Concept – Geometric sequence recursion & applications

Geometric sequences can be used to model all sorts of situations, from populations of living creatures to the depreciation of assets.
These sequences can be represented with a recurrence relation of the form:

$$t_1 = a \qquad\qquad t_{n+1} = r \times t_n$$

When working with these situations we often need to calculate the **n[th] term** of a sequence, and this can be done using the rule:

$$t_n = a \times r^{(n-1)}$$

Often the question will give us a percentage increase or decrease. We can use this to find the common ratio using these equations:

$$r = 1 - \frac{P}{100} \qquad\qquad r = 1 + \frac{P}{100}$$

How to

As a park ranger, Megan has been working on a project to increase the number of rare native orchids in Wilsons Promontory National Park.
At the start of the project, a survey found 200 of the orchids in the park. It is assumed from similar projects that the number of orchids will increase by about 18% each year.

A. State the first term a, and the common ratio r, for the geometric sequence for the number of orchids each year.

B. Write a recurrence relation to represent this situation.

C. Write the sequence representing the number of orchids in the first 4 years.

D. Find a rule for the number of orchids at the start of the n^{th} year.

E. How many orchids are predicted to be in the park in 10 years time?

F. Megan has been told that she will earn a bonus if she can increase the number of orchids above 500 within the first 5 years. Will she earn this bonus? Explain your answer.

Worked Example(s)

From the written description of a situation write a recurrence relation and use this to generate a number of terms in the sequence. The write a rule and use the rule to calculate a late term (t_{25})