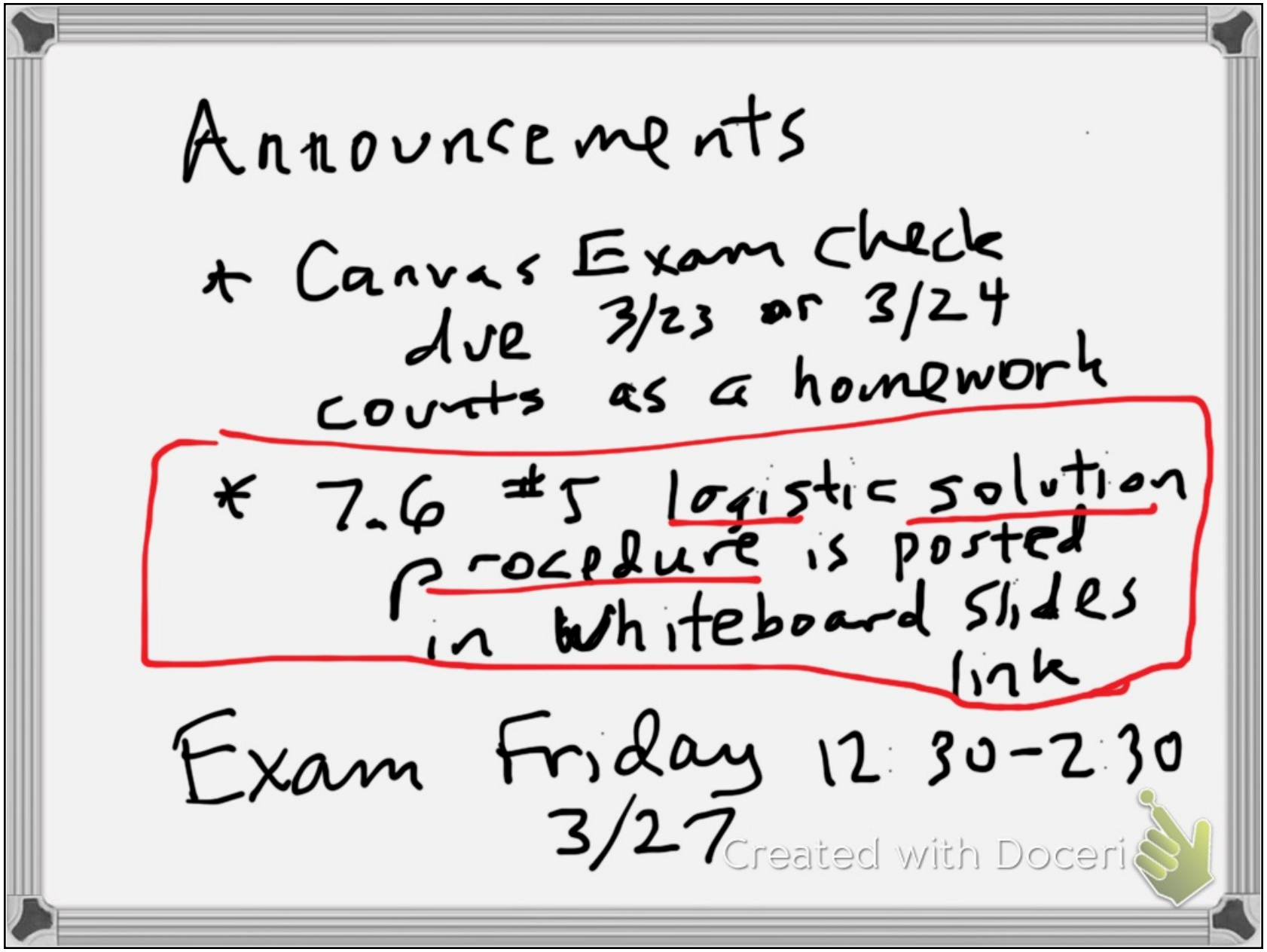
Announcements
+ Canvas Exam Check due 3/23 or 3/24 counts as a homework
* 7.6 #5 logistic solution procedure is posted in whiteboard slides link
Exam Friday 12:30-2:30 3/27
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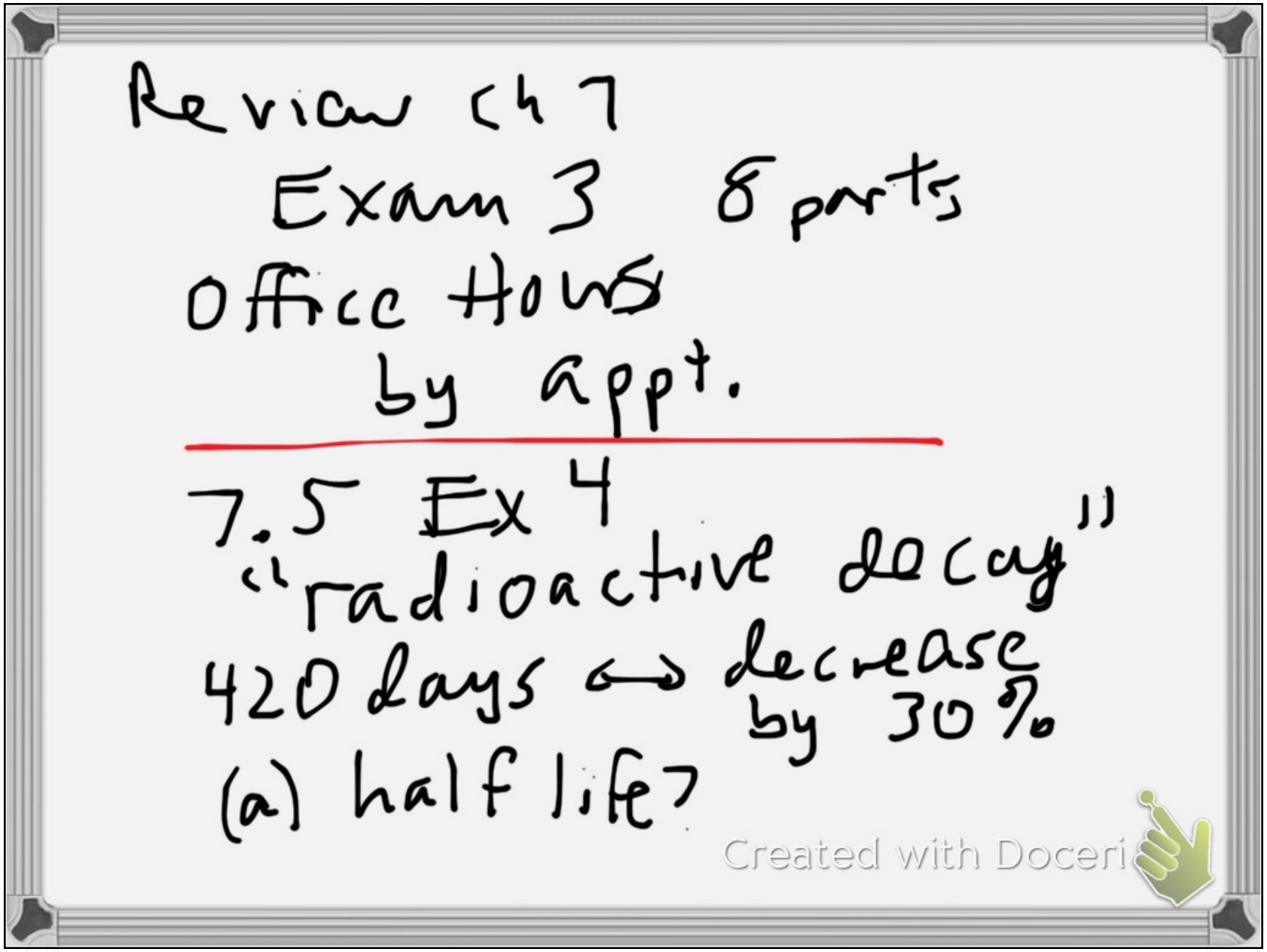
Review ch 7
Exam 3 8 parts
Office Hours
by appt.
7.5 Ex 4
"radioactive decay"
420 days ↔ decrease
by 30%
(a) half life?
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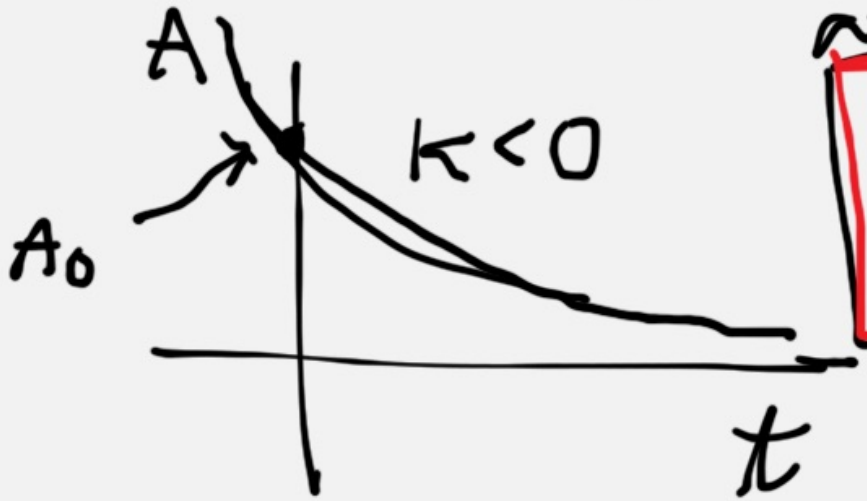
1. $A = A(t)$

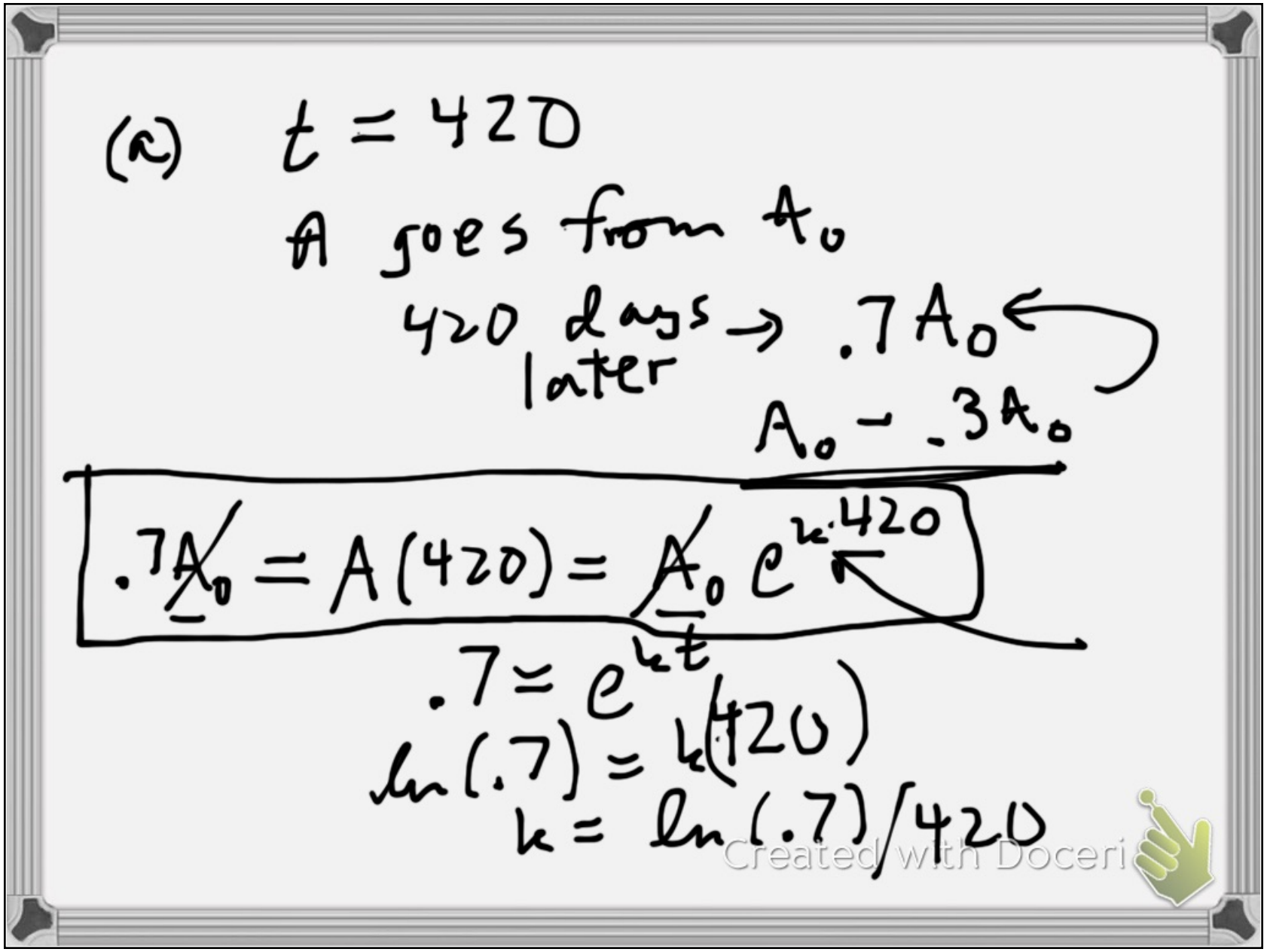
= amount (or mass) of material at time t



$$\frac{dA}{dt} = kA$$

$$A(t) = A_0 e^{kt}$$

$$A_0 = A(0)$$


(a) $t = 420$
A goes from A_0
420 days later $\rightarrow .7A_0$
$A_0 - .3A_0$
$.7A_0 = A(420) = A_0 e^{k \cdot 420}$
$.7 = e^{kt}$
$\ln(.7) = k(420)$
$k = \ln(.7)/420$
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(b)

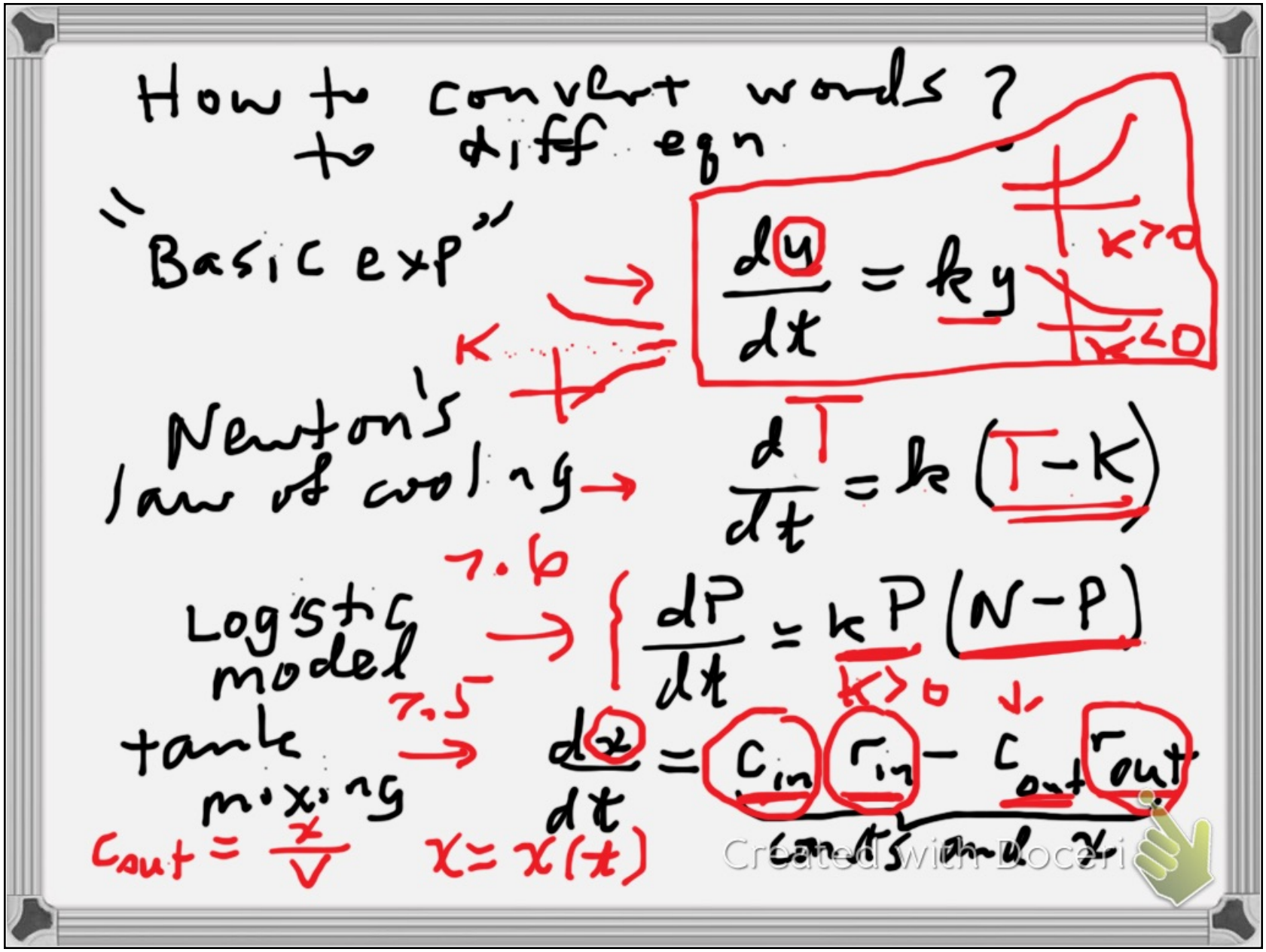
$$\frac{98}{} = \frac{100}{} e^{kt} \qquad t = ?$$

$k = \ln(.7)/420$

$$.98 = e^{\frac{\ln(.7)}{420} t}$$

$$\ln(.98) = \frac{\ln(.7)}{420} t$$

$$t = \frac{420 \ln(.98)}{\ln(.7)}$$


How to convert words ?
to diff eqn
"Basic exp"
$\frac{dy}{dt} = ky$
$k>0$
$k<0$
Newton's law of cooling
$\frac{dT}{dt} = k(T-K)$
7.6
Logistic model
$\frac{dP}{dt} = kP(N-P)$
$k>0$
7.5
tank mixing
$\frac{dx}{dt} = c_{in} r_{in} - c_{out} r_{out}$
$c_{out} = \frac{x}{V}$
$x = x(t)$
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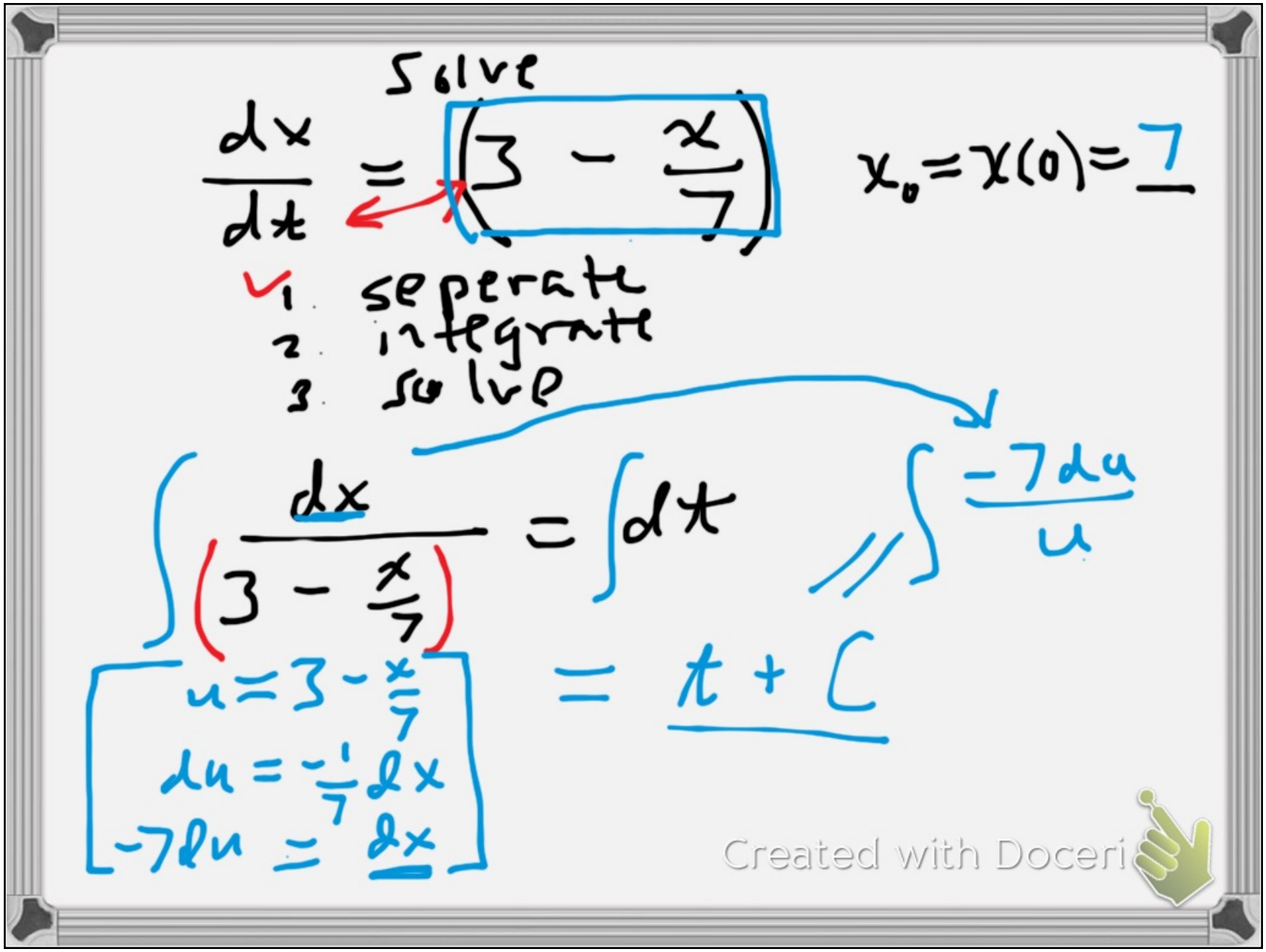
Solve
$\frac{dx}{dt} = \left(3 - \frac{x}{7}\right)$
$x_0 = x(0) = 7$
1 seperate
2 integrate
3 solve
$\int \frac{dx}{\left(3 - \frac{x}{7}\right)} = \int dt$
$\int \frac{-7\,du}{u}$
$u = 3 - \frac{x}{7}$
$du = -\frac{1}{7}dx$
$-7\,du = dx$
$= t + C$
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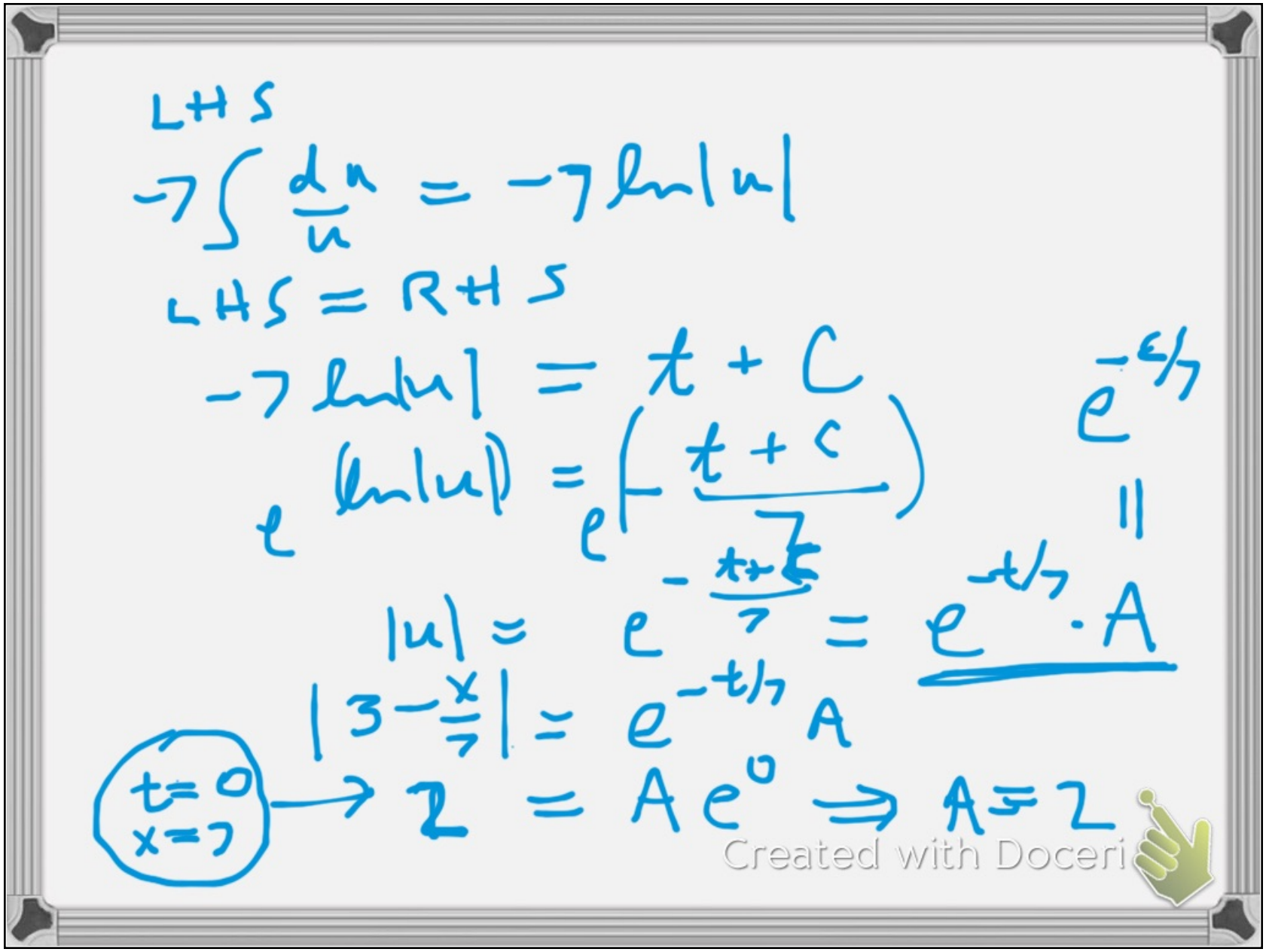
LHS
$-7\int \frac{dx}{u} = -7\ln|u|$
LHS = RHS
$-7\ln|u| = t + C$
$e^{\ln|u|} = e^{-\frac{t+C}{7}}$
$|u| = e^{-\frac{t+C}{7}} = e^{-t/7} \cdot A$
$|3 - \frac{x}{7}| = e^{-t/7} A$
$t=0$
$x=7$
$2 = Ae^0 \Rightarrow A = 2$
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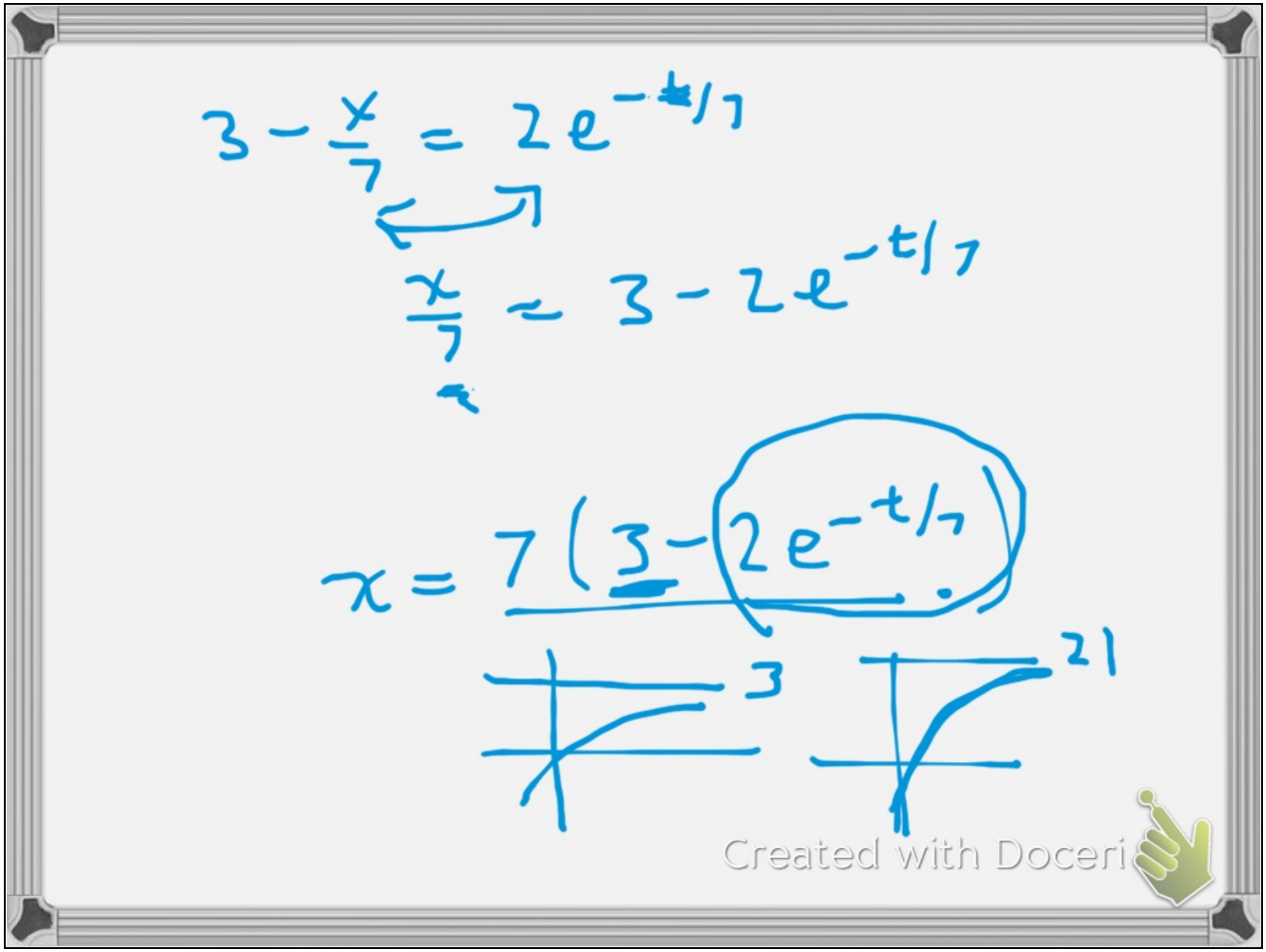
$3 - \frac{x}{7} = 2e^{-t/7}$
$\frac{x}{7} = 3 - 2e^{-t/7}$
$x = 7(3 - 2e^{-t/7})$
3
21
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