MATH	46 WORKSHEET:	Scaling & Non-dimensionalizing	F 3/30/07
Consider incoming.	a chemical reactor tank concentration of reactant ci.	with flow rate of , We stir the tank so o on, so (chemical) mass inside Inside the fank the reactant at rate k, ie rate of	ioncentration inside, c(t),
Write an	QDE expressing mass balance:	d (Vc(t)) = mass as	rival sate loss rate
	divide it by V:	is $c(0) = c_0$	
Reunite	ODE & IC using gener	al nondimensimalized E:	$=\frac{t}{t_c}, \ \overline{c}=\frac{C}{C_s}$
Choose	To assist in its chartered goal, mathematical scholmship and resear that atmosphere of mutual trust at prosper, the American Mathematical following guidelines. While it speal		
in 198 in the	$t_c = k^T$ and $c_c = c_i$ of $\delta := \frac{c_i}{c_0}$ and $\beta :=$	q (dimensionless proms).	se set forth guidelines lone Page
Instad Keep c	change to to the other to as before & rewrite ODE	inuscale derivable from original X	inal problem params.

) if in reality B<((what is the interpotation?) which of A or B is appropriate?

MATH 46 WORKSHEET: Scaling & F 3/30/07
Non-dimensionalizing
MATH 46 WORKSHEET: Scaling & F 3/30/07 Non-dimensimalizing SOLUTIONS.
Consider a chimical reactor tank with flow rate q, volume V,
Incoming concentration of reactant Ci. We stir the tale a contest of
is uniform, so (chemical) mass inside is Ve(t).
gci V Inside the fank the reactant decays mass inside
qci visite the fank the reaction decays at rate k, ie rate of loss of mass is kVCH
Write an ODE expressing mass balance: de (Vc(t)) = gc; - (ac + LVc)
civille it by V: $C = q(c, -1)$
- (0) = C
params in model
Rewrite ODE & IC using general nondimensionalized $E = \frac{t}{t_c}$, $E = \frac{C}{C_c}$ DE (Se $d = -\frac{c}{c_c}$)
$\int_{c}^{c} \int_{c}^{c} \frac{d\overline{z}}{dt} = \int_{c}^{c} \left(\frac{c!}{c_{i}} - \overline{z}\right) - kc_{i}\overline{z}$ $\int_{c}^{c} \int_{c}^{c} \frac{d\overline{z}}{dt} = \int_{c}^{c} \left(\frac{c!}{c_{i}} - \overline{z}\right) - kc_{i}\overline{z}$ $\int_{c}^{c} \int_{c}^{c} \frac{d\overline{z}}{dt} = \int_{c}^{c} \left(\frac{c!}{c_{i}} - \overline{z}\right) - kc_{i}\overline{z}$
$C_{c}(0) = C_{0}(0)$
Theose $t_c = k^{-1}$ and $c_c = c_i$, rewrite ODE a IC, expressing in terms of $\delta := \frac{c_i}{c_0}$ and $\beta := \frac{kV}{q}$ (dimensionless params).
terms of 8:= Ci and B:= KV (dimensionless params)
1/1 de -1/0 /
Kyi $d\bar{\epsilon}$ = K $d\bar{\epsilon}$ (1- $\bar{\epsilon}$) - Kef $\bar{\epsilon}$ is covered c ; and divide by $\bar{\epsilon}$ is $\int_{\bar{\epsilon}} d\bar{\epsilon} = \int_{\bar{\epsilon}} (1-\bar{\epsilon}) - \bar{\epsilon}$ Instant change to to the other timescale) derivable from original problem params. Keep c_{ϵ} as before & rewrite ODE & IC
ie $\begin{cases} \frac{dc}{dt} = \frac{1}{2}(1-z) - \overline{c} \end{cases}$
T+1 (= 1)
Instead change to to the other timescale derivable from original problem params.
resp ce as before as reumle with a se
$\frac{\cancel{\xi}_{i}}{\cancel{dt}} = \frac{1}{\cancel{\xi}_{i}}(1-z) - k\cancel{\xi}_{i}z$ is $\frac{\cancel{\xi}_{i}}{\cancel{\xi}_{i}} = 1-z-\beta z$
) if in reality B< 1 (what is the interpretation?) which of A or B) is appropriate? as a propriate? B = 0.