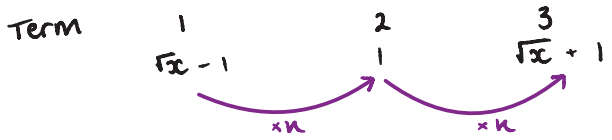
1. S is a geometric sequence.

(a) Given that $(\sqrt{x} - 1)$, 1 and $(\sqrt{x} + 1)$ are the first three terms of S, find the value of x.
You must show all your working.

Geometric sequence is a sequence in which terms are multiplied by a common ratio e.g. 1, 3, 9, 27...



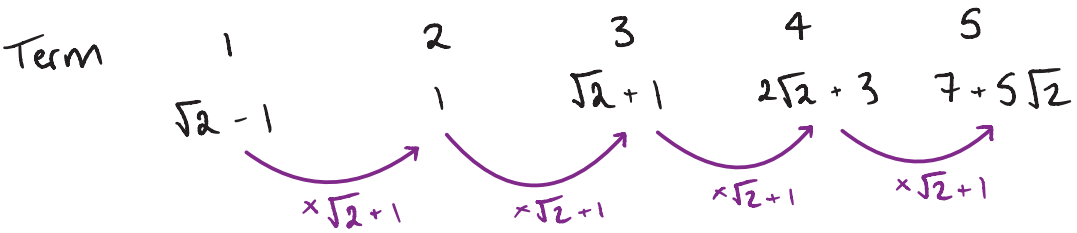
$(\sqrt{x} - 1) \times r = 1$ ✓
$(\sqrt{x} - 1)(\sqrt{x} + 1) = 1$ ✓
$x + \sqrt{x} - \sqrt{x} - 1 = 1$
$x - 1 = 1$
$(+1)\ (+1)$
$x = 2$

$1 \times r = \sqrt{x} + 1$
$r = \sqrt{x} + 1$

2 ✓

(3)

(b) Show that the 5th term of S is $7 + 5\sqrt{2}$



$r = \sqrt{2} + 1$

Term 4 =
$(\sqrt{2} + 1)(\sqrt{2} + 1)$
$= 2 + \sqrt{2} + \sqrt{2} + 1$
$= 2\sqrt{2} + 3$

Term 5 =
$(2\sqrt{2} + 3)(\sqrt{2} + 1)$
$= 2 \times 2 + 2\sqrt{2} + 3\sqrt{2} + 3$
$= 4 + 5\sqrt{2} + 3$
$= 7 + 5\sqrt{2}$

(2)

(Total for Question is 5 marks)

2. At the start of year n, the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000
At the start of 2019 the number of animals in the population was 3610

Find the value of the constant k.

$P_{n+1} = kP_n$

2017 - 2018 :

$P_{2018} = k P_{2017}$

$P_{2018} = k(4000)$

2018 - 2019 :

$P_{2019} = k P_{2018}$

$3610 = k P_{2018}$

$P_{2018} = \frac{3610}{k}$

$\therefore \quad 4000k = \frac{3610}{k}$

$4000k^2 = 3610$

$k = \sqrt{\frac{3610}{4000}} = 0.95$

0·95

(Total for Question is 3 marks)