Lesson 3.4 - The Sum of a Geometric Sequence

$$S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}, \quad r \neq 1$$

1. Consider the geometric sequence −1, 2, −4, 8, −16, …

   (a) Write down the values of u1 and r. $u_1 = -1$ + $r = -2$

   (b) Find the tenth term.

   $$u_n = u_1 \times r^{n-1}$$
   $$u_{10} = -1 \times (-2)^{10-1} = -1 \times (-2)^9 = \boxed{512}$$

   (c) Find the sum of the first ten terms.

   $$S_{10} = \frac{-1((-2)^{10} - 1)}{-2 - 1} = \frac{-1(1023)}{-3} = \boxed{341}$$

2. Consider the geometric sequence 3, 2.4, 1.92, 1.536, …

(a) Write down the value of u1. $\boxed{u_1 = 3}$

(b) Show that r = 0.8.

$$r = \frac{\text{current}}{\text{previous}} = \frac{2.4}{3} = 0.8$$

(c) Calculate S_8.

$$S_8 = \frac{3((.8)^8 - 1)}{.8 - 1} = \boxed{12.5}$$

3. The heating is switched off in a school laboratory. An experiment is set up to look at the growth in a population of fruit flies. As the temperature in the laboratory is low, it is found that the population is only growing by 30% per day. On Monday there are 20 fruit flies.

$r = 130\% = 1.3$

$u_1 = 20$

(a) How many fruit flies will there be on Friday?

$$u_n = u_1 \times r^{n-1}$$

$$u_5 = 20 \times (1.3)^{5-1} = 20 \times (1.3)^4 = \boxed{57}$$

(b) How long will it be before the population exceeds 500 fruit flies?

$S_n > 500$

$$\frac{20 \times ((1.3)^n - 1)}{1.3 - 1} > 500$$

Put in Y_1

Put in Y_2

Find the intersection or look at the table.

The population will exceed 500 flies after 9 days.