Exercise 2 continued

- Calculate the present value of £1,000 due at the end of 15 years.
  - Calculate the annual effective rate of discount implied by the transaction above.
- A continuous payment stream is received at a rate of $20e^{-0.01t}$ units per annum between $t = 10$ and $t = 15$. Calculate the present value of the payment stream.

Exercise 3 - Tutorial 5 Q1

- The force of interest, $\delta(t)$, is a function of time and at any time t (measured in years) is given by:
  - $\delta(t) = 0.07 - 0.005t$ for $t \leq 8$
  - $\delta(t) = 0.06$ for $t > 8$
- Calculate the present value at time $t = 0$ of a continuous cash flow paid at the rate of $£200 \times e^{0.1t}$ paid from $t = 10$ to $t = 18$.

Example 7

- A continuous cash flow is received for 12 years and the rate of payment at time t is $10e^{0.05t}$. The force of interest, $\delta(t)$ is constant at 0.07.
- Calculate the accumulated value of the cash flow after 12 years.

Example 8

- The force of interest, $\delta(t)$, is a function of time and, at any time t (measured in years) is given by the formula:
  - $\delta(t) = 0.06$ for $0 \le t \le 4$
  - $\delta(t) = 0.1 - 0.01t$ for $4 < t \le 7$
  - $\delta(t) = 0.01t - 0.04$ for $7 < t$

a) Calculate the discounted value at time t=5 of £1,000 due for payment at time t=10.

Lecture 5 summary: discounted values continued

- Discounted value at time t_1 of any cash flow is:

$$discounted\ value = \sum_t C_t \times \frac{v(t)}{v(t_1)} + \int_0^T \rho(t) \times \frac{v(t)}{v(t_1)} dt$$

- where
  - C_t are the discrete cash flows, and
  - ρ_t are the continuously payable cash flows.

Lecture 5 summary: accumulated amount

- For a continuous cash flow paid at rate $\rho(t)$ and received from time a to time b, the accumulated value at time b is:

$$\int_a^b \rho(t) \times \exp\left(\int_t^b \delta(s)\, ds\right) dt$$

$$= \int_a^b \rho(t) A(t,b)\, dt$$