ALGEBRA: ITERATIVE POPULATION GROWTH & DECAY

Best Guess Mastery Worksheet (Target Grade 5/6)

I Do

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

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

At the start of 2018 the number of animals in the population was 5000.
At the start of 2020 the number of animals in the population was 4050.

Find the value of the constant k.

We Do

k=..... **(3)**

At the start of year n, the number of birds in a sanctuary is B_n.
At the start of the following year, the number of birds in the sanctuary is B_{n+1} where

$$\boldsymbol{B_{n+1} = rB_n}$$

At the start of 2016 the number of birds in the sanctuary was 8000.
At the start of 2018 the number of birds in the sanctuary was 6480.

Find the value of the constant r.

r=..... **(3)**

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You Do 1

At the start of year n, the number of fish in a lake is F_n.
At the start of the following year, the number of fish in the lake is F_{n+1} where

$$\boldsymbol{F_{n+1} = mF_n}$$

At the start of 2015 the number of fish in the lake was 12000.
At the start of 2017 the number of fish in the lake was 9720.

Find the value of the constant m.

m=..... **(3)**

You Do 2

At the start of year n, the number of trees in a forest is T_n.
At the start of the following year, the number of trees in the forest is T_{n+1} where

$$\boldsymbol{T_{n+1} = cT_n}$$

At the start of 2014 the number of trees in the forest was 25000.
At the start of 2016 the number of trees in the forest was 20250.

Find the value of the constant c.

c=..... **(3)**

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Best Guess Mastery Worksheet (Target Grade 7/8)

Challenge 1

At the start of year n, the number of insects in a colony is I_n.

The population satisfies the recurrence relation

$$\boldsymbol{I_{n+1} = kI_n}$$

At the start of 2015 the population was 15000.

At the start of 2018 the population was 10935.

Find the value of the constant k.

$k=$..... **(3)**

Challenge 2

At the start of year n, the bacteria count in a sample is S_n.

The bacteria count satisfies the recurrence relation

$$\boldsymbol{S_{n+1} = xS_n}$$

At the start of 2013 the count was 50000.

At the start of 2016 the count was 36450.

Work out the bacteria count at the start of 2018 (give your answer to the nearest whole number).

..... **(4)**

Answers & Worked Solutions

I Do:

1. From 2018 to 2020 is 2 years, so $P_{2020} = k^2 P_{2018}$.
2. $4050 = k^2 \times 5000 \rightarrow k^2 = 4050 \div 5000 = 0.81$.
3. $k = \sqrt{0.81} =$ **0.9** (since population decays).

We Do:

1. From 2016 to 2018 is 2 years, so $B_{2018} = r^2 B_{2016}$.
2. $6480 = r^2 \times 8000 \rightarrow r^2 = 6480 \div 8000 = 0.81$.
3. $r = \sqrt{0.81} =$ **0.9**.

You Do 1:

1. From 2015 to 2017 is 2 years, so $F_{2017} = m^2 F_{2015}$.
2. $9720 = m^2 \times 12000 \rightarrow m^2 = 9720 \div 12000 = 0.81$.
3. $m = \sqrt{0.81} =$ **0.9**.

You Do 2:

1. From 2014 to 2016 is 2 years, so $T_{2016} = c^2 T_{2014}$.
2. $20250 = c^2 \times 25000 \rightarrow c^2 = 20250 \div 25000 = 0.81$.
3. $c = \sqrt{0.81} =$ **0.9**.

Challenge 1:

1. From 2015 to 2018 there are 3 yearly multiplications.
2. $10935 = 15000 \times k^3$, so $k^3 = 10935 \div 15000 = 0.729$.
3. $k = \sqrt[3]{0.729} = 0.9$.

Challenge 2:

1. From 2013 to 2016 there are 3 yearly multiplications.
2. $36450 = 50000 \times x^3$, so $x^3 = 36450 \div 50000 = 0.729$.
3. $x = \sqrt[3]{0.729} = 0.9$.
4. From 2016 to 2018: $36450 \times 0.9^2 = 29524.5$.
5. To the nearest whole number, the population is 29525.