

2 For each sequence:

- i write down the first 5 terms of the sequence
- ii state whether the sequence is increasing, decreasing, or periodic.
- iii If the sequence is periodic, write down its order.

a  $u_n = 20 - 3n$

b  $u_n = 2^{n-1}$

c  $u_n = \cos(180n^\circ)$

d  $u_n = (-1)^n$

e  $u_{n+1} = u_n - 5, u_1 = 20$

f  $u_{n+1} = 5 - u_n, u_1 = 20$

g  $u_{n+1} = \frac{2}{3}u_n, u_1 = k$

4 A population of ants is growing at a rate of 10% a year.

If there were 200 ants in the initial population, write down the number of ants after:

- a 1 year      b 2 years      c 3 years      d 10 years.

**Problem-solving**

This is a geometric sequence.  
 $a = 200$  and  $r = 1.1$

5 A motorcycle has four gears. The maximum speed in bottom gear is  $40 \text{ km h}^{-1}$  and the maximum speed in top gear is  $120 \text{ km h}^{-1}$ . Given that the maximum speeds in each successive gear form a geometric progression, calculate, in  $\text{km h}^{-1}$  to one decimal place, the maximum speeds in the two intermediate gears.

6 A car depreciates in value by 15% a year.

After 3 years it is worth £11 054.25.

- a What was the car's initial price?
- b When will the car's value first be less than £5000?

**Problem-solving**

Use your answer to part a to write an inequality, then solve it using logarithms.

7 A salesman is paid commission of £10 per week for each life insurance policy that he has sold. Each week he sells one new policy so that he is paid £10 commission in the first week, £20 commission in the second week, £30 commission in the third week and so on.

- a Find his total commission in the first year of 52 weeks. **(2 marks)**
- b In the second year the commission increases to £11 per week on new policies sold, although it remains at £10 per week for policies sold in the first year. He continues to sell one policy per week. Show that he is paid £542 in the second week of his second year. **(3 marks)**
- c Find the total commission paid to him in the second year. **(2 marks)**

8 Prospectors are drilling for oil. The cost of drilling to a depth of 50 m is £500. To drill a further 50 m costs £640 and, hence, the total cost of drilling to a depth of 100 m is £1140.

Each subsequent extra depth of 50 m costs £140 more to drill than the previous 50 m.

- a Show that the cost of drilling to a depth of 500 m is £11 300. **(3 marks)**
- b The total sum of money available for drilling is £76 000. Find, to the nearest 50 m, the greatest depth that can be drilled. **(3 marks)**

9 Each year, for 40 years, Anne will pay money into a savings scheme. In the first year she pays in £500. Her payments then increase by £50 each year, so that she pays in £550 in the second year, £600 in the third year, and so on.

- a Find the amount that Anne will pay in the 40th year. **(2 marks)**
- b Find the total amount that Anne will pay in over the 40 years. **(3 marks)**
- c Over the same 40 years, Brian will also pay money into the savings scheme. In the first year he pays in £890 and his payments then increase by £ $d$  each year. Given that Brian and Anne will pay in exactly the same amount over the 40 years, find the value of  $d$ . **(4 marks)**

- 2 a i 17, 14, 11, 8, 5                      ii decreasing  
 b i 1, 2, 4, 8, 16                            ii increasing  
 c i -1, 1, -1, 1, -1                        ii periodic  
    iii 2  
 d i -1, 1, -1, 1, -1                        ii periodic  
    iii 2  
 e i 20, 15, 10, 5, 0                        ii decreasing  
 f i 20, -15, 20, -15, 20                    ii periodic  
    iii 2  
 g i  $k, \frac{2k}{3}, \frac{4k}{9}, \frac{8k}{27}, \frac{16k}{81}$   
    ii dependent on value of  $k$

4 a 220                      b 242                      c 266                      d 519

5 57.7, 83.2

6 a £18 000                      b after 7.88 years

7 a £13 780

- b Let  $a$  denote term of first year and  $u$  denote term of second year

$$a_{12} = 10 + 51(10) = 520$$

$$u_1 = 520 + 11$$

$$u_2 = 531 + 11 = 542$$

c £42 198

8 a 500 m is 10 terms,

$$S_{10} = \frac{10}{2}(1000 + 9(140)) = 11\,300$$

b 1500 m

9 a £2450                      b £59 000                      c  $d = 30$