

Actuarial Mathematics Sample Test

Write your name and student number at the top of your Test. Answer all questions

The present values of annuities-certain are given below:

$$\begin{aligned}\ddot{a}_{\overline{n}|} &= \frac{1 - V^n}{1 - V} & a_{\overline{n}|} &= V \ddot{a}_{\overline{n}|} \\ \ddot{a}_{\overline{n}|}^{(p)} &= \frac{1}{p} \left[\frac{1 - V^n}{1 - V^{\frac{1}{p}}} \right] & a_{\overline{n}|}^{(p)} &= V^{\frac{1}{p}} \ddot{a}_{\overline{n}|}^{(p)}.\end{aligned}$$

1. If the nominal rate of interest per annum is 6% when interest is compounded monthly, find the annual equivalent rate of interest.

How much interest should be paid in arrears for the use of £1,000 over a one month period?

Find the present value of £5000 which is to be received in 5 years time.

2. £1,000 is invested for 3 years. For the first 6 months the interest rate is 0.5% per month. For the remaining period the APR is 5%. How much interest will have accrued by the end of the 3 year period.

3. John Brown takes out a loan for £100,000 to purchase a property. The loan is to be repaid over a 25 year period by making equal annual payments in arrears. Find the annual payment if the APR is 10%.

He sells his property and repays the outstanding amount of the loan at the time that the 10th annual payment is due (but has not been paid). How much does he need to pay at that time?

4. The survival function $S(x) = e^{-x/100}$ for $x > 0$. Find the instantaneous death rate $\mu(x)$. If $K(x)$ is the curtate further lifetime of a life aged x , find $P(K(x) = k)$ and give the range. Find ${}_{30}q_{20}$.

- 5 Use the life table ELT12 to obtain the following results:

(a) Calculate the probability that a newborn survives to age 21.

(b) Calculate the expected number surviving to age 30 out of 1000 men aged 20.

(c) Let x and n be integers and let $0 < t < 1$. Use linear interpolation of the survival function between integer ages to show that ${}_n|_t q_x = t \times {}_n|_1 q_x$.

Find the probability that a life who has just reached 60 survives to his 65th birthday but dies within the next 6 months.