10. The population of rabbits, $R(t)$, and the population of foxes, $F(t)$, in a given region are modelled by the functions $R(t) = 10000 + 5000\cos(15°t)$ and $F(t) = 1000 + 500\sin(15°t)$, where t is the time in months. Referring to each graph, explain how the number of rabbits and the number of foxes are related.

① k-values are the same, $k = 15°$

$$\text{period} = \frac{360°}{k}$$

$$= \frac{360°}{15°}$$

$$= 24$$

Since t is measured in months, the population of rabbits and foxes repeats over a 24 month cycle.

② Comparing q-values, the average population of rabbits is 10 000 and foxes is 1000
(more prey than predators makes sense).

③ Comparing a-values, the population changes by a large amount:

rabbits : $a = 5000$　　　　foxes : $a = 500$

　　　　max $= 15000$　　　　　　max $= 1500$

　　　　min $= 5000$　　　　　　　min $= 500$

④ Rabbit population is a + cosine function, while foxes are a + sine.

max at 0.

min at 12 months, many rabbits eaten!

max at 6 months

min at 18 months, foxes starving!

→ changes in rabbit population result in a time-delayed change in foxes