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Problem 5-1: Role of Preferential Attachment

1

$$\frac{dk_i}{dt} \approx m\Pi k_i \approx m \cdot \frac{1}{m_0 + k - 1} = \frac{m}{m_0 + t - 1} \tag{5.12}$$

2

$$K_i(t) = m\left[1 + \log\left(\frac{m_0 + t - 1}{m_0 + t_i - 1}\right)\right]$$

3

$$m\left[1 + \log \frac{m_0 + t - 1}{m_0 + 1 - m_0 + (m_0 + t - 1)\exp\left(1 - \frac{k}{m}\right)}\right]$$

$$= m\left[1 + \log(m_0 + t - 1) - \log(m_0 + t - 1)\exp\left(1 - \frac{k}{m}\right)\right]$$

$$= m\left[1 + \log(m_0 + t - 1) - (\log m_0 + t - 1) - \log\left(\exp\left(1 - \frac{k}{m}\right)\right)\right]$$

$$= m\left[1 - 1 + \frac{k}{m}\right]$$

$$= k$$

4

$$P(k) = 1 - \exp\left(1 - \frac{k}{m}\right)$$

5

$$P(k) = \frac{dP(k)}{dk} = \frac{e^{1-\frac{k}{m}}}{m}$$

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Problem 5-2: Friendship Paradox

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Problem 5-3: Barabási-Albert Model