ſhould be duly conſider'd, and a proper Allowance made, before the Value of the Leaſe can be determin'd.

That the common Way of Eſtimation doth not provide for theſe Differences in any regular manner, is very evident; and therefore muſt of neceſſity be deficient on that account.

CHAP. IV.

Of ſome Things that are to be conſider'd before the real Value of an Eſtate or Annuity can be diſcover'd.

PREVIOUS to the aſcertaining the Value of Leaſes, 'twill be neceſſary to have a right Underſtanding of the following Particulars:

1. The Nature of the Tenure, and Term of Continuance, (as near as may be) of the Eſtate to be purchaſed; and whether the Lord hath a full, or only a conditional Power of granting it for ſuch a Term.

2. The Caſualties, Incumbrances, and Impoſitions that go along with the Eſtate, and how far the Poſſeſſor of the Eſtate is liable to them.

3. The Quality of the Eſtate, as to the preſent Condition of Repair; how much it will coſt to put it in good Repair, and how much *per Ann.* afterwards to keep it in that Condition during the Term to be purchaſed.

4. The Rate of Intereſt for Money, together with the Analogy that the common Security for Money lent, bears to the Security for the Income of the Eſtate to be purchas'd.

5. The

5. The yearly Value. And here great Care muſt be taken, that it be not fix'd too high, nor too low; for it is not always the Rent that an Eſtate is lett for, that is the Value of it. A Landlord may ſett out an Eſtate for more or leſs than it is really worth, according to the Neceſſities or Convenience of himſelf or Tenant.

Beſides theſe, there may be other accidental Circumſtances that attend particular Tenures; but theſe being the principal, I ſhall take notice of them in order, as they are here ſet down; and leave the other leſs material ones, to be conſider'd according to the Diſcretion of the Parties concern'd.

1. And *Firſt*, As to the Nature of the Tenure, enough hath been ſaid already: But for the Continuance of the Term, which is very often during 1, 2, or 3 Lives; this is a Matter very precarious, becauſe no body can tell how long theſe Lives will continue in Being; and therefore ſince the certain *Knowledge* of this is entirely out of our reach, the beſt that we can do is to inform ourſelves, as well as we may, of the moſt probable Conſequences in thoſe reſpects: And tho' in regard to theſe Uncertainties, the Buyer muſt be ſaid to purchaſe a Chance; yet the real Value of theſe Chances (as ſuch) may be found to a tolerable degree of Certainty: To do which, I muſt beg leave here to aſſume an *Hypotheſis*, viz.

The Probability that a Life of any given Age will continue in Being 1, 2, 3, 4, &c. *Years, is juſtly exhibited in Dr.* Halley's *Tables, publiſhed in* Philoſ. Tranſ. *N°.* 196. *or may be deduced therefrom.*

No body will undertake to prove, that this is mathematically certain; for it is very evident, that the nature of the thing will not admit of mathematical Certainty. The Deficiency that the Doctor ſeem'd to apprehend in it, was the want of a very great Number of Years Experience; but it will, I believe, cauſe but a ſmall Error in the Reſult, if the Numbers in the Doctor's Tables ſhould, on future Experience, be a little varied.

But to proceed: If the Lord, or Perſon from whom you purchaſe, hath no more, or will grant no more than a conditional Right; then muſt the Value of the Hazard of ſuch Conditions be computed, whether it depend on a Chance, or otherwiſe; and that Sum muſt be deducted according as Prudence and Diſcretion ſhall direct.

2. In the ſecond place: By Caſualties, I mean ſuch unforeſeen Accidents which an Eſtate is expos'd to; ſuch as Fire and Inundations, whereby Houſes are conſumed, Wears, Banks, *&c.* demoliſh'd, and Cattle deſtroy'd. That ſome Eſtates are more liable than others to ſuch Accidents, is very certain. Again: Is the Eſtate likely to be always tenanted?

and

and will it not be often changing Tenants, which always brings a Charge with it? *&c.* And here, if on a Scrutiny the Hazards that a Perſon runs by the Purchaſe be evidently greater, or leſs, than the common Hazards on lending Money, a Purchaſer muſt be allowed a proportionable greater or leſs Intereſt for the Money he thus lays out.

By the Incumbrances and Impoſitions that always go with an Eſtate, muſt be underſtood all Tythes, Rents, Rates, Taxes, Herriots, Suits, Services, *&c.* for the Payment of which the Eſtate is generally bound; and conſequently theſe muſt be valued as a Rent Charge, or clear Annuity to be paid out, when (ſometimes at leaſt) the Income of the Eſtate, as being attended with ſome Uncertainties, *&c.* muſt be reckon'd at 1 or 2 *per Cent.* more than theſe Outgoings.

3. *Thirdly*, I am to conſider of the Quality of the Eſtate as to Repair: And herein, as I take it, the greateſt Difficulty lies; for the beſt that can be done is but Gueſs-work, as to theſe Diſburſements. If it be out of Repair at the time you purchaſe, the beſt way will be, whether it be Fields or Houſes, or both, to get Men that are skill'd in theſe Matters, to compute the Charge of putting it into a tenantable Condition of Repair; which Charge ought to be deducted out of the Value, and reckon'd as ſo much Money paid: and ſo far this Difficulty is ſurmounted.

But

But then as all Eſtates will coſt Money every Year to keep them in Repair, and ſome more, ſome leſs; theſe yearly Diſburſements muſt be likewiſe computed in the beſt manner that may be. To do which, the Judgment and Experience of honeſt Men, that have been accuſtom'd to ſuch Affairs in that Country or Place where the Eſtate lies, muſt be your Guide: for as Repairs of Houſes, *&c.* are dearer in one Place than in another, ſo likewiſe are they more expos'd to Storms, *&c.* in one Place than another. Again: Old Houſes (tho' they are at firſt put into Repair by the former Suppoſition) are more chargable in the future Repairs, than thoſe that are of a later building; and Houſes that were at firſt ſlightly built, are more chargeable than others of a more ſubſtantial Structure. Thus ſometimes it may be neceſſary (in Eſtates conſiſting chiefly of Houſes) to allow one Fifth, and at other times not above one Tenth Part of the yearly Income towards the Repairs of thoſe Houſes. And as to the Repair of Gates, Hedges, Wears, *&c.* no great Difficulty will occur; for moſt commonly the under-Tenant is by his Agreement to do this at his own Charge; and then the Rent is the yearly Value clear of thoſe Deductions: But if it be otherwiſe, it may eaſily be found by the Cautions that are mentioned above.

If the Right to Timber-trees, Coppice-wood, Corn, *&c.* or the Profits of Mines, *&c.* be likewiſe to be transferr'd to the Purchaſer; then

then (as to the former of theſe) they muſt be valu'd as to the preſent Worth of them, and ſo much Money muſt be added to the Fine. But as to Mines, the clear yearly Profit like to ariſe thereby, and the probable Time of their Continuance muſt be conſider'd; and (the Chances being more hazardous than others) perhaps the Perſon that purchaſes may reaſonably expect a greater Rate of Intereſt for the Money he lays out in theſe; and therefore they muſt be valu'd by themſelves, and this Value muſt be added to that of the Eſtate before found.

4. I am to conſider the Rate of Intereſt, and Security for Money lent; and compare it with that on Money laid out in Lands, *&c.* The legal Intereſt for Money is well known to every body to be at this time 5 *per Cent. per Ann.* But though a Perſon can lawfully take no more, yet may he without the Violation of any Law lay out his Money for *leſs* Advantage; and many People who lend their Money by way of a Mortgage, or lay it out in purchaſing of landed Security, will, and often do, accept of 4 *per Cent.*

And indeed where Money is laid out on Mortgage, or to purchaſe a Rent Charge, or Annuity on Land, of a much greater yearly Value, or the like; in regard that the Caſualties are very few, or none at all, the Rate of 4 *per Cent.* may be very reaſonably comply'd with: But if the Purchaſe be of Lands

in

in Fee, consisting of Fields chiefly, here perhaps it may be reasonable to allow the Buyer something more, *viz.* 4½ *per Cent.* in regard that some Hazards, such as bad or no Tenants, *&c.* do attend these Estates: And this lower Rate than legal Interest is the more reasonable, in consideration that the legal Interest for Money is more likely to be abated, than it is to be advanc'd.

But if a Man lays out his Money on an Estate for Life only, then I see no Reason why he should not expect the legal Interest for his Money, in regard of the Uncertainty of the Tenure, *&c.* And indeed so he may a great deal more, if the Estate to be purchas'd be Houses, or the like, where the Casualties are many and great; such as Fire, Damage by Storms, very bad Tenants, or perhaps none at all: Here sometimes 6, 7, or even 8 *per Cent.* may be little enough. See more of this in *Chap.* 9.

5. Because the Value of Estates of all Kinds is to be computed from the yearly Income, great Care must be taken to ascertain the said Income.

In order whereto, if the Estate hath not been lett out at an yearly Rent, then the Judgment of honest Men in the Neighbourhood will be a good Guide; who may likewise be able to determine, whether the over-good or bad Condition it is in, do render it of greater or less Value *per Ann.* than, generally speaking,

ing, it will by a moderate Charge be kept in; as alſo of what Value ſuch Advantages or Deficiencies are. And again: If the Eſtate has been lett at an yearly Rent, theſe Perſons can inform whether too much, or too little hath been given for it, and upon what Account. By ſuch Methods as theſe, 'twill not be difficult to arrive at a perfect Knowledge of that yearly Value of an Eſtate, by which it will be proper to compute the Worth of the Fee, or Leaſe for Years or Lives.

Beſides theſe, there may be divers other things neceſſary to be known relating to particular Conditions in a Leaſe for Lives, or for Years, *&c.* as where the Leſſee is bound to pay a Herriot or Farley, either abſolutely of each Life, or conditionally if the Lives dye in courſe. In the firſt Caſe, the Probability of Life being known, *i. e.* how long 'tis likely each Life may continue in Being; the Value of the Money or Herriot then to be paid, may by the following Tables be found in ready Money; and ſo of each Life: And in the ſecond Caſe, the Probability of the Lives dying in courſe, together with the Probability as to the Number of Years (as before) being found, by the Rules and Tables hereafter laid down, the Value in ready Money may thence be found; which Sums ſo found muſt be deducted out of the Purchaſe-Money as before.

Again: Sometimes there is a Condition in a Leaſe for a certain Sum to be paid for re-

newing a Life, in caſe one ſhould die within a time prefix'd. And here the Probability of all the Lives living for that time being found, the Value of ſuch a Privilege to the Leſſor or Leſſee may be found.

If there be any other Conditions of this Kind, I preſume they may be fairly reduced to ſome or other of theſe, and the following Caſes.

Before I proceed to the Tables, it will be neceſſary to ſay ſomething in general,

CHAP. V.

Of Reverſions.

BY Reverſions, I mean that Right to an Eſtate, which is to take place after the Determination of a Term of Years, or Lives, during which it is held by ſome former Grant.

And the Queſtions that will ariſe in relation to theſe Eſtates in *Poſſe*, are ſuch as theſe:

1. What is the Value of the Fee in Reverſion of a certain Number of Years, or of a Life or Lives in Being?

2. What is the Value of a Term of Years to commence after the Expiration of another Term of *Years certain?*

3. What

3. What is the Value of a Term of Years, or of a Term of one, two, or three Lives, in Reverſion of a Life or Lives in Being, to be nominated either now, or at the End of the Term in Being?

4. Three Perſons being to enjoy an Eſtate by equal Portions during their joint Lives, the Remainder to the Survivors and Survivor; What is the Value of each Man's Right?

Theſe and the like are the Queries that will ariſe about Reverſions; and the Solution of them will appear eaſy enough, if we conſider,

1. *Firſt*, That the Value of the Eſtate in *Eſſe* added to the Reverſion, is equal to the Value of the Fee in Poſſeſſion: Whence 'tis plain, that ſubſtracting the Value of the preſent Poſſeſſor's Right out of the Value of the Fee-Simple, the Remainder is the Value of the Reverſion in the firſt Query.

2. Find the Value of the Term of Years in *Eſſe*, and then add the two Terms together, and find the Value of that whole Term; the Exceſs in Value of that whole Term above the Value of the Eſtate in *Eſſe*, is the Value ſought in the ſecond Query.

3. If, in the third Query, the Life or Lives in Reverſion be to be nominated at the time of taking; firſt find the Value of a Leaſe to continue during the Term of all the Lives, and from that Value ſubſtract that of the Lives in *Eſſe*; the Remainder is the Anſwer

to the firſt Part of the Queſtion. But if the Lives are to be nominated at the Expiration of the Right in *Eſſe*, find the probable Duration of the preſent Eſtate in Years, and alſo the Value of one, two, or three Lives in Caſh; then (from the Tables for that purpoſe) find how much this laſt Sum, payable at the End of the Years before found, is worth in ready Money, rebate at *5 per Cent.* for this is the Value required.

4. For a Solution to the fourth Queſtion; *Note*, That each Perſon hath a Right to one third of the Value of their joint Lives, and to half the Value of the Expectation after the Death of either of the other two; and alſo to the whole Value of the Expectation after the Death of both the others; which three Sums added together, gives the Value for each. The Value of two or three joint Lives is found by the Tables for that purpoſe, which follow.

CHAP. VI.

THE following Tables, for the more eaſy computing the Value of Annuities upon Lives, are (as I have before obſerv'd) the Reſult of thoſe Obſervations publiſhed by Dr. *Halley*, and were calculated by the Method laid down by Mr. *Abraham de Moivre* in a late Treatiſe, entitul'd, *Annuities upon Lives.* But

But before I proceed to theſe, it may be proper to tranſcribe a Table for finding the Value of an Annuity for Years certain at 4, 5, 6, 7, and 8 *per Cent.*

Tho' the following Tables are calculated, ſome for every 5th, and ſome but for every 10th Year of Age; yet I preſume, that the commonly known Method of Equating will accommodate them, as well to any other Year of Age, as to any intermediate Rate of Intereſt.

TAB. I.

Shewing the Value of an Annuity in Years, and decimal Parts for any Number of Years not exceeding 100, *at the Rate of* 4, 5, 6, 7, *or* 8 per Cent.

Years of Contin.	4 per Cen. Value in Years.	5 per Cen Value in Years.	6 per Cen. Value in Years.	7 per Cen. Value in Years.	8 per Cen. Value in Years.
1	0.98	0.95	0.94	0.93	0.92
2	1.88	1.86	1.83	1.81	1.78
3	2.79	2.72	2.67	2.62	2.58
4	3.61	3.55	3.46	3.39	3.31
5	4.44	4.33	4.21	4.10	3.99
6	5.23	5.07	4.92	4.77	4.62
7	5.99	5.79	5.58	5.39	5.21
8	6.57	6.46	6.21	5.97	5.75
9	7.42	7.11	6.80	6.51	6.25
10	8.09	7.72	7.36	7.02	6.71
11	8.75	8.31	7.89	7.50	7.14
12	9.37	8.86	8.38	7.94	7.54
13	9.97	9.39	8.85	8.36	7.90
14	10.55	9.90	9.29	8.74	8.24
15	11.10	10.38	9.71	9.11	8.56
16	11.60	10.84	10.15	9.45	8.85
17	12.15	11.27	10.47	9.76	9.12
18	12.64	11.69	10.83	10.06	9.37
19	13.12	12.08	11.16	10.33	9.60
20	13.57	12.46	11.47	10.59	9.82
21	14.01	12.82	11.76	10.83	10.02
22	14.43	13.16	12.04	11.06	10.20
23	14.84	13.49	12.30	11.27	10.37
24	15.25	13.80	12.55	11.47	10.53
25	15.60	14.09	12.78	11.65	10.67

Years of Contin.	4 per Cen. Value in Years.	5 per Cen. Valuo in Years.	6 per Cen. Value in Years.	7 per Cen Value in Years.	8 per Cen. Value in Years.
26	15.96	14.37	13.00	11.83	10.81
27	16.31	14.64	13.21	11.99	10.93
28	16.64	14.90	13.40	12.14	11.05
29	16.97	15.14	13.59	12.28	11.16
30	17.27	15.37	13.76	12.41	11.26
31	17.57	15.59	13.93	12.55	11.35
40	19.78	17.08	15.03	13.39	11.91
50	21.47	18.25	15.67	13.83	12.17
60	22.61	18.93	16.17	14.00	12.34
70	23.39	19.34	16.34	14.11	12.42
80	23.90	19.58	16.50	14.15	12.46
90	24.26	19.75	16.59	14.18	12.47
100	24.50	19.85	16.64	14.20	12.48
The Fee-Sim.	25.	20.	16.66	14.29	12.50

In this and the following Tables, the Numbers at the Left Hand of the Points are Years, and the remaining Figures are Decimals of a Year. I ſuppoſe there will be no Difficulty to underſtand the Value of theſe decimal Parts; but if there ſhould, it may be very uſeful to ſuch as are wholly unacquainted with Decimals, only to take the half of the Decimal, and reckon it for ſo many Weeks. Thus; Againſt 40 Years of Continuance you'll find under *4 per Cent.* 19.78. the 19 ſhews ſo many Years, and the half of 78 being 39 ſhews ſo many Weeks; therefore an Annuity for 40 Years is worth 19 Years 39 Weeks; or rather 19 Years 10 Months Purchaſe nearly.

Tab. II.

Shewing the present Value of 1 l. *payable at any Number of Years hence under* 100, *at* 5, 6, 7, *or* 8 per Cent.

Years.	Value at 5 *per Cen.* in Parts.	Value at 6 *per Cen* in Parts.	Value at 7 *per Cen.* in Parts.	Value at 8 *per Cen.* in Parts.
1	.95	.94	.93	.92
2	.91	.89	.87	.86
3	.86	.84	.82	.79
4	.82	.79	.76	.74
5	.78	.75	.71	.68
6	.75	.71	.67	.63
7	.71	.67	.62	.58
8	.68	.63	.58	.54
9	.64	.59	.54	.50
10	.61	.56	.51	.46
11	.58	.53	.47	.43
12	.56	.50	.44	.40
13	.53	.47	.41	.37
14	.51	.44	.39	.34
15	.48	.42	.36	.32
16	.46	.39	.34	.29
17	.44	.37	.32	.27
18	.42	.35	.30	.25
19	.40	.33	.28	.23
20	.38	.31	.26	.21
21	.36	.29	.24	.20
22	.34	.28	.22	.18
23	.32	.26	.21	.17
24	.31	.25	.20	.16
25	.29	.23	.18	.15

Years.	Value at 5 *per Cen.* in Parts.	Value at 6 *per Cen* in Parts.	Value at 7 *per Cen* in Parts.	Value at 8 *per Cen.* in Parts.
26	.28	.22	.17	.13
27	.27	.21	.16	.12
28	.25	.19	.15	.11
29	.24	.18	.14	.11
30	.23	.17	.13	.10
35	.18	.13	.09	.07
40	.14	.10	.07	.05
50	.09	.05	.03	.02
60	.05	.03	.02	.01
70	.03	.017	.008	.004
80	.02	.009	.004	.002
90	.012	.005	.002	.001
100	.008	.003	.001	.0004

I ſuppoſe that an Example or two will render the finding the Value of theſe Parts in Money very eaſy.

Thus: Againſt 15 Years, and under 5 *per Cent.* is —— .48

Multiply theſe Parts by —— 20

In the Parts given are two Figures at the right Hand of the Point; therefore cut off 2 Figures in the Product, and the remaining Figure to the left Hand is Shillings —— 9.60

Again: Multiply theſe Parts by —— 12

And cut off as before, then the Figures at the left Hand are Pence —— 7.20

Hence the Parts .48 is the ſame with 9*s*. 7*d*. $\frac{2}{10}$.

Again: Oppoſite to 70 Years, under 7 *per Cent.* is —— .008

20

00.160

12

1.920

Hence the Value in Money is 0*s*, 1*d*. $\frac{2}{10}$, &c.

TAB. III.

Shewing the Value (in Years and decimal Parts) of Annuities to continue 7, 10, 14, *or* 21 *Years, if a Perſon of a given Age live ſo long; calculated to every* 10*th Year of Age, at* 5, 6, 7, *and* 8 per Cent.

Annuity for 7 Years on a Life.				
Age.	5 *per C.* Y. Par.	6 *per C.* Y. Par.	7 *per C.* Y. Par.	8 *per C.* Y. Par.
2	5.11	4.94	4.77	4.62
7	5.43	5.24	5.06	4.88
12	5.59	5.40	5.21	5.04
22	5.55	5.36	5.18	5.00
32	5.42	5.24	5.06	4.88
42	5.27	5.10	4.92	4.74
52	5.07	4.91	4.76	4.59
62	4.80	4.64	4.38	4.13
72	3.92	3.80	3.69	3.58
79	2.64	2.58	2.52	2.46
Annu. for 10 Years on a Life.				
2	6.75	6.45	6.18	5.91
7	7.15	6.83	6.53	6.24
12	7.36	7.02	6.70	6.40
22	7.24	6.91	6.50	6.31
32	7.05	6.73	6.43	6.15
42	6.77	6.47	6.19	5.92
52	6.48	6.20	5.93	5.68
62	5.91	5.66	5.42	5.20
72	4.70	4.55	4.36	4.21
82	1.38	1.36	1.34	1.32

Annuity for 14 Years on a Life.				
Age.	5 *per Cen*	6 *per Cen*	7 *per C.*	8 *per C.*
	Y. Parts.	Y. Parts.	Y. Par.	Y. Par.
2	8.58	8.12	7.72	7.21
7	9.21	8.68	8.23	7.69
12	9.27	8.73	8.28	7.75
22	9.04	8.51	8.10	7.50
32	8.70	8.21	7.81	7.30
42	8.24	7.80	7.43	6.94
52	7.76	7.36	7.02	6.56
62	6.78	6.28	6.17	5.76
72	5.08	4.94	4.74	4.56
Annuity for 21 Years on a Life.				
2	11.00	10.16	9.41	8.75
7	11.63	10.70	9.90	9.18
12	11.60	10.67	9.87	9.16
22	11.18	10.30	9.55	8.86
32	10.60	9.80	9.10	8.46
42	9.98	9.24	8.61	8.03
52	8.99	8.42	7.88	7.39
62	7.77	7.26	6.86	6.47
65	7.18	6.77	6.40	6.06

Tab. IV.

Of the Value of an Annuity for one Life, calculated to every 5th Year of Age, at 4, 5, 6, 7, *and* 8 per Cent.

Age.	Value at 4 *per C.*	Value at 5 *per C.*	Value at 6 *per C.*	Value at 7 *per C.*	Value at 8 *per C.*
	Y. Parts.	Y. Parts.	Y. Parts.	Y. Parts.	Y. Parts.
2	15.28	13.56	11.92	10.59	9.64
7	17.32	15.30	13.42	11.79	10.69
12	17.20	15.23	13.36	11.72	10.67
17	16.68	14.73	12.99	11.47	10.46
22	16.05	14.14	12.54	11.14	10.17
27	15.18	13.46	11.97	10.73	9.78
32	14.30	12.79	11.47	10.38	9.46
37	13.40	12.10	10.90	9.90	9.07
42	12.50	11.27	10.24	9.37	8.62
47	11.58	10.49	9.58	8.82	8.16
52	10.50	9.65	8.91	8.25	7.68
57	9.31	8.70	8.11	7.58	7.10
62	8.04	7.53	7.08	6.66	6.29
67	6.53	6.21	5.90	5.60	5.32
72	5.21	4.98	4.78	4.56	4.38
77	3.52	3.40	3.29	3.19	3.09
82	1.41	1.38	1.36	1.34	1.32

TAB. V.

Of the Value of an Annuity for two joint Lives, (to continue till one of them dies) of equal Ages, calculated to every fifth Year of Age, at 4, 5, 6, 7, *and* 8 per Cent.

Age.	Value at 4 *perCen.* Y. Parts.	Value at 5 *perCen.* Y. Parts.	Value at 6 *perCen.* Y. Parts.	Value at 7 *perCen.* Y. Parts.	Val. at 8 *perC.* Y. Par.
2	10.89	10.04	9.24	8.50	7.84
7	13.04	12.08	11.16	10.26	9.37
12	13.01	12.05	11.13	10.22	9.32
17	12.36	11.42	10.60	9.76	8.95
22	11.64	10.80	10.00	9.24	8.53
27	10.80	10.12	9.43	8.73	8.04
32	9.94	9.41	8.83	8.19	7.49
37	9.07	8.61	8.12	7.58	7.01
42	8.21	7.78	7.36	6.94	6.52
47	7.37	7.02	6.69	6.36	6.02
52	6.52	6.26	6.00	5.75	5.49
57	5.58	5.44	5.25	5.04	4.84
62	4.63	4.53	4.42	4.27	4.10
67	3.70	3.63	3.56	3.48	3.40
72	2.73	2.68	2.60	2.58	2.53
77	1.68	1.66	1.64	1.62	1.60
82	0.55	0.54	0.54	0.53	0.53

TAB. VI.

Shewing the Value of Annuities for two joint Lives of any Ages, (that is, to continue till one of them dies) calculated to every 10th Year of either of their Ages, at 4, 5, 6, 7, and 8 per Cent.

Age.	4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen.	8 per C.
	One Life 2 Years old.				
2	10.89	10.04	9.24	8.50	7.84
12	11.88	10.99	10.11	9.28	8.48
22	11.28	10.40	9.60	8.87	8.21
32	10.37	9.68	9.01	8.35	7.67
42	9.36	8.77	8.19	7.62	7.07
52	8.17	7.74	7.31	6.88	6.45
62	6.59	6.29	5.99	5.70	5.41
72	4.52	4.37	4.22	4.07	3.93
82	1.33	1.31	1.29	1.27	1.25
	One Life 12 Years old.				
12	13.01	12.05	11.13	10.22	9.32
22	12.37	11.41	10.50	9.67	8.88
32	11.27	10.96	9.84	9.11	8.39
42	10.52	9.47	8.84	8.22	7.64
52	8.73	8.39	7.84	7.38	6.91
62	6.94	6.68	6.39	6.08	5.75
72	4.71	4.57	4.42	4.26	4.10
82	1.35	1.34	1.32	1.30	1.28

Age.	4 per Cen.	5 per Cen.	6 per Cen.	7 per C.	8 per C.
	One Life 22 Years old.				
22	11.64	10.80	10.00	9.24	8.53
32	10.82	10.09	9.11	8.73	8.05
42	9.65	9.22	8.45	7.92	7.45
52	8.42	8.00	7.55	7.12	6.67
62	6.71	6.43	6.15	5.88	5.61
72	4.58	4.45	4.32	4.20	4.09
82	1.44	1.33	1.31	1.29	1.27
	One Life 32 Years old.				
32	9.94	9.41	8.83	8.19	7.49
42	8.97	8.54	8.03	7.53	7.04
52	7.89	7.54	7.19	6.78	6.38
62	6.39	6.14	5.89	5.62	5.35
72	4.43	4.31	4.18	4.03	3.88
82	1.31	1.30	1.28	1.26	1.25
	One Life 42 Years old.				
42	8.21	7.78	7.36	6.94	6.52
52	7.26	6.92	6.58	6.25	5.96
62	5.93	5.71	5.49	5.29	5.09
72	4.27	4.12	3.96	3.81	3.71
82	1.28	1.27	1.25	1.24	1.23
	One Life 52 Years old.				
52	6.52	6.26	6.00	5.75	5.49
62	5.42	5.24	5.06	4.88	4.70
72	3.92	3.83	3.73	3.63	3.50
82	1.25	1.23	1.22	1.20	1.19

Age.	One Life 62 Years old.				
	4 *per C.*	5 *per C.*	6 *per C.*	7 *per C.*	8 *per C.*
62	4.63	4.53	4.42	4.27	4.10
72	3.46	3.38	3.30	3.21	3.13
82	1.18	1.17	1.16	1.14	1.12
	One Life 72 Years old.				
72	2.73	2.68	2.63	2.58	2.52
82	1.04	1.03	1.03	1.01	1.00
	One Life 82 Years old.				
82	0.55	0.54	0.54	0.53	0.53

The Uſe of the foregoing Table is very eaſy; for the Age of one of the Lives being found at the top, and that of the other in the left Hand Column (as is uſual in ſuch like Tables) right againſt it (under the proper Rate of Intereſt) you'll find the Value of the Annuity in Years and decimal Parts: Which decimal Parts may be reduced to Months or Weeks, by the foregoing Rules laid down under *Tab.* 1.

TAB. VII.

Wherein is shewn the Value of an Annuity for three joint Lives, in Years and decimal Parts, calculated to every 10*th Year of either of the Ages, at* 4, 5, 6, 7, *and* 8 per Cent.

2d Life	3d Life.	One Life 2 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
Two Years old.	2	8.44	7.97	7.49	7.01	6.53
	12	9.03	8.60	8.11	7.60	7.66
	22	8.69	8.21	7.73	7.26	6.80
	32	8.17	7.87	7.50	7.09	6.44
	42	7.49	7.25	6.90	6.52	6.04
	52	6.69	6.44	6.13	5.85	5.54
	62	5.55	5.31	5.06	4.92	4.75
	72	3.98	3.89	3.78	3.67	3.53
	82	1.25	1.23	1.21	1.20	1.18
Twelve Years old.	12	9.70	9.23	8.75	8.21	7.58
	22	9.31	8.85	8.37	7.85	7.30
	32	8.66	8.28	7.89	7.43	6.92
	42	7.94	7.60	7.24	6.86	6.46
	52	7.04	6.79	6.50	6.28	5.88
	62	5.82	5.65	5.46	5.24	4.98
	72	4.12	4.04	3.93	3.82	3.68
	82	1.28	1.27	1.27	1.26	1.25

2 Life.	3d Life.	One Life 2 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
22 Years old.	22	8.94	8.50	8.04	7.58	7.05
	32	8.35	8.00	7.61	7.19	6.72
	42	7.67	7.33	6.98	6.63	6.26
	52	6.84	6.60	6.31	6.04	5.71
	62	5.66	5.50	5.31	5.12	4.89
	72	4.04	3.96	3.86	3.75	3.61
	82	1.27	1.25	1.23	1.22	1.21
32 Years old.	32	7.82	7.56	7.25	6.85	6.37
	42	7.24	6.95	6.63	6.31	5.95
	52	6.48	6.28	6.08	5.80	5.48
	62	5.39	5.26	5.11	4.94	4.70
	72	3.91	3.83	3.74	3.64	3.51
	82	1.24	1.23	1.22	1.21	1.19
42 Years old.	42	6.71	6.44	6.16	5.88	5.60
	52	6.06	5.86	5.63	5.42	5.17
	62	5.09	4.95	4.81	4.59	4.43
	72	3.72	3.65	3.57	3.48	3.36
	82	1.22	1.20	1.19	1.18	1.16
52 Years old.	52	5.50	5.37	5.21	5.03	4.79
	62	4.68	4.59	4.47	4.33	4.16
	72	3.49	3.43	3.36	3.28	3.19
	82	1.18	1.17	1.15	1.14	1.13
62.	62	4.07	3.99	3.90	3.80	3.68
	72	3.12	3.07	3.02	2.97	2.91
	82	1.12	1.11	1.10	1.09	1.08
72.	72	2.50	2.47	2.43	2.39	2.33
	82	0.99	0.98	0.96	0.95	0.94
82.	82	0.53	0.52	0.52	0.51	0.50

2d Life.	3d Life.	One Life 12 Years old.				
		4 per Cen.	5 per Cen.	6 per C.	7 per C.	8 per C.
Twelve Years old.	12	10.44	10.00	9.50	8.94	8.24
	22	10.01	9.58	9.09	8.58	7.95
	32	9.28	8.94	8.55	8.07	7.48
	42	8.45	8.15	7.78	7.37	6.89
	52	7.46	7.22	6.90	6.64	6.26
	62	6.07	5.93	5.75	5.55	5.30
	72	4.27	4.20	4.11	3.99	3.85
	82	1.29	1.28	1.27	1.26	1.24
22 Years old.	22	9.60	9.18	8.71	8.27	7.61
	32	8.93	8.60	8.21	7.76	7.26
	42	8.15	7.83	7.47	7.12	6.69
	52	7.24	6.99	6.71	6.42	6.08
	62	5.91	5.77	5.60	5.42	5.19
	72	4.18	4.10	4.01	3.90	3.77
	82	1.29	1.28	1.26	1.25	1.23
32 Years old.	32	8.32	8.06	7.74	7.33	6.88
	42	7.64	7.40	7.11	6.77	6.38
	52	6.82	6.64	6.41	6.13	5.80
	62	5.55	5.48	5.37	5.19	4.96
	72	4.03	3.98	3.92	3.82	3.66
	82	1.27	1.26	1.24	1.22	1.21
42 Years old.	42	7.09	6.83	6.56	6.28	5.95
	52	6.36	6.18	5.96	5.73	5.48
	62	5.33	5.20	5.04	4.88	4.69
	72	3.85	3.79	3.71	3.62	3.50
	82	1.24	1.23	1.22	1.21	1.20

2 Life.	3 Life.	One Life 12 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
Aged 52.	52	5.76	5.63	5.47	5.29	5.15
	62	4.88	4.78	4.66	4.53	4.38
	72	3.61	3.55	3.49	3.41	3.31
	82	1.20	1.19	1.18	1.17	1.16
Aged 62.	62	4.22	4.15	4.07	3.97	3.85
	72	3.20	3.16	3.11	3.06	3.00
	82	1.14	1.13	1.12	1.11	1.09
Ag. 72.	72	2.56	2.53	2.49	2.46	2.41
	82	1.01	1.00	0.99	0.98	0.97
82.	82	0.54	0.53	0.53	0.52	0.51

		One Life 22 Years old.				
22 Years old.	22	9.20	8.80	8.33	7.88	7.35
	32	8.58	8.25	7.85	7.42	6.95
	42	7.88	7.57	7.21	6.86	6.46
	52	7.11	6.88	6.50	6.23	5.92
	62	5.77	5.62	5.43	5.26	5.03
	72	4.10	4.01	3.91	3.87	3.70
	82	1.27	1.26	1.25	1.24	1.22

2d Life.	3d Life.	One Life 22 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
32 Years old.	32	8.03	7.78	7.48	7.08	6.59
	42	7.41	7.14	6.84	6.53	6.17
	52	6.63	6.44	6.21	5.96	6.66
	62	5.44	5.35	5.22	5.06	4.84
	72	3.95	3.89	3.81	3.71	3.59
	82	1.25	1.24	1.23	1.22	1.21
42 Years old.	42	6.99	6.66	6.34	6.05	5.77
	52	6.17	5.98	5.75	5.56	5.33
	62	5.19	5.06	4.91	4.76	4.58
	72	3.78	3.71	3.63	3.54	3.43
	82	1.23	1.22	1.21	1.19	1.18
52 Years old.	52	5.61	5.46	5.30	5.13	4.93
	62	4.77	4.67	4.56	4.44	4.28
	72	3.53	3.48	3.42	3.36	3.28
	82	1.19	1.18	1.17	1.16	1.15
62.	62	4.14	4.06	3.97	3.88	3.77
	72	3.16	3.11	3.06	3.00	2.93
	82	1.12	1.11	1.11	1.10	1.09
72.	72	2.53	2.49	2.45	2.42	2.38
	82	1.00	0.98	0.97	0.97	0.96
82.	82	0.53	0.52	0.52	0.51	0.51

One

2d Life.	3d Life.	One Life 32 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
32 Years old.	32	7.55	7.35	7.09	6.77	6.25
	42	6.96	6.76	6.52	6.25	5.87
	52	6.27	6.12	5.93	5.71	5.42
	62	5.26	5.16	5.03	4.88	4.60
	72	3.83	3.77	3.70	3.61	3.48
	82	1.23	1.22	1.21	1.20	1.19
42 Years old.	42	6.49	6.27	6.03	5.79	5.53
	52	5.87	5.70	5.51	5.33	5.11
	62	4.96	4.85	4.72	4.58	4.42
	72	3.65	3.60	3.53	3.42	3.29
	82	1.20	1.19	1.18	1.17	1.16
52 Years old.	52	5.34	5.24	5.12	4.95	4.74
	62	4.58	4.50	4.40	4.28	4.14
	72	3.42	3.38	3.33	3.26	3.16
	82	1.17	1.16	1.15	1.14	1.13
62.	62	3.98	3.92	3.85	3.77	3.66
	72	3.06	3.03	2.99	2.94	2.86
	82	1.11	1.10	1.09	1.08	1.07
72.	72	2.46	2.44	2.41	2.38	2.33
	82	0.98	0.97	0.96	0.95	0.94
82.	82	0.55	0.54	0.54	0.53	0.52

One

2d Life.	3d Life.	One Life 42 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
42 Years old.	42	6.07	5.88	5.66	5.45	5.22
	52	5.43	5.33	5.20	5.03	4.83
	62	4.70	4.59	4.46	4.35	4.21
	72	3.49	3.44	3.37	3.30	3.21
	82	1.18	1.17	1.16	1.15	1.13
52 Years old.	52	5.05	4.88	4.71	4.58	4.44
	62	4.33	4.29	4.25	4.20	4.14
	72	3.28	3.23	3.18	3.13	3.04
	82	1.15	1.14	1.13	1.12	1.11
62.	62	3.81	3.74	3.67	3.60	3.50
	72	2.95	2.91	2.87	2.82	2.76
	82	1.08	1.07	1.06	1.05	1.04
72.	72	2.39	2.36	2.33	2.30	2.25
	82	0.96	0.96	0.95	0.94	0.93
82.	82	0.52	0.51	0.51	0.50	0.49

One

2d Life.	3d Life.	One Life 52 Years old.				
		4 per C	5 per C.	6 per C.	7 per C.	8 per C.
52 Years old.	52	4.65	4.57	4.46	4.35	4.20
	62	4.04	3.98	3.90	3.82	3.71
	72	3.10	3.06	3.02	2.96	2.89
	82	1.12	1.11	1.10	1.09	1.08
62.	62	3.57	3.52	3.45	3.39	3.31
	72	2.79	2.76	2.73	2.69	2.63
	82	1.05	1.04	1.04	1.03	1.02
72.	72	2.28	2.26	2.23	2.20	2.16
	82	0.94	0.93	0.92	0.91	0.90
82.	82	0.51	0.50	0.50	0.49	0.48
		One Life 62 Years old.				
Aged 62.	62	3.18	3.14	3.10	3.06	2.99
	72	2.54	2.52	2.49	2.46	2.41
	82	0.99	0.98	0.98	0.97	0.97
72.	72	2.09	2.08	2.06	2.04	2.01
	82	0.89	0.89	0.88	0.88	0.87
82.	82	0.49	0.49	0.48	0.47	0.46
		One Life 72 Years old.				
72.	72	1.76	1.75	1.73	1.71	1.68
	82	0.80	0.80	0.79	0.79	0.78
82.	82	0.45	0.45	0.45	0.44	0.44
		One Life 82 Years old.				
82.	82	0.28	0.28	0.27	0.27	0.27

The way of finding the Values of Lives of any Ages, howſoever combined in the foregoing Tables, cannot be difficult; for if the Age of any one of the Lives be found at the top, then may the Age of the other two be met with in the two left-hand Columns; and the Value of thoſe three joint Lives is given in Years and decimal Parts, in the Column under the given Rate of Intereſt. How to reduce thoſe decimal Parts to Weeks or Months hath been already ſhewn; I ſhall therefore proceed to

CHAP. VII.

Of Annuities for Years abſolute, &c.

THE Application of the preceding Tables, to the finding the Value of Annuities for Years abſolute, *&c.* is next to be conſider'd; and in order to render them uſeful to thoſe Perſons and Purpoſes for which they are chiefly deſign'd, 'twill be neceſſary to explain them in as familiar Terms as poſſible.

To this purpoſe, I know of no better way than by giving ſome Examples in moſt, or all, of the particular Caſes before-mention'd: In doing of which, I ſhall be as particular as to the Nature of the Diſburſements; and as

careful to ſtart all the Objections that may ariſe on account of the Precariouſneſs of the Tenure, *&c.* as I poſſibly can.

Example I.

There is an Annuity of 40 *l.* payable to the Annuitant, free and clear of all Outgoings, and to continue for 30 Years abſolute; for the true Payment of which, he hath Security on Lands of a much greater Value, (which is equal to Parliamentary Security) what is this worth in ready Money, legal Intereſt being at *5 per Cent.*?

For a Solution to this, it muſt be conſider'd, that in regard the Security for the true Payment is better than the common Security on Money lent, and alſo that the Aſſeſſment of 2, 3, or 4 Shillings in the Pound on Intereſt of Money is hereby ſaved, (the 40 *l. per Ann.* being by the Suppoſition to be paid in clear of all Outgoings;) the Purchaſer ought to be contented with leſs than legal Intereſt; and perhaps, all things duly conſider'd, 4 *per Cent.* may be ſufficient Intereſt.

This being premis'd; in order to ſolve the Queſtion, look in *Tab.* 1. for the Number of Years in the firſt Column, and right againſt it, under the Rate of Intereſt, *viz.* 4 *per Cent.* you'll find 17.27, which ſhews that the Annuity is worth ſo many Years Value; wherefore 17.27 being multiplied by 40, the Product is 690.8, which is the Value ſought.

To

To find the Value of the decimal Part ,8 in Shillings and Pence by the foregoing Rule:

Multiply—,8
by——20

Product—16.0

Hence the Annuity is worth 690 *l.* 16 *s.* in ready Money, allowing the Purchaſer 4 *per Cent.* Intereſt for the Money he lays out.

Again: Suppoſe the Annuitant be to allow his Proportion towards the Rates and Aſſeſſments, and that thoſe Deductions (excluſive of the Land Tax) amount to 2 *l.* 10 *s.* a Year; in this Caſe, I think if the Annuitant be to pay his Share to the Land Tax, he ought to be allow'd 4 *l.* 10 *s.* *per Cent.* and then the reſt of the Outgoings being deducted out of the Annuity 40 *l.*; the Remainder, *viz.* 37 *l.* 10 *s.* muſt be called the Annuity.

Againſt 30 Years in *Tab.* 1. and under 4 *per Cent.* is 17.27; and in the ſame Table againſt 30, and under 5 *per Cent.* is 15.37. The Mean between theſe two Numbers, *viz.* 16.32, is the Number of Years anſwering to 4½, or 4 *l.* 10 *s.* *per Cent.* and this Number multiplied by 37.5 (or 37 *l.* 10 *s.*) the Product 612 *l.* is the Value of the Annuity required in the Queſtion.

Example II.

Admit the *Barton* or Farm of——were to be leaſed out for a Term of 21 Years; at the End of which Term, the Tenant to yield it up in as good Condition as he finds it.

Suppoſe the yearly Value thereof, at a Rack-Rent, to be (the Landlord paying Tythes, and all Outgoings except the King's Tax) 76 *l. per Annum*, according to the beſt Judgment that can be made thereof; and ſuppoſe that thoſe Tythes, chief Rents, Rates and Repairs amount to 11 *l.* yearly; and further, ſuppoſe the Leſſor will reſerve 10 *l.* a Year Rent: Now, granting that the Caſualties, *&c.* to which it is expos'd, make it reaſonable that the Purchaſer ſhould be allowed 6 *per Cent.* for the Money he lays out, what Fine ought he to pay for the 21 Years?

In this Caſe, I take it, that tho' the Purchaſer may expect 6 *per Cent.* for his Money that he lays out on an Eſtate encumber'd with ſuch Outgoings, and ſubject to ſuch Caſualties; yet as to the Rates, Tythes, Chief Rent and Repairs, it being a Tenure of the beſt Kind, and ſubject to no Deductions at all, it muſt be reckon'd at 4 *per Cent.*; and then the reſerved Rent being liable to the King's Tax only, may be conſider'd as an Annuity at 4 ½ *per Cent.* This being premiſed, the whole Matter will ſtand thus:

The

	£.
The Rack-Rent is an Annuity of 76 *l.* *per Annum*, ſubject to divers Incumbrances, Caſualties, *&c.* and therefore, 6 *per Cent.* Intereſt being allow'd, 21 Years Continuance is worth *per Tab.* 1. 11.76 Years Value, which amounts to ——	894.
Out of this, the Parſon, the Pariſh, the Chief Lord, *&c.* have an Annuity paid free, without any Deductions whatſoever, which (on the beſt Computation that can be made of it,) amounts to 11 *l.* yearly: This, at 4 *per Cent.* is worth, *per Tab.* 1. 14.01 Years Value, which in Caſh amounts to ——	154.
Again; The Reſerv'd Rent is an Annuity of 10 *l.* yearly, ſubject only to the King's Tax, and therefore to be valued at $4\frac{1}{2}$ *per Cent.*; which, *per Tab.* 1. (due Equation being made,) is worth 13.41 Years Value, which in Caſh amounts to ——	134.

Laſtly, If theſe two laſt-mention'd Sums of 154 *l.* and 134 *l.* be deducted out of the whole Value, the Remainder, or 506 *l.* is the Sum that ought to be paid by the Purchaſer, for the Grant of 21 Years in the Barton. I hope my being ſo very particular in this Example, will in ſome meaſure excuſe me from expatiating ſo largely again.

Example III.

An Eſtate in Houſes containing divers Tenements, to be let out for a Term of 21 Years; the whole yearly Rent amounts to 50 *l.* the Charge of putting the Houſes in Repair is 40 *l.* or thereabout, and of keeping them ſo during the Term, 7 *l. per Ann.*; the Out-going in Rates, *&c.* 4 *l.* a Year; Rent reſerv'd 3 *l.* a Year. Now, in regard of the Situation, Caſualties, Hazards of bad Tenants, or of none at all, *&c.* the Purchaſer ought to be allow'd 7 *per Cent.* *Query.* What Fine ought he to pay?

	l.	*s.*
An Annuity of 50 *l* for 21 Years, at 7 *per Cent.* ——	541.	10
Out of which deduct		
An Annuity of 11 *l.* for the ſame Time, at 4 *per Cent.*	154.	
An Annity of 3 *l.* for 21 Years, at $4\frac{1}{2}$ *per Cent.*	40.	
And the Charges of putting it into Repair ——	40.	
The Remainder, after theſe Deductions, is the Anſwer to the Query.	307.	10

If it be conſider'd that Houſes are liable to Accidents by Fire, and that where the Eſtate (as in this Inſtance) conſiſts of divers Tenements, the Change of Tenants always brings

brings a Charge of Repairs with it, and very often a Loſs of Rent, by the Time between one Tenant and another; I ſay, if this be duly conſider'd, I believe that 7 *per Cent.* will be thought little enough to be allow'd the Purchaſer.

Example IV.

Out of a Leaſe for 30 Years in an Eſtate which at 6 *per Cent.* coſt 700 *l.* there is lapſed 17 Years: What muſt be given (at the ſame Rate of Intereſt,) to renew the ſaid 17 Years?

In *Tab.* 1, againſt 30, and under 6 *per Cent.* I find 13.76, by which dividing 700, the Quotient is 50.85: And this is the yearly Income or Annuity, which was at firſt purchaſed for 700 *l.*

	£.
The Value of an Annuity of 50 *l.* 17 *s.* to continue 30 Years at 6 *per Cent.* is ——	700
The Value for 13 Years, at the ſame Rate, by the ſame Table, is ——	450
The Remainder, after Subſtraction, is the Sum to be paid for renewing the 17 Years lapſed, ——	250

Example V.

An Eſtate in Fields, only worth 70 *l. per Annum*, out of which is iſſuing a chief Rent

of

of 1 Pound *per Annum*, and the Rates and Tythes therof amount (excluſive of the King's Tax,) to 12 *l.* a Year: What is the Fee in Reverſion of a Leaſe of 40 Years worth in ready Money, the Accidents and Caſualties very few, or none at all?

Here the Neat Produce of the Eſtate is 57 *l.* a Year:

	£.
And 57 *l. per Annum*, to continue for ever, is equal to the Fee-Simple, if it were in Poſſeſſion; which at $4\frac{1}{2}$ *per Cent.* is ——	1267
The Value of the Leaſe for 40 Years, by the Tables and Multiplication, is, at $4\frac{1}{2}$ *per Cent.* ——	1050
This laſt Value ſubſtracted from the former, leaves the Value of the Reverſion ——	217

In this laſt Example, the Security that the Purchaſer hath for the Rack-Rent, is near as good as that for the Payment of the Out-goings; on which account, I firſt of all deduct the Out-goings from the yearly Value, and reckon the Remainder as an Annuity: But generally ſpeaking, it ought to be done otherwiſe, *viz.* by reckoning the whole Rent as an Annuity, to be received at a proper Rate of Intereſt, and then to compute the Out-goings ſo near as poſſible, and to value that Sum as an Annuity to be paid out, for which, generally, the Rate of Intereſt ought

to

to be 10 *s.* and ſometimes 1 *l. per Cent.* leſs than the legal Intereſt on Money.

Having given theſe Cautions, I ſhall, in all that follows, call this laſt mention'd Annuity, *the Sum paid out*; which ſhall include all Rates, Tythes, Repairs, or the like Diſburſements, which neceſſarily go along with the Tenure; and which muſt be very carefully and judiciouſly computed, before the juſt Value of the Purchaſe can be obtain'd.

I have, in the foregoing Examples, made a Difference in the Reſerv'd Rent, and other Outgoings; and that on this Reaſon, *viz.* that when the Reſerv'd Rent amounts to 20 *s.* or upwards, the Landlord is to allow the Tenant a Proportion towards the King's Tax, and therefore half *per Cent.* more ſhould be reckon'd for it, than for clear Annuities; ſuch as Rates, Tythes, Repairs, *&c.*

CHAP. VIII.

Of COPYHOLDS.

MY Method leads me next to ſhew, how by the foregoing Tables the Value of Eſtates held from Deans and Chapters, Colleges, *&c.* for Term of Years, or for Life or Lives, renewable at certain Periods on fixed Conditions, or otherwiſe, may be found; and

to this purpoſe I proceed to give ſome Examples.

Example I.

A Tenement of Church Lands of 30 *l. per Ann.* Rent, to be leaſed on the following Conditions, *viz.* that the Tenant pay at the End of every ſeven Years 30 *l.* which is one Year's Value, for ever; What ought to be paid for the firſt Purchaſe, the Sum paid out yearly being 4 *l.* and the Rate of Intereſt to the Purchaſer 6 *per Cent.*?

N. B. Though perhaps no Biſhops, Deans, or Fellows of Colleges, do or can grant their Leaſes on ſuch abſolute Conditions of renewing; yet, in effect, 'tis all one to the Tenant; for they always think themſelves ſure of theſe Terms, and the common Practice hath confirm'd it: By this Example therefore I deſign to ſhew, how much they ought to pay for the firſt Purchaſe.

	£.
The Value of the Fee at 6 *per Cent.* is, by the foregoing Tables, 16 ⅔ Years Purchaſe	500
Deduct the Value of the Sum paid out at 4 *per Cent.* 25 Years	100
Remainder is the Value of the Eſtate in Fee	400

For the Value of the Septennial Payment of 30 *l. per Tab.* 1. an Annuity of 1 *l.* to conti-

continue 7 Years at 4 *per Cent.* is worth 5.99; and *per Tab.* 2. the preſent Value of 1 *l.* to be paid at the End of 7 Years, is (at 4 *per Cent.*) .760. Wherefore dividing .760 by 5.99, the Quotient .1269 being multiplied by 30, produces 3.84, or 3 *l.* 16 *s.* 1 *d.* ½. And this is the Sum that may be paid yearly as an Equivalent for the 30 *l.* that is to be paid at the End of every ſeven Years. And conſequently an Annuity of that Value to continue for ever, muſt be deducted out of the Value of the Fee before found.

	£.
Thus the Value of that Annuity at 4 *per Cent.* is worth 25 Years Value, or	95
Hence the Remainder, after Subſtraction, is the Sum that ſhould be paid for the firſt Purchaſe, *viz.*	305

That this is the real Value of ſuch a Tenure, if the Landlords have a Power to oblige their Succeſſors, is very plain: I ſhall not here enquire, how far the common Practice agrees with this, or after what manner they adjuſt the yearly Value, or Sum expected, every ſeventh Year; of that enough already. The Method I make uſe of here to compute the Value of the Septennial Payment may perhaps be a little too difficult for ſome People: But as this Propoſition is not very uſeful, I think 'twou'd be more inexcuſable to fill up Paper with a Table for the more expeditious Performance of it, in order to ſwell the Bulk of theſe Pages, as has been the Pra-

dice of a late Author; half of whose Performance consists of Tables computed to as little purpose as this would be.

Example II.

What is the Sum to be paid for renewing of 7 or 14 Years lapsed in a Lease of 21, in an Estate of 40 *l. per Ann.* at 6 *per Cent.* the Sum paid out being 6 *l. per Ann.*?

	£.
The Value of the yearly Rent for 21 Years, at 6 *per Cent.* is	470
Deduct the Value of the Sum paid out, at 4 *per Cent.*	84
The Rem. is the Value of the 21 Years	386
The Value of 14 Years at 6 *per Cent.*	371:12
The Value of the Sum paid out for that time	63: 6
Remains the Value of the Estate of 14 Years in *Esse*	308:06
Hence the Sum to be paid for the renewing of the 7 Years shou'd be	77:14

Again:

The Value of the 21 Years, as above, is,	386
The Value of 7 Years, the time in *Esse*, at 6 *per Cent.*	223
The Value of the Sum to be paid out for that time	36
Remains the Value of the 7 Years in *Esse*	187

Hence

Hence the Sum to be paid for the renewing of 14 Years lapſed ſhould be } £. 199

And by the like Proceſs may the Value of renewing any Number of Years be found, without any Difficulty, by the Table before mention'd.

Example III.

To find the Value of a Leaſe of 7, 10, 14, or 21 Years, if a Perſon of a given Age ſhould ſo long happen to live.

Let the yearly Rent be 50 *l.* the Rate of Intereſt 6 *per Cent.* the Sum to be paid out 7 *l. per Annum*, and the Perſon's Age 42 Years, What is the Value?

By *Tab.* 3. I find the Value of the Annuity for 7 Years on the given Age, at 6 *per Cent.* to be 5.10 Years, or ——— £. 255

Deduct the Value of the Out-goings taken from the ſame Table, at 4 *per Cent.* 5.6 Years Value, ——— } 39

Remainder is the Sum to be paid for 7 Years, on a Life of 42 Years old, — } 216

By the like Method of proceeding, the Value of 10 Years on the ſame Life is ——— } 274

That for 14 Years is worth ——— 329

That for 21 Years is worth ——— 386

Exam-

Example IV.

Admit there be 7 Years lapſed in the former Leaſe of 21 Years, What is the Value of renewing the ſaid Lapſe?

	£.
Firſt, The Value of a Leaſe of 21 Years to a Perſon of 49, (for that will be now the Age,) is ——	364
Secondly, The Value of the Leaſe for 14 Years, on the ſame Life of 49, to be deducted, ——	316
Remainder is the Value for renewing 7 Years, ——	48

Let there be 10 Years lapſed in the ſame Leaſe, and then by the like Proceſs,

The Value of a Leaſe of 21 Years, to a Life of 52, at 6 *per Cent.* is ——	353
The Leaſe of 11 Years in *Eſſe* is worth—	282
The Remainder after Subſtraction is the Sum to be paid for renewing, ——	71

By theſe Examples it appears plain, that the Value of renewing 7 Years lapſed in a Leaſe of 21, is, to the Perſon that purchaſes it, abſolutely worth almoſt twice as much, as it is to him that can enjoy it only conditionally; *viz.* if a Perſon of 42 Years of Age live ſo long. One Example more, and I have done with this Head.

Ex-

Example V.

What is a Leaſe for 7 Years abſolute, in Reverſion of a Life of 52 Years old, worth in ready Money, on an Eſtate worth 60 *l.* *per Annum*, at 5 *per Cent.* Intereſt, the Sum paid out being 9 *l.* *per Ann.* and to be valu'd at 4 *per Cent.*?

	£.
The Value of a Life, of that Age, and at that Rate of Intereſt, as may be found by *Tab.* 4, is 9.65 Years Purchaſe, or ——	579
This Number 9.65 being found in *Tab.* 1. under 5 *per Cent.*, againſt it in the firſt Column (by making due Equation,) is 13.51, which ſhews that the Life is reckon'd to continue in Being ſo many Years: —— To this add 7, the Term of the Reverſion, the Sum is 20.51; againſt which, in *Tab.* 1. under 5 *per Cent.* is 12.62, for the Years Value of the Rent during both Terms, which in Money is ——	757
The Remainder after Subſtraction is the Value of the Rent in Reverſion, if it were to be paid clear of Out-goings; that is, ——	178
The Value of the Sum paid out at 4 *per Cent.* during the Life in *Eſſe*, is 10.50 Years Value, ——	94

The

The Number 10.50, found in *Tab.* 1. under 4 *per Cent.* anſwers to 13.96 Years; this added to 7, the Years of the Reverſion, makes 20.96; to which Number of Years, in the ſame Table, anſwers under 4 *per Cent.* 13.96: This in Money is ——	£.	128
The Difference of theſe two Sums is the Value of the Sum paid out, ——		34
This laſt Sum ſubſtracted from the Sum before found, *viz.* the Value of the Rent, leaves the Value of the Reverſionary Leaſe requir'd; ——		144

CHAP. IX.

Of Leaſes for One, Two, or Three Lives.

IT hath been obſerv'd before, that the Value of a Leaſe for 99 Years, determinable on the Death of one, two, or three Lives, is the ſame with that of a Leaſe on thoſe Lives abſolute; ſo that I ſhall make no difference, but call them all Leaſes for Life, or Lives.

EXAMPLE I.

A Man of 37 Years of Age is poſſeſſed of an Eſtate for his Life of 65 *l. per Ann.* the yearly

yearly Out-goings of which are as follow; *viz.*

	l.	*s.*
To the Lord's Rent	3	00
To the Church and Poor Rates	3	00
To Tythes	5	10
To Repairs (one Year with another,)	2	10

How much is the Leſſee's Right worth in ready Money, at 5 *per Cent.*?

	l.	*s.*
In *Tab.* 4. the Value of a Life of 37 Years, at 5 *per Cent.* is 12.10 Years, or, in Caſh,	786	10
The Value of the ſame Life at 4 *per Cent.* by the ſame Table, is 13.40 Years Value, which for the Rates, Tythes, and Repairs, amount to	147	00
The Value of the ſame Life, at $4\frac{1}{2}$ *per Cent.* is 12.70 Years, which for the high Rent is	38	00
The whole Sum to be deducted is	185	00
And hence the Value required is	601	10

Example II.

What is the Value, in the ſame Eſtate, of two joint Lives, one of which is 12, the other 32 Years old; and the Eſtate to be extinct when one of them dies?

Out of *Tab.* 6. take the Value of the two joint Lives at 5 *per Cent.* for the Rent which

is 10.56 Years; this, multiplied by 65, produces —— £. 686

From the ſame Table, the Value of the joint Lives at 4 *per Cent.* is 11.27 Years; which multiplied into 11 *l.* the yearly Out-goings in Rates, Tythes, and Repairs, produces —— 124

By the ſame Table, the Value at 4½ *per Cent.* is 10.92 Years Value, which, multiplied by 3 *l.* the yearly Rent to the Lord, produces —— 33

Hence the Value of the Eſtate for two joint Lives, (that is,) to continue till one of them dies, is —— 529

Example III.

To find the Value of three joint Lives on the ſame Eſtate, one of whom is 12, another 22, and the third 42 Years old.

From *Tab.* 7. finding the Age of the youngeſt at the Top, the next at the Left-hand Column, and the other in the ſecond Column to the Left Hand, under 5 *per Cent.* I take out the Value of the three joint Lives, which is 7.83 Years; this drawn into 65, the yearly Rent, produces —— £. 509

At the ſame Place (and under 4 *per Cent.*) I find 8.15, which multiplied by 11 *l.* the Product is —— 90

Again;

	£.
Again; in the ſame Table, the Number anſwering to 4½ *per Cent.* is 8.00; this, for the High-Rent, 3 *l. per Annum*, is worth	24
Theſe two laſt Sums being ſubſtracted out of the former, the Remainder is the Value of a Leaſe to continue as long as all three of the Lives remain in Being;	395

Example IV.

An Eſtate of bad Houſes meanly ſituated, containing divers ſmall Tenements, in all, (when full of Tenants,) of the yearly Value of 50 *l.* to be leaſed for the Term of one, two, or three Lives, and the longeſt Liver of them; the Purchaſer to have 6 *per Cent.* for his Money: The Sum to be paid out in Rates, Repairs, and High-Rent, (which laſt is under 20 *s. per Annum*, and therefore to be reckon'd as a clear Annuity, as well as the other Diſburſements;) amounts to 6 *l.* a Year: What muſt be paid for the Purchaſe?

Firſt,

For one Life aged 67 Years.

This, for the whole Rent, by *Tab.* 4. is worth, at 6 *per Cent.* 5.90 Years Purchaſe; which, in Caſh, at 50 *l.* a Year, amounts to —— £. 295

The Value of the Sum to be paid out at 4 *per Cent.* is 6.53 Years, or	39
The Value of a Leaſe for one Life	256

Secondly,

For the Value of two Lives, one 67, the other 52 Years, Mr. *Abraham de Moivre* hath demonſtrated, in *p.* 37. of his Book of Annuities, that the Value of an Annuity upon the longeſt of two Lives, is the Remainder, after Subſtraction of the Value of thoſe Lives jointly taken, from the Sum of their Values ſingly taken.

I have by choice omitted every thing that I think would perplex the Readers, for whoſe Uſe theſe Papers are principally deſign'd; and of that kind I take thoſe Algebraical Demonſtrations to be: Not but I am well ſatisfied of the Neceſſity that the Method ſhould be demonſtrative; but after the ſame hath been ſo elegantly perform'd by the afore-mention'd ingenious Author, it would be ſtuffing in things to no purpoſe, to tranſcribe it here; ſince any Perſon that is not ſatisfied without a Mathematical Proof, may be referred to that Treatiſe, and receive ſuch Satisfaction as muſt needs convince every body that underſtands it. But to proceed:

	£.
The yearly Rent on the Life of 67 Years was found before to be worth	295
That for the Life of 52 is worth	445
The Sum is	740
The Value of the ſame for the joint Lives is 4.39 Years, or	220
Remainder after Subſtraction is the Value on the longeſt Liver of the two,	520

The

		£.
The Value of the Sum paid out on the first Life, at 4 *per Cent.* is 6.53 Years, or		39
The Value of the ſecond Life is 10.50 Years, or		63
The Sum		102
On the two joint Lives 4.67		28
The Remainder after Subſtraction is the Value of the Out-goings on the longeſt,		74
This Sum being ſubſtracted from the 520 *l.* leaves the Value required; —		446

Thirdly,

Let a third Life, aged 22 Years, be join'd with the two before mention'd, and let the Value of the Eſtate on the longeſt Liver of theſe three be requir'd.

For the whole Rent	The Life 67 Years old	5.90	Years Val.
	The Life 52 Years old	8.91	
	The Life 22 Years old	12.54	
	Their Sum is	27.35	
The Value for the three joint Lives, at the ſame Rate, (*viz.* 6 *per Cent.*) is		3.99	
	The whole Sum	31.34	

The

The before-mention'd ingenious Author ſhews, that the Values of the joint Lives combin'd, two and two added together, and the Sum ſubſtracted from the foregoing Sum, leaves the Value of the Annuity upon the longeſt Liver of them.

Thus for the Purpoſe:

	Years.
The Value of the firſt and ſecond jointly	4.39
The Value of the firſt and third jointly	5.26
The Value of the ſecond and third jointly	7.56
The Sum is ——	17.21
This laſt Sum being ſubſtracted from the former Sum, the Remainder is 14.13 Years for the Value of the longeſt Liver, which in Caſh is ——	£. 707

In the next place, I am to find the Value of the Sum to be paid out at 4 *per Cent.* in the ſame manner as the former was found.

The Life of 67 Years old Value in Years	6.53
That of 52 ——	10.50
That of 22 ——	16.05
The three joint Lives ——	4.15
The Sum of which is——	37.23
The firſt and ſecond jointly ——	4.66
The firſt and third jointly ——	5.67
The ſecond and third jointly ——	8.42
The Sum of theſe three ——	18.75
Remainder after Subſtraction ——	18.48

This

This drawn into 6, the yearly Out-goings, produces in Money ——— £. 111

This Sum being ſubſtracted from the Value before found, (*viz.* 707,) leaves the Value of the Leaſe on the longeſt of the three Lives, and at the Rate of Intereſt propoſed, ——— £. 596

The Reſult of the whole Operation will appear to be as follows, *viz.*

	£.
One Life of 67 Years old is worth ——	256
Two Lives, one 67, the other 52, worth	446
Three Lives, aged 67, 52, and 22, worth	596

And now, here I am aware of an Outcry that will be made on account of the Difference that there is, or ſeems to be, betwixt this Reſult, and the common way of Eſtimation: For, ſays the Gentleman's Steward, 'tis always reckon'd, that one Life in Poſſeſſion is as good as two in Reverſion; and a third Life in Reverſion of two, is generally reckon'd but in two Years Value: Whereas, by this Way of computing, the firſt Life amounts out to $5\frac{1}{4}$ Years Value; whereas the other two are here worth above 7. And again: The third Life in Reverſion of 2, in the above Example, amounts to almoſt 3 Years and an half's Value: And how can this be?

In Anſwer to which Objection, I muſt obſerve, that tho' this be true in the Example alledged, yet it is no Deviation from Reaſon, tho' it be from common Practice; and that

it

it rather eſtabliſhes the Truth and Neceſſity of this Method, than brings any Argument againſt it, will plainly appear by another Example, wherein the Value of the Reverſions (on account of different Ages of the Life or Lives in Poſſeſſion,) will, when found by this Method, be thought as much too little, as thoſe are too great.

Example V.

Admit the Eſtate to be purchaſed on Lives be worth 40 *l. per Annum*, and of ſuch Quality, that 6 *per Cent.* is a proper Intereſt for the Purchaſer: Suppoſe that the Rates, Tythes, and Repairs, be 5 *l. per Ann.* and the Reſerv'd Rent 2 *l. per Ann.*; let 5 *per Cent.* be allow'd for the Money to be paid out, and let the Ages of the Lives to be purchaſed be,

The Firſt	32	Years old.
The Second	22	
The Third	12	

What will be the Value of one, two, or three of theſe Lives, in the Order that they are here placed?

Num-

Lives.	Number of Years Value for the 40 *l. per Annum* Rent. At 6 *l. per Cent.*	Number of Years Value for the 7 *l. per Ann.* paid out. At 5. *per Cent.*	Value in Cash after Subtraction.
1ſt	11.47 Years.	12.79 Years.	370 *l.*
2d	12.54 Years.	14.14 Years.	402
3d	13.37 Years.	15.23 Years.	428

Lives.	The Value of the longeſt Liver for the Rent.	The Value of the longeſt Liver for the Money p[d] out.	Value of the Rem. Money.
1ſt & 2d	14.60 } Years.	16.84 } Years.	466 *l.*
1ſt & 3d	14.99 } Years.	17.46 } Years.	477
2d & 3d	15.40 } Years.	17.96 } Years.	490

The Value of the longeſt Liver of the three Lives for the 40 *l. per Ann.*	The Value of the longeſt Liver for the 7 *l. per Annum.*	Value of the Remain. in Money.
15.83 Years.	18.71 Years.	502 *l.*

By the above Eſtimation, it appears that two Lives of 22, and 12 Years old in Reverſion of one of 32, is worth but 132 *l.* which is little more than $\frac{1}{3}$ of the Value of the Life in Poſſeſſion; and that two of 32 and 22 in Reverſion of one of 12, is of much leſs Value, *viz.* no more than 74 *l.*

Again;

One of 12 in Reverſion of two of 32, and 22 Years of Age, is worth but 36 *l.* that is leſs than one Year's Value; and for one Life of 32 in Reverſion of two of 12 and 22 Years old, muſt be given no more than 12 *l.*

Hence the vaſt Difference that ariſes on Account of the Age of the Lives appears (if this Method holds good) to call for a particular Regard, even when the Difference of the Age of the Lives is not very great, as in this Example; how much more then, if the Tenant ſhould defer the renewing of his Leaſe, till the Life or Lives in *Eſſe* arrive to a declining Age; as thus:

Admit that in the before-mention'd, after the Expiration of 20 Years, one of the Lives, *viz.* that of 22, ſhould be dead, and the Tenant be willing to add another inſtead thereof, of 12 Years old, What Fine ought he to pay?

This Query, in other Words, may be thus expreſs'd: What is a Life of 12 Years old in Reverſion of two, one of which is 32, the other 52, (for that will now be their Age) worth in ready Money on the foremention'd Eſtate?

Years.	For the Rent.	For the Outgoings.
The Value of a Life of 52 old—	8.91—	9.65
a Life of 32 ——	11.47—	12.79
a Life of 12 ——	13.37—	15.23
The Value of the 3 joint Lives—	6·41—	6.64
The Sum——	40.16—	44.31
The Value on the joint Lives of 52 and 32 ——	7.16—	7.50
On the joint Lives of 52 & 12—	7.84—	8.29
On the joint Lives of 32 & 12—	9.84—	10.56
The Sum of theſe Three——	24.84—	26.35

Sub-

Subtract this laſt Sum from the above Sum, the Remainder is the Value of theſe two Annuities in Years and decimal Parts——	15.32—17.96
In Money——613——126	
Hence by Subſtraction the Value of the Eſtate on the Survivor of the three Lives	£. 487
The Sum of the ſingle Values of the Lives of 52 and 32 is	20.38—22.43
Value of theſe two jointly is—	7.16— 7.50
The Difference of theſe is the Value on the Survivor——	13.22—14.93
	£. £.
Theſe Years reduced into Money will be ——	529—104
Hence the Value of the two Lives in Money will be ——	425 *l.*
Which ſubtracted from the Value of the three Lives before found, leaves the Sum to be paid for renewing the Leaſe——	62 *l.*

But again: Suppoſe the Tenant does not think fit to renew till after the Death of two of the Lives; and at that time the third or ſurviving Life is become 62 Years old, What Fine muſt he pay for adding 2 Lives, aged 22 each?

	For the Rent.	For the Outgoings.
One Life 62 Years old, Value	7.08	7.53
One of 22	12.54	14.14
Another of 22	12.54	14.14
The three joint Lives	5.43	5.62
The Sum	37.59	41.45
The Value on the joint Lives of the 1ſt & 2d	6.14	6.48
of the 1ſt & 3d	6.14	6.48
of the 2d & 3d	10.00	10.80
The Sum of theſe three	22.28	23.76
This laſt from the former Sum	15.31	17.68
This in Caſh is the Value of the two Annuities, *viz.*	612 *l.*	124 *l.*
Hence the Value of the Leaſe during the three Lives is	488 *l.*	
The Value of the 1ſt Life ſubtract	230	
Hence the Value of the two Lives in Reverſion is	258	

I have enlarg'd the more on this Example, in order to ſhew how neceſſary the Conſideration of the Age of the Lives is, to get a thorough Knowledge of the Value of an Annuity that is to continue as long as they are in Being.

That the Caſualties or Accidents to which Eſtates in Fields, but eſpecially thoſe in Houſes, are obnoxious, are ſometimes greater,

er, and at other times leſs, according to the Situation of them, and their Likelihood of producing the ſame yearly Income conſtantly during the Term of the Leaſe; and alſo according as they are more or leſs expos'd to Storms, Fire, Inundations, or the like: And again; where Houſes are of a Newer or Older, a Stronger or Weaker Structure; that this is ſo, I ſay, is very plain: but then how to bring theſe Properties to a Computation, is not ſo eaſy a Task; the Method that I have all along made uſe of, is by allowing the Purchaſer a greater or leſs Rate of Intereſt for his Money laid out: And I don't know of a more regular Way of reckoning; for hereby the Surpluſage above the Value of Money when laid out on Annuities certain, may be eſteem'd as an Inſurance for the Rent againſt thoſe Accidents and Uncertainties.

I know it may be objected, that by this Way of Computation a Caſe may be ſo put, that the Value of a Leaſe for a ſhorter Continuance may be greater than that for a longer time on the ſame Eſtate; and this I acknowledge to be true, when the Sum to be paid out is very large, in reſpect to the yearly Rent; and at the ſame time alſo the Rate of Intereſt to be allow'd the Purchaſer is very great, on account of the ruinous Condition of Houſes, or the like. And when the Caſe is ſo, let it be conſider'd, whether, for Inſtance, the Reverſion after 40 Years in an Eſtate of Houſes that are but in bad State

now,

now, and out of which the Poſſeſſor is obliged to pay an Annuity of 15 *l.* which may perhaps be as much, or more than the Rent will amount to at the End of 40 Years, be worth any thing; or rather, is not ſuch a Reverſion worſe than Money?

But here it may be ſaid, that the Leſſee is generally obliged by a Covenant in his Leaſe to yield up the Eſtate at the End of his Term in good Repair; and that therefore the yearly Value cannot be ſo prodigiouſly ſunk as is ſuggeſted. In Anſwer to this, common Experience ſhews us, that People have a great many Ways to evade the Force of this Covenant; for *good Repair* is a Term of great Latitude, and a Man may leave Houſes in ſuch a Condition, as to skreen himſelf from an Action for Dilapidations; and at the ſame time it may be neceſſary for the next Tenant, if he hath a long Term in it, to rebuild a great Part of it. And thus I have known Landlords oftentimes to give a Perſon a Leaſe for Lives in an Eſtate, on Conſideration of his laying out Money in re-edifying it; and even to give Timber, or the like, towards it, before he could get a Perſon to do it. If to this be added, that the Poſſeſſor is very often poor and unable to repair the Premiſes, and ſo it falls to ruin, and no Redreſs to be had; I believe the Benefit by ſuch a Covenant will be very ſmall; and hence the ſeeming Paradox is, I believe, in a great meaſure explain'd. But if ſome particular Caſes ſhou'd

ſeem

ſeem to thwart the Method, a Perſon is at Liberty to deviate from it; or rather he may moderate the Intereſt, at leaſt for the time of the Eſtate in *Eſſe*, or the like, according to Diſcretion.

Thus, I hope, I have clear'd up this Affair, as to Eſtates in *Eſſe*; and have given ſome Light, as to the Valuation of Reverſions; a more particular Conſideration of which ſhall be the Buſineſs of the next Chapter.

CHAP. X.

Of REVERSIONS.

AFTER what I have ſaid on this Particular in *Chap.* 5. it will be unneceſſary to define what is meant by an Eſtate in Reverſion, it being a Word very well underſtood by Landlords and Tenants; my Buſineſs is to ſhew, how to find the Value of ſuch Expectancy; to do which, I ſhall lay down the following general Rule.

From the Value of the Sum of the Terms in Poſſeſſion and Reverſion, ſubtract the Value of that in Poſſeſſion, the Remainder is the Sum to be paid for the Reverſion.

In *Chap.* 7. *Example* 5. I have ſhewn how to find the Value of the Fee in Reverſion of a

Term

Term of Years abſolute; and from the laſt Chapter may be eaſily deduced the Value of the Fee in Reverſion of Lives, or of one Life in Reverſion of two; of two in Reverſion of one, by a due Application of the above general Rule. But ſomething may be proper to be ſaid of the Value of a Life in Reverſion of a Term of Years, to be nominated at the Expiration of the ſaid Term, and of a Term of Years in Reverſion of another Term of a Life or Lives, or of 2 or 3 joint Lives; as alſo of the Right of ſuch two or more, as hold by joint Tenancy and Survivorſhip.

Example I.

Let it be required to find how much an Eſtate of 30 *l.* *per Ann.* is worth during the Continuance of a Life of 22 Years of Age; the Right to commence, and the Life to be nominated, at the Expiration of a Term of 14 Years, allowing the Purchaſer 6 *per Cent.* and deducting the Value of the Sum paid out, *viz.* 4 *l.* a Year at 5 *per Cent.*

	£.
The Value of ſuch a Life in Poſſeſſion for the whole Rent is, *per Tab.* 4. —	376
The Sum paid out is worth —	56
Remains the Value of the Life, if it were to be entred upon immediately,	320

The Queſtion then will be, What 320 *l.* payable at the End of 14 Years, is worth in

ready Money at the Rate of legal Intereſt, *viz. 5 per Cent.?*

By *Tab.* 2. I find the Value of 1 *l.* payable at the End of 14 Years, is .505 decimal Parts of a Pound; which being multiplied by 320 gives the Value of the Reverſion, that is, 162 *l.*

I need not foul Paper by producing more Examples of this Kind; for by this may be ſeen the Method to find the Worth of 2 or 3 Lives in Reverſion for a Term of Years, and alſo of a Term of Years in Reverſion of a Term in *Eſſe*.

If it be required to ſhew the Value of a Term of Years in Reverſion of a Life or Lives; firſt find the Number of Years Value of the Eſtate in *Eſſe*, and then, by *Tab.* 1. ſee how many Years it muſt continue to produce that Value; and the Value of the Eſtate in *Poſſe*, payable after the Expiration of this Number of Years, is the Sum to be paid in hand for the Expectancy.

If a Life be to be nominated at the Death of another, the Sum to be paid for it may be found, by ſeeking in the Tables the Number of Years of an Annuity that is of equal Value with each of the Lives; and then find (in the Table for that purpoſe) the Value of the Money that the Life in *Poſſe* will be worth at the Death of the other, and the preſent Value of ſuch a Sum is the Sum required.

Example II.

There is at preſent on an Eſtate of 50 *l.* *per Ann.* one Life, aged 52; the Tenant would purchaſe another Life to be nominated at the Death of the former, *viz.* one that ſhall be then 22 Years old, allowing the Purchaſer 6 *per Cent.*; and for the Sum paid out, which is 9 *l.* *per Ann.* 5 *per Cent.* What is the Value of the Life to be purchaſed?

The Life in Poſſeſſion is worth, at 6 *per Cent.* (for any Rate may be taken for this purpoſe) *per Tab.* 4. ——— } 8.91 Years.

This Number found under the ſame Rate of Intereſt, in *Tab.* 1. ſhews in the firſt Column, that the Life is as valuable as an Annuity certain for the Term of——— } 13.14 Years.

Hence the Life that is to ſucceed, is to be named at the End of 13.14 Years.

A Life of 22 is worth, by *Tab.* 4. at 6 *per Cent.* ——— } 12.54 Years.
And the ſame at 5 *per Cent.* ——— 14.14

Which being the Number of Years Value that the Rent and Outgoings will be worth for the ſecond Life at the End of 13.14 Years, the Value of each in ready Money may be found

found by taking out the Numbers in *Tab.* 2. anſwering to the times at 5 *per Cent.* and multiplying that by theſe Numbers of Years reſpectively, the two Products will ſhew the Number of Years Value for the Rent, and for the Sum paid out. Thus:

The Number in *Tab.* 2. under 5 *per Cent.* and againſt 13.14 (by duly equating) is .527.
This multiply'd by 12.54 produces 6.61 } Years
and multiply'd by 14.14 produces 7.45 }

	L.
Hence the Value of the Rent in Money--	330
And that of the Sum paid out——	67
Conſequently the Sum to be paid is——	263

By the like Proceſs may be found the Value of a third Life in Succeſſion of two to be named at the Death of one or both of theſe; or of two Lives to be named, one at the Death of the firſt, and another at the Death of the ſecond, or in any other manner; and this, I doubt not, will be eaſy enough to the Perſons concern'd, without adding any more Examples to that purpoſe.

Example III.

A Man dying leaves to his three Daughters an Annuity of 20 *l. per Ann.* each, during their Lives, payable out of Lands of a much greater Value; and he ſo order'd it, that when either of them ſhou'd die, her Annuity ſhou'd fall

to the other two in equal Shares; and at the Death of another of them, the whole is to come to the Survivor for Life; their Ages at the Father's Death are 32, 22 and 12, What is the Right of each worth in ready Money at *5 per Cent.?*

	Years.	£.
The Value of the eldeſt Life is	12.79	or 256
That of the next is	14.14	or 283
The youngeſt worth	15.25	or 305

The joint Lives of the 1ſt and 2d is 10.21 Years.
Of the 1ſt and 3d is 10.56 Years.
Of the 2d and 3d is 11.41 Years.
The three joint Lives is worth — 8.59 Years.

For the Right of the eldeſt Daughter.

	£.
Firſt, 20 *l. per Ann.* during her Life is worth	256
Secondly, 10 *l. per Ann.* in Reverſion of the youngeſt, to continue from thence during the joint Lives of the other two; found by ſubtracting the Value of the three joint Lives from the Value of the firſt and ſecond jointly	16
Thirdly, 10 *l. per Ann.* in Reverſion of the ſecond, to continue during the joint Lives of the firſt and third; found by ſubtracting the Value of the three joint Lives from that of the firſt and third jointly	20

Fourthly,

	£.
Fourthly, 40 *l. per Ann.* in Reverſion of the two youngeſt Lives during her own Life; found by ſubtracting the Value of the longeſt of the ſecond and third from that of the longeſt of the three Lives, is	30
The whole Sum of theſe four Values is the eldeſt Daughter's Portion, *viz.*	321
By the like Proceſs the ſecond Daughter's Right in the Eſtate will appear to be	376
And that of the third or youngeſt	426
The whole Value is	1123

And the Truth of the Work will appear by finding (according to the Method laid down in the former Chapter) the Value of the whole Eſtate on the Survivor of the three Lives; which by the Tables will be found to be 18.71 Years Purchaſe; and this multiply'd by 60, the whole yearly Value of the three Annuities, the Product is 1123 *l.* as before.

Thus I have, I think, given Examples in moſt of the uſeful Caſes of this Subject; by Help whereof any of the Queries that ariſe about the Values of Leaſes in Poſſeſſion or Reverſion may be ſolv'd.

It may be proper, before I conclude, to ſay ſomething of Timber-Trees and Coppice-Wood; the former being generally convey'd with the Eſtate in Fee, and the other is often-

times the Property of the Tenant for Years or Lives. The Value of Timber-Trees will be very different, tho' of the ſame Bulk and Goodneſs; I ſhall therefore conſider them as to the Quality, Quantity, and Situation.

And firſt as to the Quality: It is neceſſary to conſider whether the Timber growing on the Eſtate you would purchaſe, be of old ſtanding, and fit to be fell'd for Uſe forthwith; and if it be, then ſo much Money as it will yield, free and clear of all Charges, is the Value of the Timber, and to be added to the Value of the Eſtate before found. But if the Trees that are in Diſpute are very young thriving Timber, ſuch as Oaks perhaps of 50 Years ſtanding, or the like, and will not be fit to cut down for Uſe till they have ſtood (it may be) 50 Years longer; in ſuch Caſe it will be proper ro make ſome Experiments of the Growth of Timber in that Place, by obſerving the lower End of a large Tree after it is ſawn down; where may be ſeen by the annular Pores or quondam Sap Veſſels, the Number of Years Growth, and alſo the Quantity that it hath increas'd every Year: by which, and a due Allowance for what it may grow more in height, (which I believe is not very much after 50 Years ſtanding) a tolerable Gueſs may be made when it will be proper to cut it down, and how much Timber it will be increas'd to in that time; and then the Sum of Money that ſuch a Quantity of Timber will bring in at the End of ſo many

Years,

Years, being valued by the Tables for that purpoſe, will diſcover the Sum that ought to be added to the Value of the Lands for the preſent Purchaſe.

But then it muſt be conſider'd, that a great many Hazards attend growing Timber; ſuch as Storms of Wind, which oftentimes overturn large topped Trees, and oftner twiſts them and ſpoils the Timber. Again; Diſeaſes, which Trees of all Kinds are ſubject to, often hinder their Growth. And laſtly, that vile Practice made uſe of by Tenants on Leaſe of lopping Trees, which in time effectually renders the Body of the Tree, like its Top, fit for nothing but Fuel: It highly concerns all Lords of Manors and their Stewards, to put ſome ſtop to this deſtructive Way of proceeding, and not ſuffer their ſtately and venerable Oaks, the Glory as well as Bulwark of our Nation, to be thus mangled and murder'd. But this is a Digreſſion: On Account of theſe Accidents and Uncertainties, the Perſon that lays out Money on young Timber ought to have a greater Rate of Intereſt, than for Money laid out on Lands.

I have, by divers Experiments, found that Oak Timber increaſes, when healthy and in a good Soil from 50 to 100 Years ſtanding, to near about twice as much in Diameter as it had at 50; that is, a Tree that at 50 Years ſtanding was 12 Inches in Diameter, at the End of 100 Years was two Foot Diameter; and conſequently (allowing nothing for its

Increaſe

Increaſe in Height) 100 Foot of 50 Years ſtanding will, after 50 Years more, be increaſed to 400 Foot; to which, if there be added one fifth on account of its Increaſe in Height, the whole is 480 Foot. Now (*per* the Tables of Logarithms) the Log. of 480 divided by 50, the Number of Years, the Quotient will be the Logarithm of 1.0319. Hence Timber of ſuch Growth (granting the Premiſes) will increaſe in Quantity at the Rate of 3.19 *per Cent.* and no more. But whereas, as is before hinted, a Man may reaſonably expect 6 *per Cent.* for the Money he lays out on young Timber; it follows, that he muſt not give ſo much *per* Ton for the Timber that muſt ſtand ſome Years before it be fit to cut down, as he would for that which may be cut immediately; for 480 *l.* payable after 50 Years, at the Rate of 6 *l. per Cent.* is worth, *per Tab.* 2. in ready Money, 259 *l.* So that Timber which at 100 Years old will be worth 12 *d. per* Foot, at 50 Years old muſt be ſold for 6 *d.* $\frac{1}{2}$, or leſs.

Secondly, By the Quantity of Timber, I mean that a Man ought to conſider, whether there be more Timber on an Eſtate (that is fit for Sale) than can be diſpoſed of in one Year. Thus it may happen, that on an Eſtate to be purchaſed, there may be Timber of a great Value; but if ſold, the Buyers may expect 10, 15, or perhaps 20 Years time to clear it off, paying ſo much Money every Year; or, in other Terms, the Quantity of Timber may

be

be ſo great, that the whole cannot be vended or turn'd into Money in leſs than 10, 15, or 20 Years. And if this be the Caſe, the Purchaſer muſt conſider how much *per Ann.* and for how many Years this Income will be, and value it accordingly.

Thus for Inſtance: Let the Value of the Timber on an Eſtate be 2000 *l.* and ſuppoſe Timber to the Value of 200 *l.* were to be clear'd off every Year; then 200 *l. per Ann.* for 10 Years, at 5 *per Cent.* (*per Tab.* 1.) is worth in ready Money 1544 *l.* Which ſhews that the Man who purchaſes the Lands, muſt give but 1544 *l.* for the Timber, that will in the time prefix'd be 2000 *l.* at thoſe ſeveral Payments.

Thirdly, This Value may ſtill be leſſen'd by the bad Situation of Timber, both on account of its diſtance from a navigable River, or from ſome great Town, or from the Difficulty of Acceſs to the Place where it grows; for Timber that is large and well grown for Naval Architecture, and would bring a good Price for thoſe Uſes, may be ſo far within Land, as not to be brought in place but at an unreaſonable Charge; or it may be ſo ſituated, as to render it wholly impoſſible to draw any large Stocks out of the place where it grows. And hence Timber that is fit for the moſt noble Uſes, may, by the Declivity of the Ground where it grows, or the like bad Situation, be worth but little more than for Lath-Timber, Shingling, Veſſel Timber, Plough-boot, Fuel, or the like.

Theſe and ſome other Particulars muſt be well weigh'd and conſider'd, in eſtimating of growing Timber; which unleſs the Value be fix'd with Judgment and Diſcretion, will draw on a great Diſadvantage to the Purchaſer.

As to Coppice Wood, I take it that the beſt Way to fix its Value, is by examining how many Years Growth it may be convenient to cut it at, and how much it will yield *per* Acre at ſuch Periods after the Tythes are deducted. But in order to illuſtrate this a little, I ſhall give an Example or two.

Example I.

There is a Coppice containing 210 Acres, the Wood hath by Experience been found very good at 15 Years Growth, and uſes to be ſold for 4 *l. per* Acre, (the Buyer to diſcharge the Tythes); How much is the Fee-Simple worth, if it were to be ſold juſt after it hath been cut?

The Value of the Wood at the End of every 15 Years is 840 *l.*

Per Tab. 2. one Pound payable at the End of 15 Years is worth in ready Money ——— .481 Parts.

This multiply'd by 840, produces the Value of the Wood at that time in ready Money ——— £. 404

Per Tab. An Annuity to continue 15 Years is worth 10.38 Years Value at 5 *per Cent.* wherefore 404 being divided by 10.38, the Quotient is the Annuity that is of equal Value to the Coppice, *viz.* —— £. 39

Hence the Value of the Coppice is equal to that of an Annuity of 39 *l.* to continue for ever; which at 5 *per Cent.* will amount to the Sum of 780 *l.*

Example II.

Admit that the before-mention'd Coppice hath been conſtantly cut at 14 Acres every Year, and may be ſo continued:

Then the yearly Income is 56 *l.* which at 5 *per Cent.* is worth in ready Money 1120 *l.*

Again;

The ſame Coppice being at 10 Years Growth, what is the Value of the Fee?

	£.
Firſt, The preſent Value of 840 *l.* payable at the End of 5 Years at 5 *per Cent.* is worth ——	658
Secondly, An Annuity of 39 *l.* (found before) to continue for ever, worth --	789
The Sum ——	1438
Thirdly, Deduct the Value of an Annuity to continue 5 Years, *viz.* ——	169
The Remainder is the Value ſought ——	1269

What is ſaid in theſe Examples is, I believe, ſufficient to give a Light into this Affair. A great deal might be ſaid as to the valuing this for a Term of Years abſolute, or for Life or Lives; but I preſume all thoſe for whom theſe Papers are deſign'd, will be capable of varying the Rules according to the Nature of the Tenure, and Quality of the Woods, by what hath been before laid down in relation to Lands, *&c.*

I at firſt deſign'd to have concluded here; but on reviſing the whole, I conſider that it is likely to fall into ſome Hands to whom it will be uſeleſs (on account of the Operations) for finding the Value of Survivorſhip; to do which, the Numbers are to be taken out of ſeveral Tables, and to be added, ſubtracted, *&c.* which to ſome Perſons will ſeem ſuch an Intricacy, as will, I fear, diſcourage them from the Attempt. I hope it will not therefore be deem'd ſuperfluous, to have added Tables of the Value on the longeſt Liver of 2 or 3 Lives; where the ſame may be taken out at once for thoſe Purpoſes, and for any Ages howſoever combined to every tenth Year.

I have alſo added two ſhort Tables, the one for finding the Value of the decimal Parts of a Year in Months; and the other ſhewing the Value of the decimal Parts of a Pound in Money; ſo that it is but to find the Parts, *i. e.* the Numbers to the Right Hand of the Point in the firſt Column of the Tables; and right againſt it, in another Column, is the Value thereof in Months in one Table, and in Money in the other.

TAB. VIII.

Shewing the Value of an Annuity for two Lives, that is to continue till both are dead, at 4, 5, 6, 7, *and* 8 per Cent. *and to every tenth Year of Age.*

Age.	4 *per C.*	5 *per C.*	6 *per C.*	7 *per C.*	8 *per C.*
	One Life 2 Years old.				
2	19.67	17.08	14.60	12.68	11.44
12	20.60	17.81	15.17	13.03	11.83
22	20.05	17.30	14.86	12.86	11.60
32	19.21	16.67	14.38	12.62	11.41
42	18.42	16.06	13.97	12.34	11.19
52	17.61	15.47	13.52	11.96	10.87
62	16.73	14.80	13.01	11.55	10.52
72	15.97	14.17	12.48	11.08	10.09
82	15.36	13.63	11.99	10.66	9.71
	One Life 12 Years old.				
12	21.39	18.41	15.59	13.24	12.02
22	20.88	17.96	15.40	13.19	11.96
32	20.33	17.46	14.99	12.99	11.74
42	19.58	17.03	14.76	12.87	11.65
52	18.97	16.59	14.43	12.59	11.44
62	18.30	16.08	14.05	12.30	11.21
72	17.70	15.64	13.72	12.02	10.95
82	17.26	15.27	13.40	11.76	10.71

Age.	4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen.	8 per Cen.
	One Life 22 Years old.				
22	20.46	17.48	15.08	13.04	11.81
32	19.45	16.84	14.60	12.79	11.58
42	18.90	16.39	14.33	12.61	11.34
52	18.13	15.79	13.90	12.27	11.16
62	17.38	15.24	13.46	11.92	10.80
72	16.68	14.67	13.00	11.40	10.46
82	16.12	14.19	12.59	11.19	10.23
	One Life 32 Years old.				
32	18.66	16.17	14.11	12.17	11.43
42	17.83	15.55	13.68	12.22	11.04
52	16.91	14.90	13.21	11.85	10.76
62	15.95	14.18	12.66	11.42	10.41
72	15.08	13.46	12.07	10.91	9.96
82	14.40	12.87	11.55	10.46	9.53
	One Life 42 Years old.				
42	16.79	14.76	13.12	11.80	10.72
52	15.74	14.00	12.57	11.37	10.34
62	14.61	13.09	11.88	10.74	9.82
72	13.44	12.13	11.06	10.09	9.29
82	12.63	11.40	10.35	9.47	8.71

Age.	4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen.	8 per Cen.
	One Life 52 Years old.				
52	14.48	13.04	11.82	10.75	9.87
62	13.12	11.94	10.93	10.03	9.29
72	11.79	10.81	9.96	9.18	8.56
82	10.66	9.80	9.05	8.39	7.81
	One Life 62 Years old.				
62	11.45	10.53	9.74	9.05	8.48
72	9.79	9.13	9.56	8.01	7.54
82	8.27	7.74	7.28	6.86	6.48
	One Life 72 Years old.				
72	7.69	7.28	6.93	6.54	6.24
82	5.58	5.33	5.11	4.89	4.70
	One Life 82 Years old.				
82	2.27	2.22	2.18	2.15	2.11

TAB. IX.

Whereby is shewn the Value of an Annuity in Years and decimal Parts for three Lives, to continue till they are all dead, at 4, 5, 6, 7 *and* 8 per Cent.

2d Life.	3d Life.	One Life two Years old.				
		4 *per Cen.*	5 *per Cen.*	6 *per Cen.*	7 *per Cen.*	8 *per Cen.*
Two Years old.	2	21.61	18.53	15.53	13.28	11.93
	12	22.14	18.95	15.85	13.44	12.21
	22	21.85	18.63	15.67	13.34	11.99
	32	21.40	18.38	15.25	13.45	11.96
	42	20.94	18.06	15.36	13.33	11.90
	52	20.52	17.69	15.02	13.02	11.76
	62	20.08	17.34	14.76	13.85	11.66
	72	19.82	17.21	14.72	12.77	11.51
	82	19.67	17.08	14.59	12.68	11.44
Twelve Years old.	12	22.61	19.24	16.04	13.48	12.28
	22	22.31	19.00	15.98	13.42	12.21
	32	22.02	18.64	15.68	13.38	12.17
	42	21.56	18.44	15.57	13.32	12.13
	52	21.24	18.22	15.43	13.22	12.03
	62	20.93	18.02	15.33	12.15	11.90
	72	20.70	17.89	15.24	12.08	11.86
	82	20.61	17.80	15.19	12.06	11.85

2d Life.	3d Life.	One Life two Years old.				
		4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen	8 per Cen
22 Years old.	22	22.12	18.74	15.84	13.47	12.08
	32	21.53	18.32	15.52	13.35	12.04
	42	21.21	18.11	15.44	13.30	11.98
	52	20.80	17.81	15.22	13.15	11.85
	62	20.45	17.61	15.11	13.06	11.76
	72	20.20	17.42	14.96	12.90	11.57
	82	20.06	17.27	14.83	12.76	11.51
32 Years old.	32	21.02	17.83	15.28	13.31	12.06
	42	20.62	17.60	15.03	13.15	11.87
	52	20.13	17.22	14.86	13.01	11.74
	62	19.66	17.03	14.69	12.90	11.65
	72	19.38	16.80	14.50	12.72	11.49
	82	19.22	16.67	14.39	12.64	11.43
42 Years old.	42	20.06	17.22	14.82	13.03	11.82
	52	19.55	16.91	14.62	12.89	11.63
	62	19.03	16.54	14.38	12.58	11.41
	72	18.56	16.20	14.14	12.46	11.29
	82	18.34	16.08	14.04	12.35	11.19
Aged 52	52	18.92	16.49	14.31	12.61	11.40
	62	18.32	16.06	14.02	12.27	11.21
	72	17.73	15.68	13.71	12.10	11.01
	82	17.62	15.48	13.52	11.98	10.88
62.	62	17.62	15.50	13.68	12.04	10.98
	72	17.06	15.10	13.29	11.80	10.74
	82	16.15	14.83	12.23	11.57	10.53
72.	72	16.43	14.57	12.84	12.38	10.35
	82	15.97	14.19	12.51	11.09	10.10
82.	82	15.42	13.68	12.05	10.72	9.77

2d Life.	3d Life.	One Life 12 Years old.				
		4 per Cen.	5 per Cen	6 per Cen	7 per Cen.	8 per Cen.
12 Years old.	12	23.01	19.54	16.19	13.46	12.29
	22	22.71	19.30	16.12	13.46	12.28
	32	22.53	19.02	15.93	13.45	12.19
	42	22.10	18.89	15.83	13.42	12.15
	52	21.89	18.70	15.77	13.90	12.58
	62	21.69	18.51	15.64	13.27	12.11
	72	21.45	18.45	15.64	13.25	12.05
	82	21.39	18.39	15.58	13.22	12.02
22 Years old.	22	22.52	19.08	16.15	13.62	12.33
	32	22.44	18.71	15.83	13.49	12.24
	42	21.76	18.54	15.82	13.46	12.18
	52	21.47	18.31	15.63	13.36	12.12
	62	21.18	18.15	15.54	13.31	12.08
	72	20.98	18.02	15.45	13.19	11.92
	82	20.86	17.95	15.38	13.19	11.96
32 Years old.	32	21.64	18.34	15.53	13.40	12.17
	42	21.28	18.15	15.37	13.30	12.06
	52	20.93	17.92	15.30	13.21	11.93
	62	20.49	17.65	15.16	13.14	11.90
	72	20.33	17.53	15.09	13.08	11.80
	82	20.25	17.46	14.99	12.99	11.71
Aged 42.	42	20.84	17.88	15.36	13.36	12.06
	52	20.45	17.65	15.21	13.22	11.94
	62	20.08	17.37	15.00	13.04	11.79
	72	19.66	17.11	14.87	12.95	11.72
	82	19.60	17.04	14.78	12.89	11.66

2d Life.	3d Life.	One Life 12 Years old.				
		4 per Cen	5 per Cen	6 per Cen.	7 per Cen	8 per Cen
Aged 52.	52	19.98	17.12	14.97	13.00	11.77
	62	19.53	16.98	14.82	12.82	11.66
	72	19.17	16.72	14.55	12.67	11.53
	82	18.98	16.59	14.43	12.60	11.45
Aged 62.	62	18.99	16.55	14.39	12.68	11.50
	72	18.54	16.27	14.22	12.45	11.34
	82	18.32	16.08	14.05	12.31	11.21
72.	72	18.03	15.90	14.06	12.20	11.12
	82	17.73	15.65	13.72	12.03	10.96
82.	82	17.31	15.30	13.43	11.79	10.73
		One Life 22 Years old.				
22 Years old.	22	22.43	18.82	15.99	13.58	12.27
	32	21.74	18.34	15.58	13.38	12.12
	42	21.54	18.28	15.63	13.47	11.99
	52	21.31	18.01	15.39	13.28	11.93
	62	20.85	17.77	15.29	13.20	11.91
	72	20.61	17.57	15.13	13.12	11.82
	82	20.46	17.46	15.07	13.04	11.79

2d Life.	3d Life.	One Life 22 Years old.				
		4 per C.	5 per C.	6 per C.	7 per C.	8 per C.
32 Years old.	32	21.14	17.91	15.31	13.33	12.09
	42	20.84	17.72	15.20	13.24	11.99
	52	20.27	17.39	15.00	13.10	11.87
	62	19.93	17.15	14.86	13.01	11.77
	72	19.70	16.95	14.69	12.83	11.62
	82	19.56	18.83	14.60	12.80	11.57
42 Years old.	42	20.53	17.52	15.10	13.17	11.76
	52	19.89	17.10	14.86	13.05	11.70
	62	19.49	16.84	14.68	12.82	11.51
	72	19.04	16.51	14.46	12.65	11.35
	82	18.92	16.38	14.34	12.59	11.33
Aged 52.	52	19.30	16.64	14.56	12.78	11.59
	62	18.81	16.32	14.33	12.61	11.42
	72	18.37	15.97	14.05	12.36	11.28
	82	18.14	15.79	13.89	12.28	11.16
Aged 62.	62	18.22	15.87	13.95	12.31	11.20
	72	17.71	15.50	13.69	12.07	10.94
	82	17.39	15.23	13.47	11.93	10.86
72.	72	17.11	15.01	13.28	11.70	10.62
	82	16.70	14.67	13.00	11.51	10.48
82.	82	16.17	14.22	12.62	11.22	10.25

2d Life.	3d Life.	One Life 32 Years old.				
		4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen	8 per Cen.
32 Years old.	32	20.63	17.49	15.01	13.34	12.18
	42	20.18	17.18	14.81	13.13	11.84
	52	19.65	16.86	14.61	13.03	11.77
	62	19.28	16.58	14.44	12.87	11.68
	72	18.85	16.30	14.22	12.68	11.53
	82	18.68	16.17	14.12	12.60	11.44
42 Years old.	42	19.64	16.80	14.56	12.91	11.63
	52	19.05	16.44	14.39	12.77	11.49
	62	18.51	16.07	14.09	12.56	11.33
	72	17.99	15.70	13.87	12.33	11.12
	82	17.85	15.56	13.69	12.16	11.04
Aged 52.	52	18.34	15.99	14.07	12.52	11.31
	62	17.72	15.45	13.74	12.29	11.14
	72	17.19	15.12	13.41	12.01	10.92
	82	16.93	14.91	13.22	11.89	10.77
62.	62	16.95	14.96	13.28	11.96	10.90
	72	16.33	14.50	12.95	11.68	10.63
	82	15.98	14.19	12.67	11.39	10.41
72.	72	15.59	13.90	12.45	11.24	10.27
	82	15.12	13.48	12.08	10.93	9.97
82.	82	14.50	12.95	11.63	10.54	9.59

2d Life.	3d Life.	One Life 42 Years old.				
		4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen.	8 per Cen.
42 Years old.	42	18.94	16.35	14.30	12.74	11.52
	52	17.20	15.90	14.07	12.58	11.27
	62	17.67	15.46	13.68	12.23	11.04
	72	16.95	14.94	13.35	11.98	10.89
	82	16.82	14.78	13.14	11.80	10.71
52 Years old.	52	17.51	15.35	13.61	12.20	11.01
	62	16.76	14.87	13.35	12.06	10.98
	72	16.04	14.26	12.84	11.59	10.55
	82	15.77	14.02	12.59	11.39	10.35
Aged 62.	62	15.90	14.12	12.67	11.43	10.42
	72	15.04	13.48	12.22	11.07	10.12
	82	14.64	13.11	11.84	10.75	9.82
72.	72	14.04	12.67	11.58	10.53	9.69
	82	13.47	12.18	11·09	10.12	9.31
82.	82	12.73	11.47	10.43	9.54	8.75

2 Life.	3 Life.	One Life 52 Years old.				
		4 per Cen.	5 per Cen.	6 per Cen.	7 per Cen.	8 per Cen.
52 Years old.	52	16.59	14.80	13.19	11.85	11.23
	62	15.72	14.07	12.68	11.47	10.47
	72	14.95	13.42	12.16	11.01	10.14
	82	14.51	13.07	11.84	10.78	9.89
Aged 62.	62	14.68	13.22	11.98	10.95	10.07
	72	13.70	12.47	11.41	10.44	9.65
	82	13.15	11.96	10.95	10.06	9.29
72.	72	12.63	11.53	10.61	9.73	9.08
	82	11.85	10.85	9.99	9.22	8.51
82.	82	10.78	9.92	9.15	8.48	7.89
		One Life 62 Years old.				
62.	62	13.41	12.14	11.08	10.13	9.56
	72	12.28	11.27	10.41	9.65	9.01
	82	11.49	10.56	9.76	9.09	8.51
72.	72	10.90	10.13	9.47	8.82	8.28
	82	9.87	9.20	8.62	8.07	7.60
82.	82	8.44	7.90	7.42	6.98	6.59
		One Life 72 Years old.				
72.	72	9.19	8.64	8.19	7.64	7.26
	82	7.82	7.40	7.03	6.65	6.36
82.	82	5.85	5.59	5.37	5.14	4.95
		One Life 82 Years old.				
82.	82	2.86	2.80	2.75	2.71	2.68

TAB. X.

Shewing the Value of the decimal Parts of a Year in Months and Weeks; useful for finding the Value of those Parts in the preceding Tables.

Parts.	Value in M.W.		Parts.	Value in M.W.		Parts.	Value in M.W.	
.02	0	1	.35	4	2	.67	8	3
.04	0	2	.37	4	3	.69	9	0
.06	0	3	.38	5	0	.71	9	1
.08	1	0	.40	5	1	.73	9	2
.10	1	1	.42	5	2	.75	9	3
.12	1	2	.44	5	3	.77	10	0
.13	1	3	.46	6	0	.79	10	1
.15	2	0	.48	6	1	.81	10	2
.17	2	1	.50	6	2	.83	10	3
.19	2	2	.52	6	3	.85	11	0
.21	2	3	.54	7	0	.87	11	1
.23	3	0	.56	7	1	.88	11	2
.25	3	1	.58	7	2	.90	11	3
.27	3	2	.60	7	3	.92	12	0
.29	3	3	.62	8	0	.94	12	1
.31	4	0	.63	8	1	.96	12	2
.33	4	1	.65	8	2	.98	12	3

TAB. XI.

Shewing the Value of the decimal Parts of a Pound in Shillings and Pence at one View.

Parts.	s.	d.	Parts.	s.	d.	Parts.	s.	d.
.004	0	1	.062	1	03	.16	3	03
.008	0	2	.066	1	04	.17	3	06
.012	0	3	.070	1	05	.18	3	09
.017	0	4	.075	1	06	.20	4	00
.021	0	5	.079	1	07	.21	4	03
.025	0	6	.083	1	08	.22	4	06
.029	0	7	.087	1	09	.24	4	09
.033	0	8	.091	1	10	.25	5	00
.037	0	9	.096	1	11	.26	5	03
.042	0	10	.100	2	00	.27	5	06
.046	0	11	.11	2	03	.28	5	09
.050	1	00	.12	2	06	.30	6	00
.054	1	01	.14	2	09	.31	6	03
.058	1	02	.15	3	00	.32	6	06

Parts.	s.	d.	Parts.	s.	d.	Parts.	s.	d.
·34	6	09	·57	11	06	·81	16	03
·35	7	00	·58	11	09	·82	16	06
·36	7	03	·60	12	00	·84	16	09
·37	7	06	·61	12	03	·85	17	00
·38	7	09	·62	12	06	·86	17	03
·40	8	00	·64	12	09	·87	17	06
·41	8	03	·65	13	00	·88	17	09
·42	8	06	·66	13	03	·90	18	00
·44	8	09	·67	13	06	·91	18	03
·45	9	00	·68	13	09	·92	18	06
·46	9	03	·70	14	00	·94	18	09
·47	9	06	·71	14	03	·95	19	00
·48	9	09	·72	14	06	·96	19	03
·50	10	00	·74	14	09	·97	19	06
·51	10	03	·75	15	00	·98	19	09
·52	10	06	·76	15	03	1.00	20	00
·54	10	09	·77	15	06	1·01	20	03
·55	11	00	·78	15	09	1.02	20	06
·56	11	03	·80	16	00	1.04	20	09

A NEW and EASY

METHOD

For finding the

Number of Solid FEET

Contained in any Timber-Trees before they are cut down,

By the Help of a

Common Quadrant and a *Micrometer*.

With a familiar Deſcription of the Inſtruments, and Directions for the Uſe of them.

Whereby Gentlmen may inform themſelves how to Sell, and the Artificer how to Buy Timber by the Tree.

By *JOHN RICHARDS.*

A New and Easy

METHOD

For finding the

Number of Solid Feet

Contained in any Timber-Tree before
they are cut down.

Wherby Gentlemen may in part calculate how to
Sell, and the Artificer how to Buy Timber by
the Tree.

'TIS a common Practice when a Gentleman deſigns to diſpoſe of any Timber-Trees, he goes into the Woods or Groves, and ſets a Mark on ſuch Trees as he judges convenient to be cut down; and then lets it be known abroad, that Chapmen may have Opportunity of viewing the Trees before the Day of Sale.

In bargaining, the Carpenters, Shipwrights, *&c.* are for the moſt part willing to agree at ſo much *per* Tree, or ſo much for the whole Quantity, imagining perhaps that they can give a better Gueſs, as to the Quantity, than the Seller can, and ſo BITE him, as they ſometimes expreſs it. But whether they are not very often miſtaken, and ſo bite themſelves, is a Queſtion to be ſolved by ſuch Perſons as they have hired to meaſure for them after it has been cut down, (for ſome of thoſe that buy Timber can't meaſure it) who I believe will find it in the affirmative.

However, this way of dealing is oftentimes agreed to; the Gentleman, depending either on his own Judgment, or calling in the Aſſiſtance of ſome other Perſon, whom he hath Reaſon to think underſtands it. He farther conſiders, that by this way of dealing, all Cavils about the Menſuration are prevented, and that he hath nothing to trouble himſelf about

about but the Price, and the Security for the Payment of the Money.

How uſeful would it be now to both Parties, could they but know before-hand the Quantity of the Timber? For by this the Gentleman would be as well inſtructed to accept of a juſt and reaſonable Offer when it was made to him, as to guard himſelf againſt the wilful Impoſitions of knaviſh, and the as prejudicial Miſtakes of ignorant Chapmen.

The greateſt Pretenders to nice gueſſing in theſe Caſes, have doubtleſs found themſelves very wide from Truth, eſpecially in large Timber; and therefore they'll be ſure to keep within Compaſs, as they call it; that is, they will be ſure, if they do agree, to make ſuch a Bargain as they may get by; and one of the Parties hath as much Reaſon as the other to be thus cautious; by which Rule no Bargain can be made, unleſs one of the Parties at leaſt be deceiv'd in his Judgment; for 'tis next to impoſſible that ever the Buyer or Seller ſhould hit right by this random Gueſs.

It often happens, that thro' this Difference in Judgment no Agreement can be made; whereas if both Parties knew the Quantity of Timber, the Price would perhaps be eaſily accommodated betwixt them. But the commonly known Methods of meaſuring will by no means diſcover the Quantity of Timber, unleſs the Length and Girt of the Trees be firſt meaſured with a Rule and Line; and ſome People are ſo obſtinately wedded to their

own

own way of dealing, that they will by no means be prevailed upon to buy or ſell by the Ton or Load, and have it meaſur'd when down.

To remove this Difficulty therefore, is the chief Deſign of this *Appendix*; and was the only Motive that put me upon contriving this Inſtrument, by which the Length and the Diameter of any Tree may be found by Inſpection only; and tho' perhaps it may not be found ſo exact as it can by the Rule and Line when down, yet will the Errors be very inconſiderable to a careful Obſerver; as will, I believe, be allow'd by every body that can underſtand the Conſtruction of the Inſtrument.

SECT. I.

The Deſcription and Uſe of the Quadrant for taking the Height or Length of Trees.

I SHALL not take any notice of the Errors in the cuſtomary Way of meaſuring Timber, by girting the Trees in the middle of the Length, and taking the quarter Part of that Girt for the Side of the Square: That this is not a true Way for finding the Content, hath been plainly enough made appear by others; but as the Cuſtom of meaſuring round Timber in that manner hath ſo long

long prevailed, and as divers very good Reaſons have been given for allowing the Buyer theſe Advantages; I ſhall ſuppoſe it an eſtabliſh'd Rule, and take it for granted, that the Quantity ſo found is the Number of Feet that both Parties are contented to compute the Tree at.

But the Difficulty of meaſuring growing Timber (as before hinted) conſiſts in finding the Length, and Girt in the middle of that Length; both which Dimenſions are very difficult, troubleſome, and ſometimes impoſſible to be taken by climbing the Tree, and I preſume may be found to as much Nicety as the matter requires, by the following Inſtruments.

And firſt, For finding the Height or Length of any Tree, and the Middle of that Length.

The Inſtrument that I would recommend for this Purpoſe, is no other than a common Quadrant of about 12 Inches Radius, or more, ſuch as that deſcribed in *Fig.* 1. which may be made of Braſs, Box, Pear-tree, Holly, or the like; and upon this Quadrant (if it be made for this purpoſe) may be inſerted the two Graduations of the Quadrantal Arch within that of the Degrees, divided ſo as to ſhew at one View the Altitude of any Object in Feet or Yards, being obſerved at a Station 10 or 20 Feet or Yards diſtant from a Perpendicular ſuppos'd to fall from the top of the Object; or, which is all one (if the

Object

Object ſtand upright) at a Station 10 or 20 Feet or Yards diſtant from the Foot of the Object, be it Tree, Tower, Steeple, or the like.

But tho' theſe Lines are very handy for the purpoſe, becauſe they do at one View, without any farther Trouble, ſhew the Length required; yet are they not abſolutely neceſſary: for any Perſon that is but furniſhed with a Quadrant that hath only the Degrees on the Arch, need only to refer himſelf to the following Table; where finding the Degrees that are cut by the Thread in Obſervation on the Limb of the Quadrant, in the firſt Column, right againſt it, in their proper Columns, is the Height of the Object in Feet or Yards when the Station is 10 or 20 diſtant: and alſo in another Column of the ſame Table is the Length of the Hypothenuſal Line, that is, the Diſtance of the Apex of the Object, or the Point obſerv'd from the Eye of the Obſerver: Which laſt Numbers may be likewiſe inſerted in two other Lines within the former ones on the Quadrant, if it be deſign'd for this Uſe. Theſe Lines I have likewiſe deſcribed in the Figure of the Quadrant hereto annexed.

In *Fig.* 2, and 3. are deſcribed the Form of the Vanes to be fix'd at the time of Obſervation on the Edge of the Quadrant; the former, which I call the Eye-vane, (becauſe it is to be held to the Eye in obſerving) having a Hole to look thro' at *E*, the Jaw of

this *A* muſt be fix'd on the Edge of the Quadrant at *A*; and the other, which is the Object-vane, muſt be fix'd in like manner on the ſame Edge at *B*.

The Ball or Plummet ſuſpended by a fine Thread at the Center *C*, (as is always the way in this ſort of Quadrants) compleats the Inſtrument, and renders it fit for finding the Angle that a Line drawn from the Eye of the Obſerver to the Object obſerv'd, makes with the Horizon.

The way and manner of obſerving the Height of the Moon or Stars, or of any Tree, Tower, or the like, by the Quadrant, is thus: Holding the Quadrant in your Hand (the Vanes being firſt fix'd as before) with the Hole of the Eye-vane to your Eye, and turning towards the Object, move the Inſtrument ſo, that when you look through the Hole in the Eye-vane, the Edge of the Object Vane *D F* may cut the top of the Object, or that Place of it whoſe Height you would know. At the ſame time the Thread and Plummet playing free and ſteadily, obſerve the Number of Degrees which it cuts on the Limb of the Quadrant; and this is the Altitude in Degrees, or the Number of Degrees contain'd in the Angle made by the Horizon, and the Line drawn from the Object obſerv'd to the Eye of the Obſerver.

Let this ſuffice, as to the general Uſe of the Inſtrument; I come now to apply this to the

the finding the Height or Length of any upright Object in Feet or Yards.

With a Line, Rod, or the like, measure off 10 or 20 Feet or Yards from the Foot of the Object, any way that you shall judge most convenient for your purpose, and there fix your Station for observing; and having in the manner before described, found the Height of the Object in Degrees, right against it on the Quadrant (if those Lines are graduated thereon) or in the Tables for that purpose, under the stationary Distance, is the Height of the Object in Feet or Yards, *&c.* according to that Measure which you measur'd off the stationary Distance with. But here must be understood, that the Altitude or Length thus found, is only of that Part of the Tree, *&c.* that is above the Level of the Eye of the Person that observes.

And hence to find the whole Length of the Object from the Ground it stands on, which in measuring Timber-trees is the Length that must be used: Turn the Quadrant (held at your Eye as before, till the Thread of the Plummet falls on the Line *CG*, and then mark the Place in the Object which is cut by the Edge *DF* of the Object-vane, which Place I call the horizontal Level; measure with a Rule the Height of this Mark above the Ground, and add that Measure to the Length before found, for the whole Length of the Tree, *&c.* above the Ground whereon it stands: but with this Caution,

that it is not true except the Point of the Object obſerv'd for the Height, be perpendicular to that Place of it from which you meaſure off the Diſtance of the Station.

Wherefore in taking the Length of Timber-trees, *&c.* which ſtand inclining, if that Inclination be but little, a ſmall Allowance may be made according to Judgment. But if a Tree leans very much, as ſometimes they do; then the beſt way will be to fix your Station ſo, that the Inclination may be towards the right or left Hand, and not from or towards the Station; and having firſt of all, in the manner before-mention'd, found the Mark on the Tree level with your Eye, that is, the horizontal Level; faſten one End of the Line that you meaſure the ſtationary Diſtance with, to that place in the Tree, and the other End to the Centre of the Quadrant; change places with the Vanes, fixing the Eye-vane at *B*, and the other at *H*, and holding out the Quadrant ſo as to keep the Line ſtreight; move yourſelf to the right or left, till you bring the Line as near as you can to make a right Angle with the leaning Tree; then thro' the Hole in the Vane, and by the Edge of the Object-vane, obſerve by moving the Quadrant, and leaving it anſwerable to the Tree, the Top or Point from which you would take the Length; at the ſame time the Line extended from the Tree, and paſſing over the flat Side of the Quadrant, will cut thereon the Degrees, anſwering to the

Length, in the ſame Nature as it was ſaid to be cut by the String of the Plummet in the former Obſervation of upright Trees; and then the Length from the horizontal Level added to this, gives the whole Length of the Tree.

Tho' this may ſeem a little difficult at firſt, I doubt not but a little Practice will render it eaſy enough to find the Length of any Tree. What remains therefore towards the computing the Number of Feet contained in it, is to find how much the Tree will ſquare in the Middle. But firſt, 'tis neceſſary to ſhew how the Middle of the Tree may be found, or the Place where it ought to be girt, in order to find the Content in Feet. Thus:

From the half Length of the Tree, found before, ſubtract the Length below the horizontal Level, and note the Remainder or the Degrees correſpondent thereto. Then take the Quadrant, the Vanes fix'd as in the firſt Caſe; and hold it ſo to your Eye, that the String of the Plummet may fall on the ſaid Degrees, and at the ſame time ſee what Place in the Tree is cut by the Edge of the Object-vane *DE*; and this is the Place that the Tree is to be girt at, *viz.* the Middle of the Length of it. But if at this Place there ſhould happen to be Branches or Limbs growing out, then the neareſt ſmooth Place above or below muſt be made choice of, allowing ſomething, if need be, according to Diſcretion. The Middle being thus found, you may, by taking

king notice of ſome Limb or other Mark, be able to find the Place after you have laid down the Quadrant.

But becauſe the Diſtance of this Place from the Eye of the Obſerver, (which is the Length of the viſual Ray, or the Hypothenuſe of a right-angled Triangle; one of whoſe Legs is the Tree, and the other the Line of Station) is neceſſary towards finding the Bigneſs of the Tree at the Place aſſigned; I have therefore (as I ſaid before) inſerted that likewiſe on the Quadrant, and alſo in the following *Table*; which is too plain to need any Explanation more than hath already been given of it.

A TABLE *shewing the Altitude of any Object, and the Diſtance of the Top thereof from the Eye of the Obſerver; being ſeen from a Station of* 10 *or* 20 *Feet or Yards Diſtance, anſwering to the Degrees of the Quadrant from* 15 *to* 85 *Degrees.*

Degr. on the Quadr.	Station at 10 Diſtance Length.	Diſt. from the Eye.	Station at 20 Diſtance Length.	Diſt. from the Eye.
15	2. 7	10.3	5. 4	20.6
20	3. 6	10.6	7. 2	21.2
25	4. 7	11.0	9. 4	22.0
30	5. 8	11.5	11. 6	23.0
35	7. 0	12.2	14. 0	24.4
40	8. 4	13.0	16. 8	26.0
45	10. 0	14.1	20. 0	28.2
50	11. 9	15.6	23. 8	31.2
53	13. 3	16.6	26. 6	33.2
56	14. 8	17.9	29. 6	35.8
58	16. 0	18.9	32. 0	37.8
60	17. 3	20.0	34. 6	40.0
62	18. 8	21.3	37. 3	42.6
64	20. 5	22.8	41. 0	45.6
66	22. 5	24.6	45. 0	49.2
68	24. 7	26.7	49. 4	53.4
70	27. 5	29.2	55. 0	58.4
71	29. 0	30.7	58. 0	61.4
72	30. 8	32.4	61. 6	64.8

Degr. on Quadr.	Station at 10 Diſtance Length.	Diſtan. from the Eye.	Station at 20 Diſtance Length.	Diſtan. from the Eye.
73	32.7	34.2	65.4	68.4
74	34.9	36.3	69.8	72.6
75	37.3	38.6	74.6	77.2
76	40.1	41.3	80.2	82.6
77	43.3	44.4	86.6	88.8
78	47.0	48.1	94.0	96.2
79	51.4	52.4	102.8	104.8
80	56.7	57.9	113.4	115.2
81	63.1	63.9	126.2	127.8
82	71.1	71.8	142.2	143.6
83	81.4	82.0	162.8	164.0
84	95.1	95.7	190.2	191.4
85	114.3	114.7	228.6	229.4

I might here ſubjoin a Table of the Degrees of the Quadrant anſwering to every Foot of the Length of the Object, for the more eaſy graduating the Lines on the Quadrant: But as this would be only uſeful to ſuch as make Inſtruments, to whom it will not be difficult to form ſuch a Table for their own Uſe, I have omitted it; and proceed to

SECT.

SECT. II.

The Deſcription and Uſe of the Micrometer for finding the Bigneſs of a diſtant Object.

THIS Inſtrument conſiſts of a ſliding Rule, which when ſhut is two Foot long, and will draw out to about four Foot; the Edges running one in the other, with a Braſs at each End for the Pieces to ſlide thro'; much of the Form of a Glaſier's Dimenſion-Rule.

On the Edges of this Rule are Lines graduated; one to ſhew the Diameter of the Object, another, how much a Tree of that Diameter will ſquare, according to the common Method of taking one quarter of the Girt for the Side of the Square. There will be room for other Lines; ſuch as the Circumference, the Area (which I take to be very uſeful, for the readily computing the Quantity of Timber by Pen) the Side of the Square equal, or the like, according to any Perſon's Fancy. On the other Side may be put Lines of Numbers; and the Timber Line, for the ready caſting up the Dimenſions when taken, according to the common Form of Carpenters Sliding Rules: but all this is as People pleaſe.

To one End of this Rule muſt be fitted an Eye-vane, in all reſpects like that for the Quadrant, ſave that the Jaw for putting it on may be different; and for the other End muſt be a Piece fitted to ſtand croſs the Rule upon its Edge, and at right Angles with the flat Side of it. This Piece may be about one Inch ſquare, and four Inches long; and along the middle of the upper Side thereof muſt be a Grove work'd Dove-tail ways, for the End of a Vane to ſlide in, and to ſtand ſteady when fix'd. To this Grove muſt be fitted two Vanes, which are to be moved at a greater or leſs Diſtance; each Vane turning crooked at the top, for the convenient ſtraining of a Thread in; which two Threads muſt always ſtand upright, and parallel to one another. The Form of the Grove-piece, ſee in *Fig.* 4. and of the Vanes, *Fig.* 5. One of theſe Vanes may be fix'd, but the other muſt be moveable. The Edges of the grov'd Piece are graduated and number'd from the fix'd Vane with 10, 20, 30, *&c.* The Uſe of which Diviſion is for fixing the moveable Vane to the Diſtance of the Object from the Eye at the time of Obſervation.

It would be loſing time, to ſhew the manner of conſtructing theſe Lines on the ſliding Rule and Grove-piece; for thoſe who would underſtand ſuch a Conſtruction, will comprehend it without any Directions; and to thoſe who do not underſtand it, it will be of no Uſe at all: I ſhall therefore only give the

follow-

following Hint, as to the Foundation of them, *viz.* All the Rectangles arising from the Distance of the Vanes from each other, into the Distance of the Object from the Eye, are equal within themselves; and also equal to the Rectangles made by the Breadth of the Object into the neareſt Distance of the Eye-Vane from the Line that joins the Object-Vanes.

Tho' I have order'd one of the Object-Vanes, for the ſake of Conveniency, to be fix'd faſt; yet I am ſenſible that in Strictneſs it ſhould likewiſe move, ſo that the middle of the Sliding Rule might be always in the middle betwixt the two Strings. But the Error ariſing on this account will be of no Conſequence in Practice; for when moſt, it will not be above three Minutes in the Angle at the Eye.

Having thus largely deſcribed the Inſtrument, I ſhall have the leſs Trouble in laying down the manner of uſing it to the purpoſe in hand.

For after the Length of the Tree, and the Place where it muſt be girt, is found by the Quadrant as before directed, and alſo the Diſtance of the Place from the Eye; Take the Micrometer, and having fix'd on the Eye-vane and the Grov'd-piece, ſet the moveable Object-vane to the Diſtance of the Object from the Eye, as before found; and applying the Hole in the Vane to your Eye, draw the

Sliding Rule out, till the Threds of the Object-vanes do juſt include the Body of the Tree at the Place of girding it; then will the Braſs on the End of the Rule cut, in the Line for that purpoſe, the Side of the Square by which the Tree is to be meaſur'd, and alſo the Area (if ſuch a Line be inſerted on the Rule); which Area being drawn into the Length, or otherwiſe wrought by the Sliding Rule, (according to the commonly known Methods of working it) will ſhew the Content in Feet. And this will agree with the Content found by girding the Tree, and taking a quarter of that Girt for the Square, if the Tree to be meaſur'd be truly circular in that Place where it comes to be meaſur'd: But if the Tree ſhould in that Place happen to be flat, or rather Elliptical, as is very often the Caſe; then the beſt way will be to try it at two Stations, and take a Mean between the Area's found at each Station, for the true Area by which the Content is to be found.

This is to be obſerv'd, that the Way of meaſuring round Trees is to girt them on the Rind, and allow four Inches out of the Girt for the Thickneſs of the Rind, that is, one Inch ſquare; or elſe to beat off the Rind, and then girt it. But now in growing Timber the Bark is not to be taken off; wherefore the Allowance of one Inch out of the Side of the Square muſt be made before the ſolid Content is computed.

Here is farther to be noted, that on one Edge of the Rule is graduated the Side of the Square, when the Object-vanes muſt be ſo fix'd, as to be drawn in nearer to the Eye than two Foot, as will always happen when the Diameter of the Object is greater than 14 Inches; and on the other Edge, the Line is graduated ſo as to ſhew the Side of the Square when the Diameter of the Object is leſs than 14 Inches.

Becauſe ſome People may be deſirous of having an Inſtrument longer than two Foot, for the greater Nicety in Obſervation; I have here inſerted a Table for the graduating thereof, by which the Lines of any Length may be divided; for 'tis but to divide a Line of the Length of the Sliding Rule betwixt the inner Braſſes into 24 Parts, and each of theſe into 10; and from this Line ſet off the Parts, as in the *Table*, from either End where the Vanes are fix'd, and the thing is done; always remembring that each of the four Braſſes muſt be exactly half of one of thoſe 24 Parts in Breadth, or $\frac{1}{48}$ of the whole Length between the inner Braſſes.

I have likewiſe drawn up another *Table* for graduating the Grove-piece; the Parts in which are to be taken from the ſame Line of equal Parts, and to begin at the fix'd Vane; which Vane ſhould be fix'd $\frac{1}{3}$ of the whole Length of the Graduations on the Grove-piece from the Middle of the Jaw that fixes it to the Sliding Rule towards either End thereof.

A Ta-

A TABLE *for graduating the Grove-piece.*

Dist. of the Object in Feet.	Parts distant from the fix'd Vane.	Dist. of the Object.	Parts from the fix'd Vane.	Dist. of the Object.	Parts from the fix'd Vane.
10	3.00	16	1.87	30	1.00
11	2.73	17	1.76	40	0.75
12	2.50	18	1.67	60	0.50
13	2.31	19	1.58	80	0.37
14	2.14	20	1.50	100	0.33
15	2.00	21	1.43	120	0.25

A TABLE *for graduating the Sliding Scale of the Micrometer by a Scale of equal Parts; 24 of which Parts is the Length of the Scale (when ſhut) between the Braſſes, ſhewing in Parts the Diſtance from the Eye-vane to every Inch of the Side of the Square from 6 to 36 Inches; and alſo ſhewing the Diameter of the Object anſwering to the Sides of the Square.*

Side of the Square.	Diamr of the Object.	Parts diſtant from the Eye-van toſtrings	Side of the Square.	Diamr of the Object.	Parts diſtant from the Eye-van toſtrings
6	7.63	47.18	22	27.98	12.85
7	8.90	40.31	23	29.25	12.29
8	10.17	35.40	24	30.52	11.78
9	11.44	31.47	25	31.79	11.32
10	12.71	28.32	26	33.06	10.88
11	13.98	25.76	27	33.33	10.48
12	15.26	23.57	28	35.61	10.10
13	16.53	21.76			
14	17.80	20.20	29	36.88	10.73
15	19.07	18.86	30	38.15	9.43
16	20.35	17.68	31	38.42	9.13
17	21.62	16.64	32	37.70	9.84
18	22.89	15.71	33	40.97	8.57
19	24.16	14.88	34	42.24	8.32
20	25.43	14.14	35	43.52	8.08
21	26.70	13.47	36	44.79	7.86

FINIS.

Place this at the end of the Book

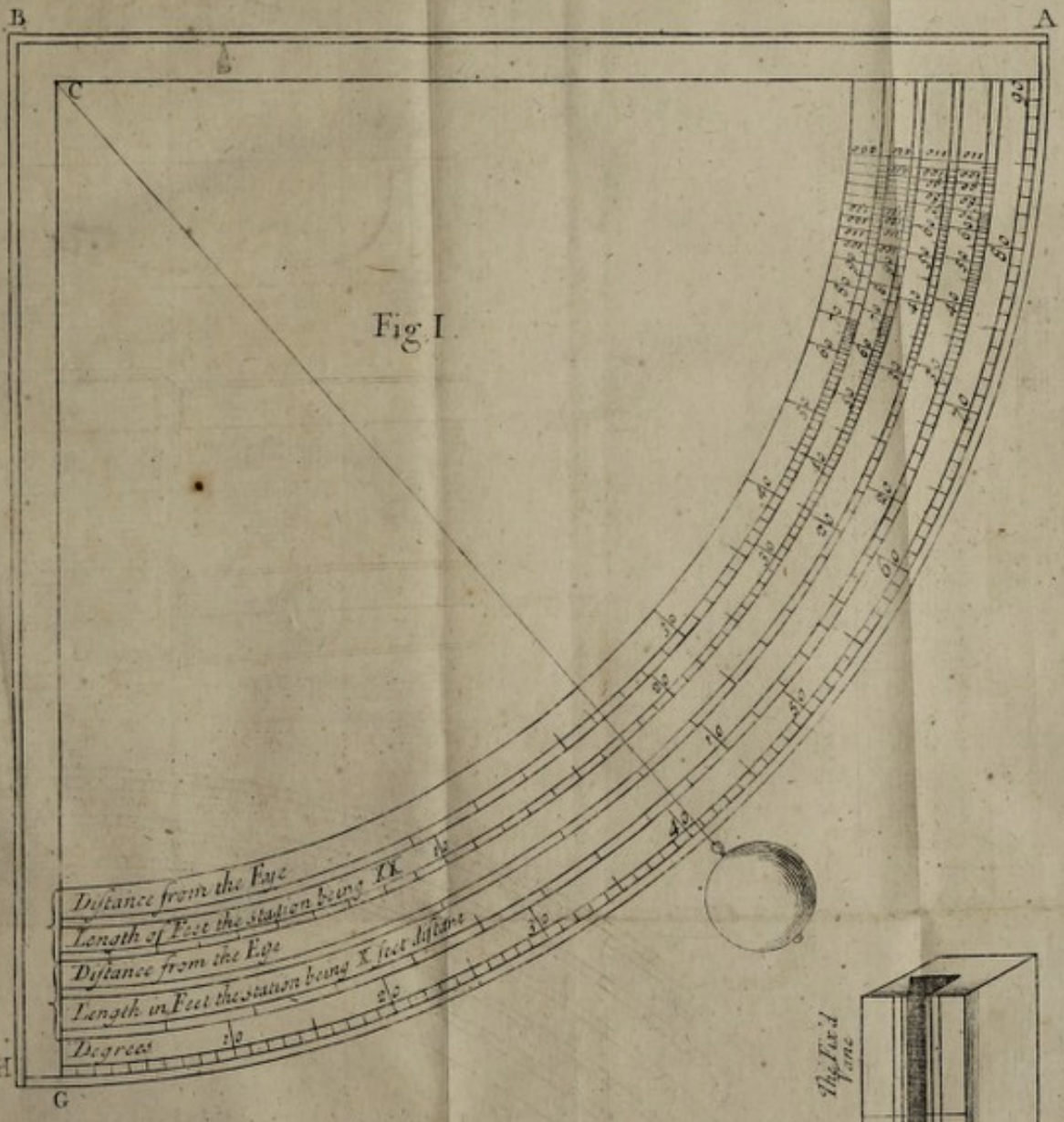


Fig. I.

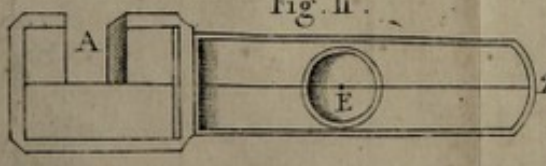


Fig. II.

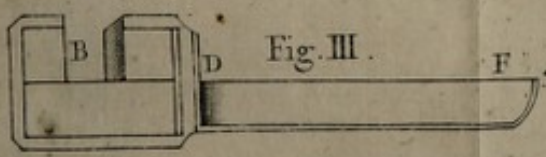


Fig. III.

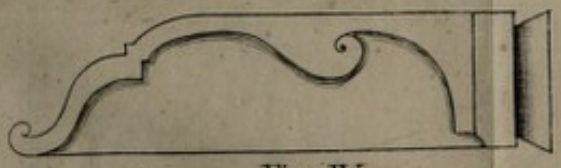
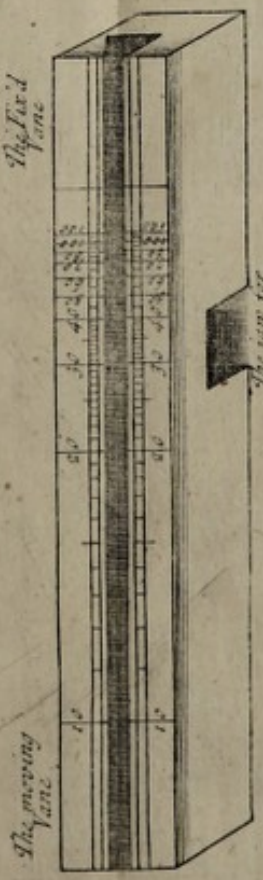
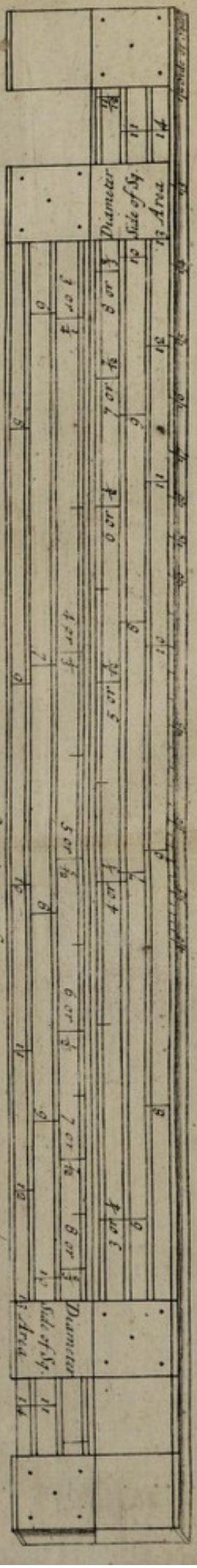


Fig. IV.





The Sliding Rule partly drawn out