A PRACTICAL QUESTION.

To the Editor of the Assurance Magazine.

Sir,—It having been suggested in a letter from Mr. Tucker, in vol. v., p. 255, that practical questions might fitly be commented on in the pages of the Magazine, and Mr. Gray, in a recent volume, having advocated the importance of keeping up the "Correspondence Department," I venture to trouble you with the following case which has occurred in practice, hoping that although it presents no algebraical difficulty in the handling of it, it may yet prove of sufficient interest to attract some of your readers.

"A lady, aged 67 last birthday, holding a jointure well secured, wishes "an advance of £1,000 to enable her to buy a house. What annuity "will an Assurance Company require, the house reverting to the Company "at her death?"

First method.

This may be viewed in the first instance as two separate transactions; and we shall proceed in the first place to determine the annuity, without taking into account the value of the reversion.

Thus, fixing the interest on our advance at 5 per cent., we have the following calculation:—

Premium at age 68=(say)	£9 15 1
	9·754
d=one year's interest at 5 per cent. discounted=	4·762
Annuity *due*, in which the Company must be secured=	14·516

$$\frac{100}{14{\cdot}516} = \begin{array}{l} 6{\cdot}889 \\ -1{\cdot} \\ \hline 5{\cdot}889 \end{array}$$

=value of annuity of £1, first payment at end of one year.

Then by the proportion 5·889 : 1000 :: 1 : 169·81 we find the annuity required for the advance of £1,000 absolutely to be (say) £170.

In the second place, we have now to determine what deduction should be made from this annuity in consideration of the reversion of the house; and let us consider this reversion equivalent to that of an absolute sum of £750, one fourth being deducted for probable depreciation of the property.

The value of £1 to be received on the death of a person aged 68 next birthday, Carlisle 3 per cent., is	·74168
And multiplying by	7½
	37084
	519176
We have value of reversion of £750=	556·260

Now the annuity which by the Office Tables £100 will purchase is (say) £10. 13s.: therefore 10·65 × 5·5626=59·241 gives the annuity (payable

yearly) to be granted for purchase price of £556. 5*s.* 2*d.*, and deducting it from the annuity required by the Company, as above £170 0 0

59 4 10

We have the net annuity required . . . £110 15 2

Second method.

The transaction, however, may be looked upon in another light.

If we look upon the reversion as equivalent to that of an absolute sum of £750, all that the Company require to assure on the life 68, is the amount of depreciation, £250.

That being the case, the calculation will stand thus:—

One-fourth of p = 2·438

d = 4·762

Annuity *due* in which the Company must be secured 7·200

$\frac{100}{7·2}$ = 13·889

−1

12·889 = value of annuity of £1, first payment at end of one year.

Then by the proportion 12·889 : 1000 :: 1 : 77·585, we have £77. 11*s.* 8*d.* as the net annuity which the Company require to secure them, a seemingly fair rate.

If we adopt the second view of the case, the transaction partakes more of the nature of an advance on security, and involves the consideration of the desirableness of lending on house property. But taking into account the extent to which depreciation is provided against, I think the security may be held to be good.

The first method is that which would be adopted, in each case, if the two proposals contained in the transaction were made by different persons.

Between the limits there is a wide range for fixing the rate, and I shall be glad to have the opinion of any gentleman as to what may be thought an equitable one.

I am, Sir,

Your most obedient servant,

Edinburgh, 19*th September*, 1867. J. C.

P.S.—Under the first method, the value of the reversion has been taken so as to bring out the most favourable value for the proposer. If it had been found by the usual formula $\frac{1-ia_x}{1+i}$,—taking a_x from the Office tables and i at 5 per cent. from Orchard*—it would have been only £379. 1*s.* 3*d.*, which would have brought out the difference between the rates of annuity required under the two methods, still greater.

* Is our correspondent correct in terming this the "usual formula"? As regards the problem, we should ourselves be disposed to adopt his *Second method*, taking d at $s.x$ per cent., = ·05660, which would give £33. 2*s.* 5*d.* as the annuity to be received by the Company.—Ed. *J. I. A.*