

PRACTICE Sequences Word Problems

1. Jane is researching her family genealogy and finds that she is able to record all direct ancestors to the ninth generation preceding her. How many ancestors would she have in this ninth preceding generation? (Be careful about $n!$)
2. A recovering heart attack patient is told to get on a regular walking program. The patient is told to walk a distance of 5 km the first week, 8 km the second week, 11 km the third week and so on for a period of 10 weeks. At that point the patient is to maintain the distance walked during the 10th. How far will the patient walk during the 10th week?
3. The sum of the interior angles of a triangle is 180° , of a quadrilateral is 360° and of a pentagon is 540° . Assuming this pattern continues, find the sum of the interior angles of a dodecagon (12 sides).



4. After knee surgery, your trainer tells you to return to your jogging program slowly. He suggests jogging for 12 minutes each day for the first week. Each week thereafter, he suggests that you increase that time by 6 minutes per day. How many weeks will it be before you are up to jogging 60 minutes per day?



5. A car depreciates 30% every year. Find the value of a car 5 years old if the original price was \$30 000. (Be careful about what n equals!)



You complain that the hot tub in your hotel suite is not hot enough. The hotel tells you that they will increase the temperature by 10% each hour. If the current temperature of the hot tub is 75°F , what will be the temperature of the hot tub after 3 hours, to the *nearest tenth* of a degree?

7. A culture of bacteria doubles every 2 hours. If there are 500 bacteria at the beginning, how many bacteria will there be after 24 hours?



8. A mine worker discovers an ore sample containing 500 mg of radioactive material. It is discovered that the radioactive material has a half life of 1 day. Find the amount of radioactive material in the sample at the beginning of the 7th day.



9. **Application Problem:**

Suppose you participate in a bike-a-thon for charity. The charity starts with \$1100 in donations. Each participant must raise at least \$35 in pledges. What is the minimum amount of money raised if there are 75 participants?

In other words, "What is the 75th term in the sequence?"

**** Be careful when identifying the first term in the sequence! ****

The term number will represent the number of participants...
How much money does the charity have with 0 participants? With 1 participant?

10. A house worth \$350 000 sold for \$475 000 three years later. Find the annual rate of increase if the value of the house increased geometrically.
11. In a certain region, the number of highway accidents increased by 20% over a four year period. How many accidents were there in 2006 if there were 5120 in 2002? (Be careful about n !)
12. Elliot borrowed \$370 from his parents. He will pay them back at the rate of \$60 per month. How long will it take for him to pay his parents back?
13. If groceries now cost Mrs. Boughen \$240 per week, she predicts that the cost will increase 10% per year due to inflation **AND** her 3 growing boys eating more and more each year. How much money will she be spending per week on groceries in 5 years?



ANSWERS

1.

$$t_{10} = 1(2)^9$$

$$= 512$$

she has 512 ancestors in this 9th generation.

2.

$$t_{10} = 5 + (9)(3)$$

$$= 5 + 27$$

$$= 32$$

The patient will be walking 32 km in the 10th week.

3.

The sequence

	180	360	540	...	?
Sides:	3	4	5	...	12
Term:	1	2	3	...	?

This sequence is arithmetic and the common difference is 180. The 12-sided figure will be the 10th term in this sequence. Find the 10th term.

$$a_n = a_1 + (n-1)d$$

$$a_{10} = 180 + (10-1)180 = 1800$$

4.

Adding 6 minutes to the weekly jogging time for each week creates the sequence: 12, 18, 24, ...

This sequence is arithmetic.

$$a_n = a_1 + (n-1)d$$

$$a_n = 60 = 12 + (n-1)6$$

$$n = 9 \text{ weeks}$$

5.

$$t_6 = 30\,000(.70)^5$$

$$= 5042.10$$

The car will be worth \$5042.10 after 5 years.

6.

Starting temperature is 75°.

If the temperature is increased by 10%, the new temperature will be 110% of the original temperature. The common ratio will be 1.10.

There are 4 terms.

75, after 1 hour, after 2 hours, after 3 hours (4 terms)

$$a_n = a_1 \cdot r^{n-1}$$

$$a_4 = 75 \cdot (1.10)^{4-1} = 99.8^\circ F$$

7. There are 500 bacteria to start, doubling every 2 hrs.

500	1000	2000	...	?
Start	after 2 hrs.	4 hrs	...	24 hrs
Term #	1	2	...	?

Such bacterial growth is a geometric sequence with a common ratio of 2. The number of hours, however, is arithmetic with common difference of 2.

Which term number is 24? Find out by observation or:

$$a_n = a_1 + (n-1)d$$

$$24 = 2 + (n-1)2$$

$$n = 12$$

Now find the number of bacteria. The starting number and number of terms used may vary:

$$a_n = a_1 \cdot r^{n-1}$$

$$a_{12} = 500 \cdot (2)^{12-1} = 2,048,000$$

8. 500 mg of ore. Half life of one day means that half of the amount remains after 1 day.

Begin of day 1 500 mg	Begin of day 2 250 mg	Begin of day 3 125 mg	...
End of day 1 250 mg	End of day 2 125 mg	End of day 3 62.5 mg	...

Decide to either work with the "beginning" of each day, or the "end" of each day, as each can yield the answer. Only the starting value and number of terms will differ. We will use "beginning":

$$a_n = a_1 \cdot r^{n-1}$$

$$a_8 = 500 \cdot \left(\frac{1}{2}\right)^{7-1} = 7.8125 \text{ mg}$$

- 9.

$$1100, \quad \textcircled{1135}, \quad 1170, \quad \dots$$

$a_0, \quad a_1, \quad a_2$

$$* a_n = 1135 + 35(n-1)$$

$$a_n = 1135 + 35n - 35$$

$$* \textcircled{a_n = 1100 + 35n}$$

$$\begin{cases} a_1 = 1135 \end{cases}$$

$$\begin{cases} a_n = a_{n-1} + 35 \end{cases}$$

For a problem like this it is a better idea to use the explicit formula.

10. $475\,000 = 350\,000 r^3$
 $1.357 = r^3$
 $r = 1.107$

\therefore The rate of increase is 10.7% per year

11. $t_5 = 5120 (1.20)^4$
 $= 10\,616.8$

There will be about 10 617 accidents in 2006.

12. Generate the sequence:

$370, 310, 250, \dots$
 a_0 a_1

$a_1 = 310$ $d = -60$



Write an equation:

EXP:

$a_n = 310 - 60(n-1)$
 $a_n = -60n + 370$

REC:

$\begin{cases} a_1 = 310 \\ a_n = a_{n-1} - 60 \end{cases}$

Solve and Answer the question:

$0 = -60n + 370$
 $\frac{-370}{-60} = \frac{-60n}{-60}$

$6\frac{1}{6} = n$

He will be done paying in the 7th month.

$370, 310, 250,$
 $190, 130, 70,$
 $10, -50$

↑
after 7 months

For a problem like this we could use EITHER an explicit or recursive formula.

13. $t_6 = 240 (1.10)^5$
 $= 386.52$

Mrs. Baughen will be spending \$386.52 per week in 15 years.