

**6** Helga invests £4000 in a savings account.  
After  $t$  days, her investment is worth £ $y$ .  
The rate of increase of  $y$  is  $ky$ , where  $k$  is a constant.

**(a)** Write down a differential equation in terms of  $t$ ,  $y$  and  $k$ . [1]

**(b)** Solve your differential equation to find the value of Helga's investment after  $t$  days.  
Give your answer in terms of  $k$  and  $t$ . [4]

It is given that  $k = \frac{1}{365} \ln \left( 1 + \frac{r}{100} \right)$  where  $r$  % is the rate of interest per annum.

During the first year the rate of interest is 6% per annum.

**(c)** Find the value of Helga's investment after 90 days. [2]

After one year (365 days), the rate of interest drops to 5% per annum.

**(d)** Find the total time that it will take for Helga's investment to double in value. [5]