BJSDR

late
11-5
①

broadcast info
human memory
} → learning curve

disease
word-of-mouth
} → logistic curve

$$P(t) = M(1 - e^{-kt})$$

$$\%(t) = \frac{P(t)}{M} = 1 - e^{-kt}$$

So... if population of big city is under a hurricane watch and @ 8:00 am radio/TV begin saturation coverage, and we know by 10:00 am 20% of population has been informed, when will 80% of population have heard?

$y_0(2) = .20$

$1 - e^{-kt} = .2$

$.8 = e^{-kt}$

take ln's $\quad -.223 = -kt = -2k$

$k = .112$

$y_0(t) = 1 - e^{-.112t}$ ✓

$.8 = 1 - e^{-.112t}$?

$e^{-.112t} = .2$

$-.112t = -1.609$

$t = 14.4$ hrs

So by 10:30 pm 80% know

(3)

An actor knows 30% of a script after 5 days. When should he know 90%?

Use data point:

$$.3 = 1 - e^{-5k}$$

$$.7 = e^{-5k}$$

take ln:

$$-0.357 = -5k$$

$$k = .0713$$

$$\%(t) = 1 - e^{-.0713t}$$

$$.9 = 1 - e^{-.0713t}$$

$$.1 = e^{-.0713t}$$

$$-2.302 = -.0713t$$

32.3 days (from t=0)

(4)

$$P(t) = \frac{M}{1 + Be^{-Mkt}}$$

If 2 people start rumor in class of 50 people and in 2 hours 10 people know, when will 25 people know.

$$2 = \frac{50}{1+B}$$

$$2(1+B) = 50$$

$$2 + 2B = 50 \rightarrow 24 = 13$$

$$P(t) = \frac{50}{1+24e^{-Mkt}}$$

$$P(2) = 10 = \frac{50}{1+24e^{-100k}}$$

(5)

$$10(1+24e^{-100k}) = 50$$

$$10 + 240e^{-100k} = 50$$

$$240e^{-100k} = 40$$

$$e^{-100k} = 0.1667 \quad \downarrow \ln$$

$$-100k = -1.792$$

$$\boxed{k = .0179}$$

$$P(t) = \frac{50}{1+24e^{-.895t}}$$

$$25 = \frac{50}{1+24e^{-.895t}}$$

$$.5(1+24e^{-.895t}) = 1$$

$$.5 + 12e^{-.895t} = 1$$

(6)

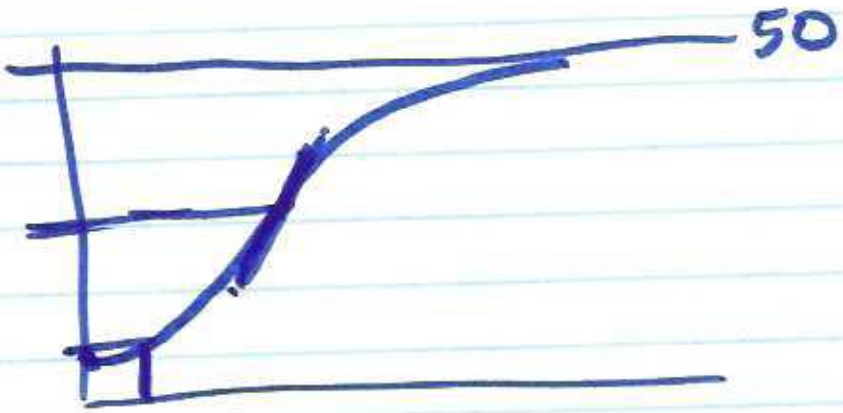
$\frac{.5}{12} = e^{-.845t}$

$.042 = e^{-.845t}$

$-3.178 = -.845t$

$t =$ ~~3.776~~ 3.55 hrs

15 gained into in ~~1.776~~ 1.55 hrs.



(2)

$$F = ma = m\frac{dv}{dt} = -kv.$$

s
l
v
l
a ← big
j ← small

$$\int \frac{dv}{v} = \int -\frac{k}{m}dt$$

$$\ln v = -\frac{k}{m}t + C$$

$$v = e^{-\frac{kt}{m}} \cdot e^{C}$$

If $v(0) = v_0$

So $v(t) = v_0 e^{-\frac{kt}{m}}$

$$\int e^{au}\,du \quad \frac{e^{au}}{a}$$

$$\int \frac{ds(t)}{dt}dt = \int v_0 e^{-\frac{kt}{m}}dt$$

$$s(t) = v_0 \frac{e^{-\frac{kt}{m}}}{-\frac{k}{m}} = + \frac{v_0 m}{k} e^{-\frac{kt}{m}}$$

Sequences & Series

→ $1, 2, 3, \cdots n, \cdots$

$a_0, a_1, a_2, a_3 \cdots a_n, \cdots$

$a_0 = 1$

$a_{n+1} = a_n + 1$

1) $1, \frac{1}{2}, \frac{1}{6}, \frac{1}{24}, \frac{1}{120}, \frac{1}{720}, \frac{1}{5040}, \cdots$

$a_0 = 1$

$a_n = \frac{1}{(n+1)!}$

2) $0, 3, 8, 15, 24, 35, 48, \cdots$

$1^2 - 1 = 0$

$2^2 - 1 = 3$

$3^2 - 1 = 8$

$0, -1, 4, -9, 16, -25, +36$

a_0, a_2, a_4 are +

$a_0 = 1$

$a_n = (\sqrt{3}+\sqrt{2})^n$ $\quad (a+b)^3 = a^3+3a^2b+3ab^2+b^3$

$1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \cdots \frac{1}{2^n}$

$\lim_{n\to\infty} \left(\frac{1}{2^n}\right)$ exists and is zero

$\left|\frac{1}{2^n} - 0\right| = \left|\frac{1}{2^n}\right|$ by picking n large enough

$\rightarrow \dfrac{0 < \frac{1}{2^n} < \varepsilon}{\frac{1}{2} < \sqrt[n]{\varepsilon}}$

$$s(t) = \frac{v_0 m}{k}\left(1 - e^{-\frac{kt}{m}}\right)$$

$$\lim_{t \to \infty} s(t) = \frac{v_0 m}{k} \quad \text{- am't of coast}$$

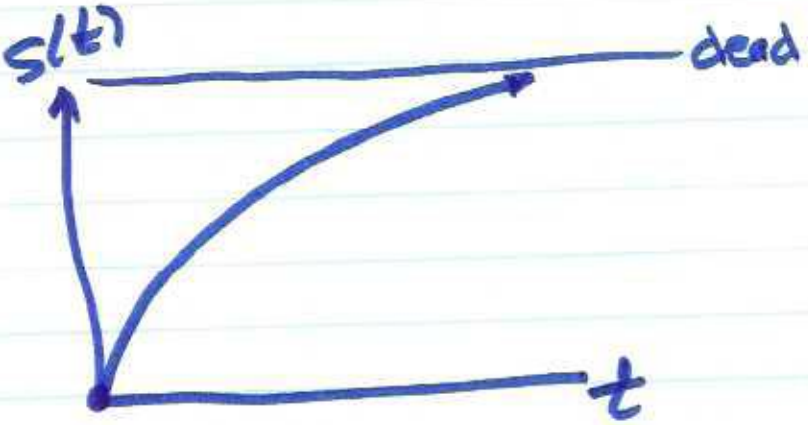
Problem: Iowa class battleship $m = 5.1 \times 10^7 \text{ kg}$

k for seawater is $59{,}000 \frac{\text{kg}}{\text{s}}$

If ship is doing 10 kn = $16.9 \frac{\text{m}}{\text{s}}$

Coast time is $\frac{(16.9)(5.1 \times 10^7)}{(5.9 \times 10^4)} = 14.6 \times 10^3$

~ 15 km



(11)

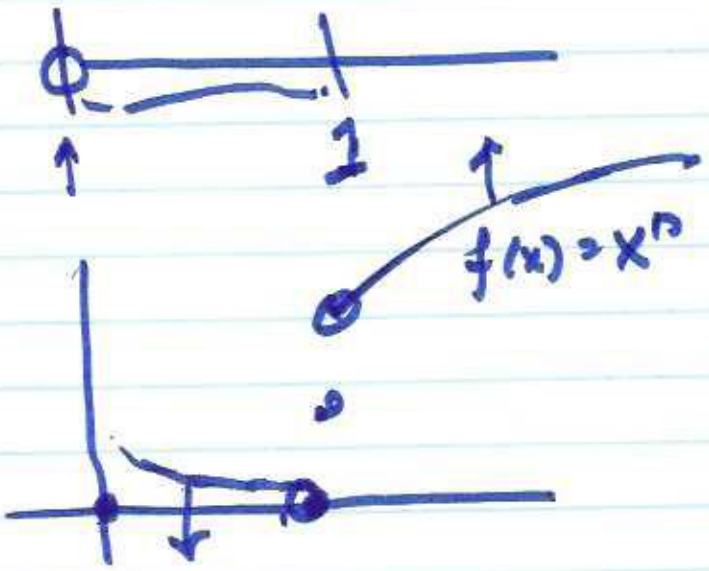
$a_n = \frac{1}{(\sqrt{3})^n}$

$0 < x < 1$

$\lim_{n \to \infty} x^n = 0$

$x = 1 \quad = 1$

$x > 1 \quad = \infty$



$y = x^n$