some general comments

Socratic questioning!

1. So that you can continue to solve the current problem yourself

2. So that you can copy the approach and supervise yourselves!

# Feedback on explaining

Simplify your explanation!

Step by step forward with clear direction

Confirm claims, arguments and designs with an experiment or simulation

Focus on the core issues - not avoid!

Present weak arguments cautiously

Avoid irrelevant information that clutters the argument

figures or tables are sometimes essential

…

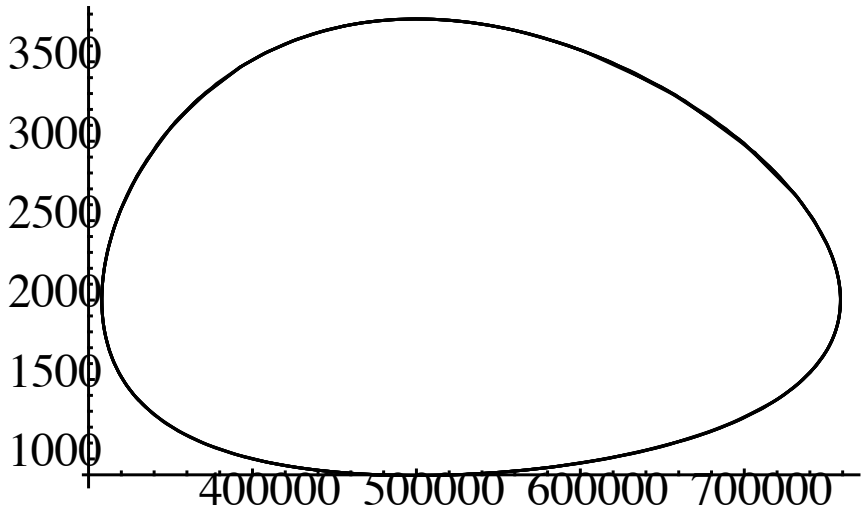
*Explaining is an important aspect of your reasoning ability and critical in all problem solving!*

line
function
curve
exponential function
polynomial function
…

equality
equivalence
equilibrium
equation
expression
…

*Be careful with concepts and terminology!*

The importance of trying things out!



# The importance of trying things out!

*This is about how to work!*

Clearly underestimated at the expense of specialised techniques

*Not at all like when you follow a given method!*

Not best for specific purposes, but most general and robust problem solving technique

It can be efficient, but only if you practice it to develop the skill!

*Especially important in early stages of problem solving!*


DT SWISS


MORAKNIV
MADE IN SWEDEN
CARBON STEEL
MORAKNIV

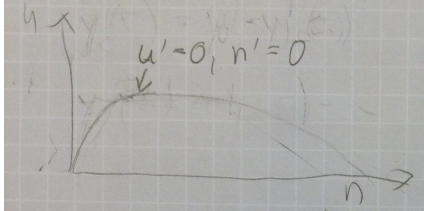
med lågt valbestånd. (När krill tar slut måste valarna dö av innan krillbeståndet återhämtar sig. Tills krillbeståndet växer fortare än valarna)

$y(0) = 0$

$y'(t) = max + y(t)$

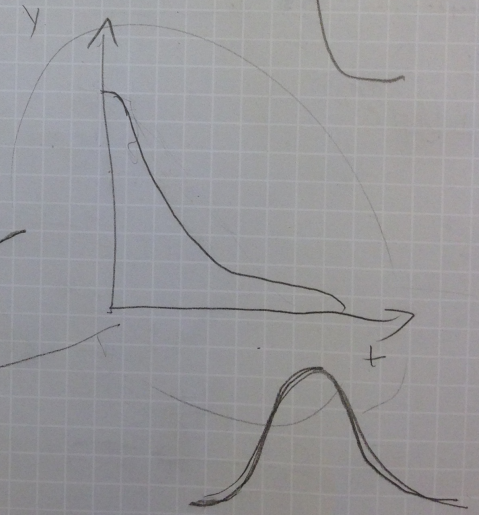
upptagning $u(t)$

nedbrytning $n(t)$




$u'(t) =$

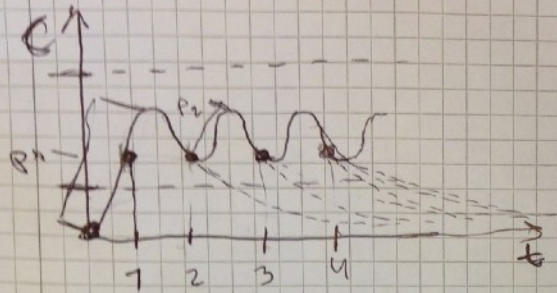
$y(t) = max - y(t)$



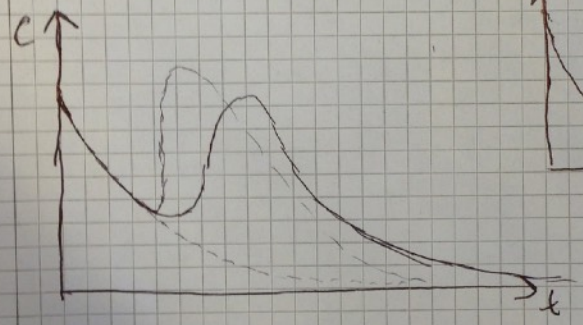

$y'(t) = -\frac{y(t)}{a}$

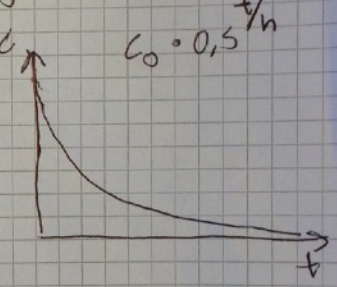
$u'(t) = \frac{y(t)}{b}$

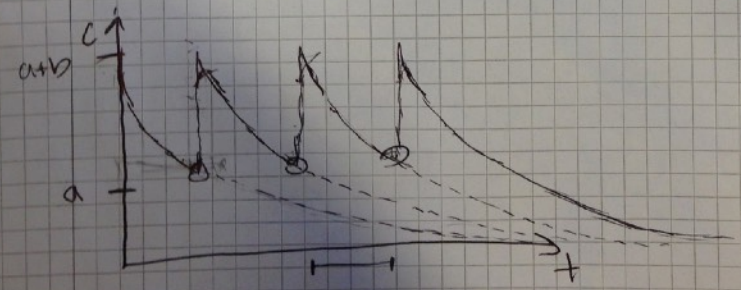
$n'(t) = n(t)(a-b)$




Interested in dose & time interval.
Depends on accepted low & high,
half-life of the substance



$$\left(\left(\left(\left(D\left(\tfrac{1}{2}\right)^{t/h} + D\right)\tfrac{1}{2}^{t/h}\right) + D\right)\left(\tfrac{1}{2}\right)^{t/h}\right)\left(\tfrac{1}{2}\right)^{t/h}$$

$$D\cdot\tfrac{1}{2}^{nt/h} + D\cdot\tfrac{1}{2}^{(n-1)t/h} + D\cdot\tfrac{1}{2}^{(n-2)t/h} + D\cdot\tfrac{1}{2}^{(n-3)t/h} + \cdots + D\cdot\tfrac{1}{2}^{t/h} = D$$

$$\tfrac{1}{2}^{nt/h} + \tfrac{1}{2}^{(n-1)t/h} + \cdots + \tfrac{1}{2}^{t/h} = 1$$

$$\frac{1}{2^{nt/h}} + \frac{1}{2^{(n-1)t/h}} + \cdots + \frac{1}{2^{1\cdot t/h}} = 1$$

$$\left(D\cdot\underbrace{\left(\tfrac{1}{2}^{n} + \tfrac{1}{2}^{n-1} + \tfrac{1}{2}^{n-2} + \tfrac{1}{2}^{n-3} + \cdots + \tfrac{1}{2}^{2} + \tfrac{1}{2}^{1}\right)}_{M}\right)^{t/h} = D$$

$$D^{t/h}\cdot M^{t/h} = D$$

Vi använder sprutor för att administrera dosen så upptagningen blir direkt.

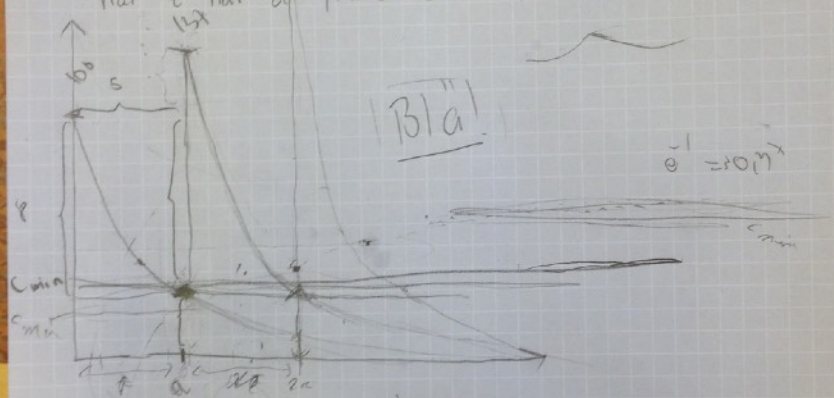
nedbrytning i kroppen $\Rightarrow y(t)$

$$y'(t) = \frac{-y(t)}{a} \Rightarrow y'(t) = -y(t) \cdot \frac{1}{a}$$

$\rightarrow \alpha$ alive

$$\Rightarrow y(t) = C_1 e^{-\frac{t}{a}} \quad \text{sätt} = 1 \Rightarrow 0{,}37^{-1} \cdot C$$

när t når a finns ≈ 37% kvar av dosen




$(1 + e^{-ta})$

$1: C_1 \frac{1}{e^{t+a}}$

$2: C_2 e^{-\frac{t+a}{a}} + C_2 e^{-t/a} = y(t+a) + y(t)$

$3: C_1 e^{-\frac{t+2a}{a}} + C_1 e^{-\frac{t+a}{a}} + C_1 e^{-t/a} \; C_1$

$\frac{1}{e^{t+a}}$

$\frac{1}{e^{\frac{t}{a}}}$

$$n: \sum_{i=0}^{n-1} y(t + i \cdot a) \Rightarrow C_{min}$$

$$\Rightarrow \frac{c \cdot e^{1 - \frac{t}{a}}}{e-1} \Rightarrow C_{min}$$

$((a+b)a+b)a+b$

$N_0 \left(\frac{1}{2}\right)^{\frac{t}{T}}$

$k' = \frac{-\ln(2)}{h} \cdot k$

aaaat baa a + baa + ba + b

$a^n + ba^{n-1} + b$

$t_0$ $t_{min}$

$K(t) = C = (max - min)$

$a^n + ba^{n-1} + ba^{n-2} + \dots + ba^1$ varda

$k[0]$

$t_i$

$3h = t_{min}$

$t_0$ $t_{zero}$

$t$ $K(t)$ $ce^{tran-}$

$K(t) \approx (max - min)\left(\frac{1}{2}\right)^{t/h} = (max - min)$

$K(t) = D \cdot \left(\frac{1}{2}\right)^{t/h}$

$K(t_{min}) \approx D \left(\frac{1}{2}\right)^{t_{min}/h}$, $n \cdot t_{min} \to \infty$

$n \cdot t_{min}$

$a^n + b^{n-1} + b^{n-2}$ lim $t \to \infty$ $+ b^{n-3}$ max $= b^{n-4}$ min $b^1$

$F = \frac{1}{s}e^{sx}$

$f(x) = e^{sx}$

$f'(x) = se^{sx}$

$((a+b)C+b)C$

$aC + bC + b$ min

$aCC + bCC + bC + b$

$aCCC + bCC + bC + b$

$\left(\left(D\left(\frac{1}{2}\right)^{t/h} + D\right)\frac{1}{2} + D\right)\left(\frac{1}{2}\right)^{t/h}$

$f(0) = 0$, $f(n) = (f(n-1) + D)\left(\frac{1}{2}\right)^{t/h}$ $D\left(\frac{1}{2}\right)$

Struggle and think!

Then I present my nice and simple solution,
but this is almost a deception!

# On independence in problem solving

# About your ability to think and work independently

It is good to ask, but…

"what is expected" =>
what makes sense to you?

make unclear
questions precise!

assumptions when
needed

"are we on the right track" =>
investigate broadly and learn
techniques to correct yourself

solve from scratch!

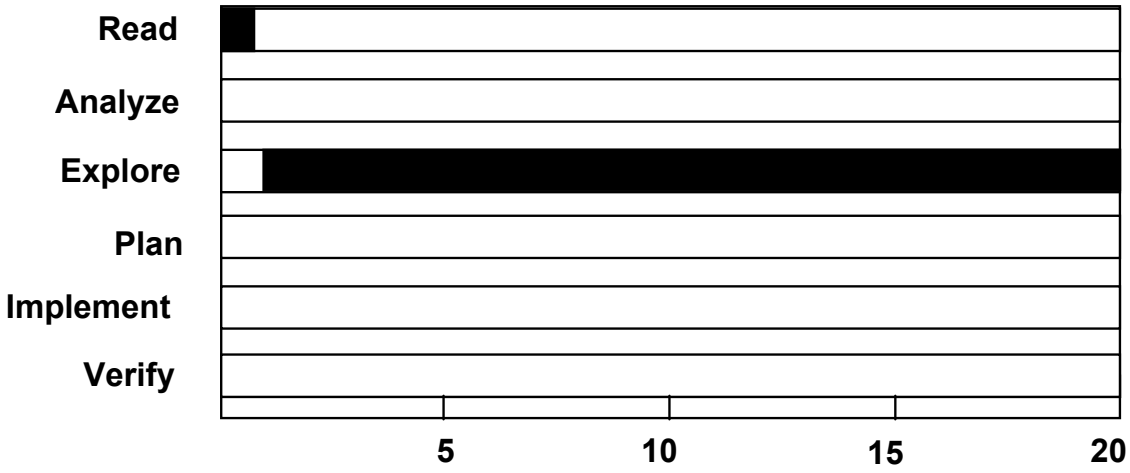
self-check + reflection

**generally take control of your own thinking!**

What is your metaphor for problem solving?

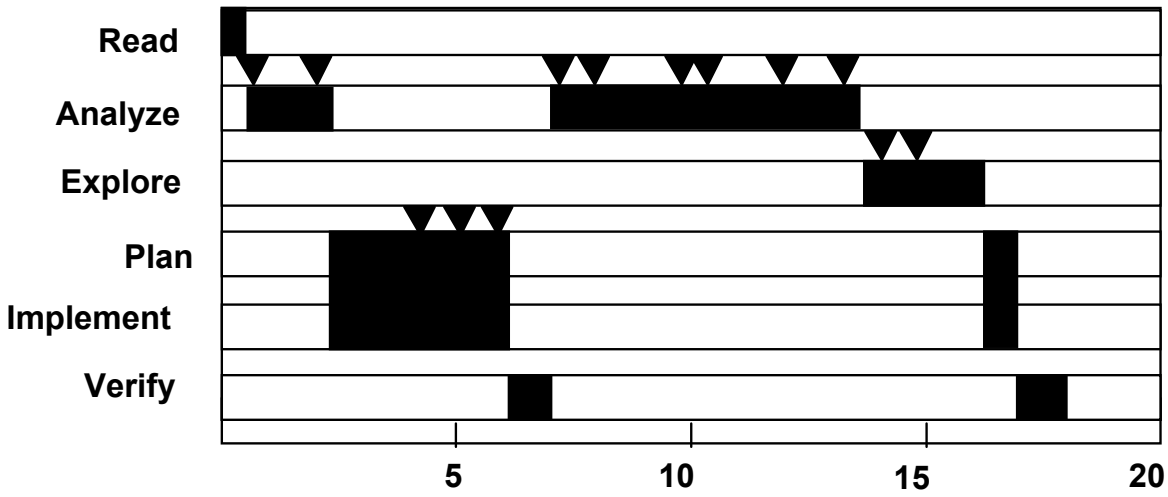
*"The breakthrough was to go from waiting for somebody to tell you something, to a discussion on possible approaches"*

It is simply not a natural situation to have all the information from the beginning, or to be told everything.



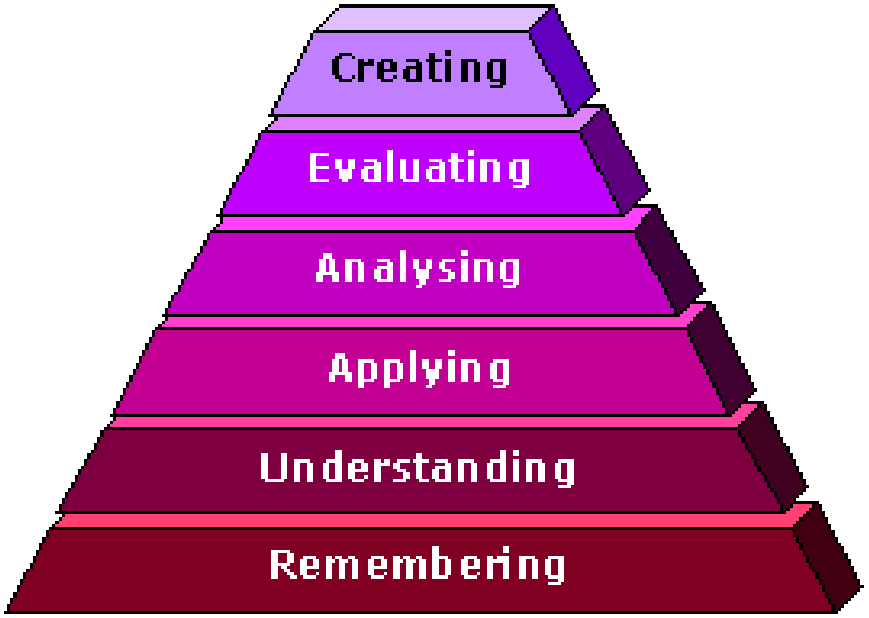

**Time-line graph of a typical student attempt to solve a non-standard problem.**

(Schoenfeld)




**Time-line graph of a mathematician working a difficult problem**

Bloom's taxonomy (1956, improved by Anderson et al 2001)




*We try to work upwards in this hierarchy*