Exercise 14C

1. Trudy puts $500 into a savings bank account on the first day of January each year from 2000 to 2010 inclusive. The account pays interest at 5% for each complete year of investment. How much money will there be in the account on 2 January 2010?

2. Jayesh invests $100 in a savings account on the first day of each month for one complete year. The account pays interest at $\frac{1}{2}$% for each complete month. How much does Jayesh have invested at the end of the year (but before making a thirteenth payment)?

3. Neeta takes out a 25-year mortgage of $40 000 to buy her house. Compound interest is charged on the loan at a rate of 8% per annum. She has to pay off the mortgage with 25 equal payments, the first of which is to be one year after the loan is taken out. Continue the following argument to calculate the value of each annual payment.
   - After 1 year she owes $\$(40 000 \times 1.08)$ (loan plus interest) less the payment made, $P$, that is, she owes $\$(40 000 \times 1.08 - P)$.
   - After 2 years she owes $\$(40 000 \times 1.08 - P) \times 1.08 - P$.
   - After 3 years she owes $\$(40 000 \times 1.08 - P) \times 1.08 - P \times 1.08 - P$.

   At the end of the 25 years this (continued) expression must be zero. Form an equation in $P$ and solve it.

4. Fatima invests $100 per month for a complete year, with interest added every month at the rate of $\frac{1}{2}$% per month at the end of the month. How much would she have had to invest at the beginning of the year to have the same total amount after the complete year?

5. Charles borrows $6000 for a new car. Compound interest is charged on the loan at a rate of 2% per month. Charles has to pay off the loan with 24 equal monthly payments. Calculate the value of each monthly payment.

6. The population of Pascalia is increasing at a rate of 6% each year. On 1 January 1990 it was 35 200. What was its population on
   (a) 1 January 2000,   (b) 1 July 1990,   (c) 1 January 1980?

7. The population of the United Kingdom in 1971 was 5.5615 \times 10^7; by 1992 it was estimated to be 5.7384 \times 10^7. Assuming a steady exponential growth estimate the population in
   (a) 2003,   (b) 1981.

8. The population of Pythagora is decreasing steadily at a rate of 4% each year. The population in 1998 was 21 000. Estimate the population in
   (a) 2002,   (b) 1990.

9. A man of mass 90 kg plans to diet and to reduce his mass to 72 kg in four weeks by a constant percentage reduction each day.
   (a) What should his mass be 1 week after starting his diet?
   (b) He forgets to stop after 4 weeks. Estimate his mass 1 week later.