A period 2 fixed point is obtained when \( F_a \) becomes unstable i.e. for \( a = 3 \)

due to

\[
F_a^2 = a (a x (1-x) - a (a x (1-x)))^2 = a (a x (1-x) (1-ax (1-x))
\]

\[
F_a^2(x) = x \Rightarrow x = a^2 x (1-x) (1-ax (1-x))
\]

\[
= 0 \text{ or } 1 = a^2 (1-x) (1-ax (1-x))
\]

\[
x = 1 - \frac{1}{a} \text{ is a fixed point and therefore a solution}
\]

\[
a^2 (1-x) (1-ax (1-x)) - 1 = (x - 1 + \frac{1}{a}) P_2(x)
\]

\[
P_2(x) = (-a^3 x^2 + a^2 (1+a)x - a(1+a))
\]

\[
D = a^4 (1+a)^2 - 4 a^3 a (1+a)
\]

\[
= a^4 (1 + a^2 - 4 - 4a) = a^4 (a^2 - a - 3)
\]

\[
= a^4 (a+1)(a-3)
\]

We find solution for \( a > 3 \)

at \( a = 3 \) a period 2 orbit appears. This is called period doubling.

When \( F_a^2 \) becomes unstable, a 2nd period doubling occurs.