

Exponential Growth

population of bacteria is known to increase in size by 50% every 2 hours. There are 2000 bacteria in the population at 12 noon

i) the constant of proportionality correct to four decimal places

$$k=0.5 \quad t=2 \quad a=2000 : a=2000e^{kt} : 3000=2000e^{2(k)} : k=0.2027$$

ii) the time when population will reach 8000

$$a=2000e^{0.2027t} : 8000=2000e^{0.2027t} : t=6.84 : \text{after 12 pm}$$

Binomial Distribution

$$E(X) = np$$

$$\text{Var}(X) = npq$$

Binomial

Binomial experiment has 7 trials. prob. of successes is 0.4. what is the probability that:

$$X=3$$

$$0.2903 \text{ (BinPDF)}$$

X is at least 3

$$0.58009 \text{ (BinCDF)}$$

X is more than 5

$$(\text{go from } 5.5) = 0.018842$$

Rate of Change

ROC is modelled by $d/dx = -x^2 + e^{0.4x}$, where A is the area, x is the time- days from June 1st. on june 1st there was 6000m infested

i) the ROC in area on June 5th. ie when $x=4$

$$-(4)^2 + e^{0.4(4)} = -11.047 : 11 \text{ m/sq}$$

ii) the date when ROC is a minimum

$$f(x) = 2x + 0.4e^{0.4x} \text{ solve: } x=9.7 = 10 \text{th June}$$

iii) what is the total change in area infested between June 1st and June 12th inclusive

$$\text{integral from 0 to 12 of } -x^2 + e^{0.4x} = -274.7 \text{ thus decreases by } 275 \text{ m/sq}$$

iv) what is the total area infested by end of june 15th

$$6000 + \text{integral from 0 to 15 of } -x^2 + e^{0.4x} = 5881.1 \text{ m/sq}$$



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