CORRESPONDENCE.

REPLY TO "A CHALLENGE".

To the Editor of the *Mathematical Gazette.*

Dear Editor,—This reply to "Wrangler's" challenge in the current number of the *Gazette* is sent off post-haste, as I believe that the acceptors of such challenges strove to be first in the field.

To find p the probability that a man of age a reaches age b, multiply $(b-a)$ by the mean of the reciprocals of the expectations of life from a to b, add the logarithm of the expectation at b and subtract the logarithm of the expectation at a, thus obtaining the logarithm of $1/p$ (natural logarithms are to be used or the product should be multiplied by μ).

If $f(x)$ is the chance that a man of age a reaches the age $a+x$, and $\phi(x)$ the expectation of life at that age,

$$\phi(x)=\frac{1}{f(x)}\int_x^\infty f(x)dx.$$

or if $f(x)$ is the derivative of a function $F(x)$,

$$\frac{1}{\phi(x)}=\frac{f(x)}{F(\infty)-F(x)}, \qquad \text{(i)}$$

and, integrating, we have

$$\int_0^x \frac{dx}{\phi(x)}=-\log\frac{F(\infty)-F(x)}{c},$$

where c is a constant. Thus making use of (i),

$$\int_0^x \frac{dx}{\phi(x)}=-\log\frac{f(x)\,.\,\phi(x)}{c}.$$

As $f(0)=1$, we have $c=\phi(0)$ and

$$\log f(x)=\log\phi(0)-\log\phi(x)-\int_0^x\frac{dx}{\phi(x)}.$$

For example, if the expectations of life at yearly intervals from 50 to 60 are

$$20{\cdot}3,\ 19{\cdot}5,\ 18{\cdot}9,\ 18{\cdot}2,\ 17{\cdot}6,\ 16{\cdot}9,\ 16{\cdot}2,\ 15{\cdot}6,\ 15{\cdot}0,\ 14{\cdot}4,\ 13{\cdot}8,$$

then

$$\log\phi(0)-\log\phi(x)=\log 20{\cdot}3-\log 13{\cdot}8={\cdot}7080-{\cdot}3221,$$

while for the integral Simson's rule gives ·5979, so that $\log p=\bar{1}{\cdot}7880$ and $p=\frac{4}{5}$ approximately. Consequently the chance that two men of 50 reach 60 is about $\frac{16}{25}$, that neither do so about $\frac{1}{25}$, and that one only does so about $\frac{8}{25}$.

C. H. Hardingham.

July 3, 1932.

IS THE EARTH ROUND OR FLAT?

To the Editor of the *Mathematical Gazette.*

Sir,—Has the above question any meaning? If it is not possible for human beings to prove that the Earth is either round or flat, surely the question becomes meaningless. I give below reasons for thinking that we cannot answer the question one way or the other.

Let us take a system of three unit vectors, $\mathbf{e}_1$, $\mathbf{e}_2$, $\mathbf{e}_3$, at right angles to each other and use spherical polar coordinates, viz. ϕ for the co-latitude measured from $\mathbf{e}_3$, θ for the meridian angle measured from $\mathbf{e}_1$, r for the radius vector.

https://doi.org/10.2307/3605553 Published online by Cambridge University Press