1 Calculate the degree exponent, and its dependence on the parameter a.

Rate of change for the nodes

$$m\frac{ak_a}{a\sum_{k_a} k_a + \sum_{k_1} k_1}$$
$$m\frac{k_1}{a\sum_{k_a} k_a + \sum_{k_1} k_1}$$

We know that

$$\sum_{k_a} k_a + \sum_{k_1} k_1 = 2mt$$

We substitute this into the rate of change

$$m\frac{ak_a}{2mt} = \frac{ak_a}{2t}$$
$$m\frac{k_1}{2mt} = \frac{k_1}{2t}$$

After differentiating, we get

$$k_a \propto t^{\frac{a}{2}}$$
$$k_1 \propto t^{\frac{1}{2}}$$

When we integrate, we find that the degree exponent is

$$1 + \frac{1}{a}$$

2 Calculate the stationary degree distribution of the network.

We use our calculations from the previous section to find the stationary degree distribution of the network.

$$P(k) = \frac{1}{2}k^{-(1+\frac{1}{a})} + \frac{1}{2}k^{-3}$$