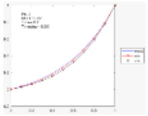
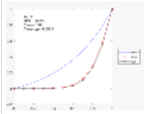
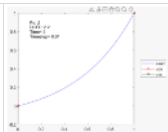
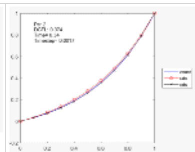
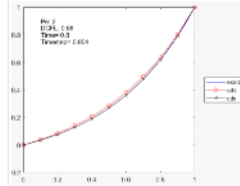
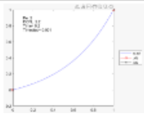
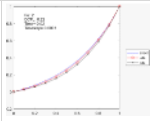
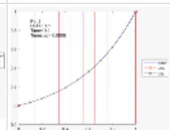
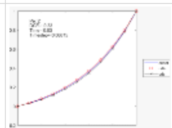
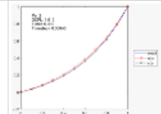
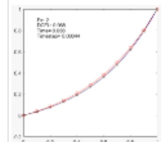
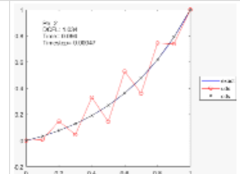
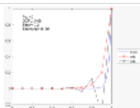
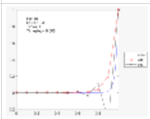
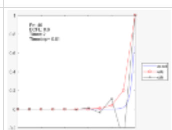
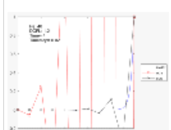
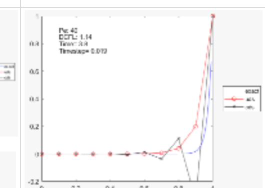
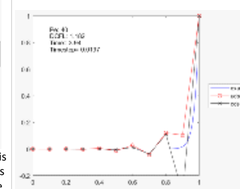
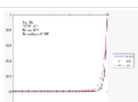
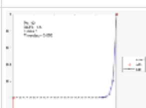
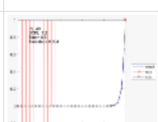
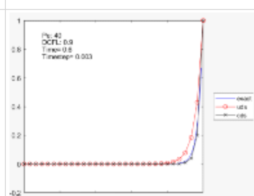
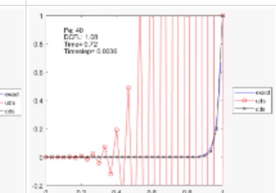
FDM

Saturday, January 16, 2021 11:06 PM

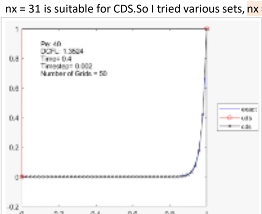
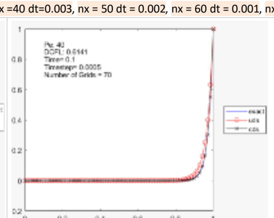
nx=11; Pe=2 with rho=1 kg/m³; u0=2 m/s; gamma=1 kg/ms;					 Time step from 0.0015 - 0.003 touching exact line. Timestep 0.006 not good, timestep 0.005 only cds touch line. 0.004, black line on exact	Time step limit:0.004 too big when 0.005(1st trial) Timestep limit: 0.0046 Too big when 0.0047(based on second graph set)
nx=11; Pe=2 with rho=1 kg/m³; u0=20 m/s; gamma=10 kg/ms;				 It gives about the same result as the first case if we change the timestep to *1/10 of the value.	  The graph looks more or less the same from timestep of 0.00040 onwards until....	 The limit of stability is at 0.00046, at 0.00047 it looks like this (Note: this should also be the same property for the previous case)
nx=11; Pe=40 with rho=1 kg/m³; u0=4 m/s; gamma=0.1 kg/ms;			 	 I tried from 0.011-0.019 since it looks like there is something in between 0.02 and 0.01. I based this off the previous where 0.0005, when you reduce the number it gets more stable.	With a higher significant figure it becomes even more unstable from 0.0197 onwards. 	Time step limit: 0.019 too big at 0.02
nx=31; Pe=40 with rho=1 kg/m³; u0=4 m/s; gamma=0.1 kg/ms;				 From 0.003 to 0.0035 it looks like this.	 0.0036 onwards its unstable.	Time step limit at 0.0035 too big at 0.0036

- How would you distribute the grid nodes for higher Peclet numbers?
  - Higher Peclet points affect the exact solution, So it's better for the grid nodes to be higher in order to find out the changes better. Because of higher grid nodes per spatial area, every little changes is able to be calculated more but this would increase the calculation time. [compare graph set 3 and graph set 4, at the curved area on the right, better approximation due to higher grid nodes.]

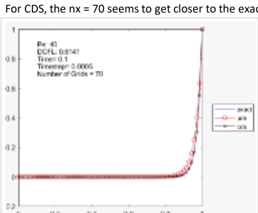
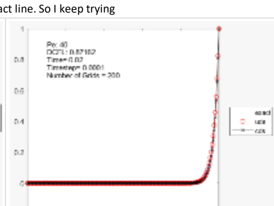
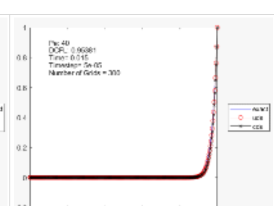
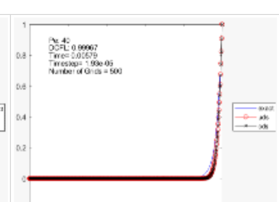
- Why is the stability limit at larger time step for CDS and at lower one for UDS?
  - CDS's (difference of x) is 2x bigger than the UDS (difference of x).With CDS, the grid points with which the gradient is formed are twice as far from each other as with UDS.

- Would you use a different initialization? For which Peclet numbers is this better?
  - No, all other values are known so the initialization for phi is a good choice. Phi's boundary conditions are also known.
  - The smaller the value the more linear the curve gets, so the only possible smallest value is pe=x, because that pe=x will give a linear graph. and the more linear the graph is, the easier to approximate it(because u know that the approximation equations we have been doing all this time is actually finding the gradient between two points, so if its just a straight line, its less complicated in a sense.) [Compare graph set 3 and graph set 4, you can see the graph set 3 with lower Pe is more linear than graphset 4 which has a higher Pe]

- Which spatial resolution gives a reasonable accurate solution for Pe=40 for UDS, and which one for CDS?
  - nx = 31 is suitable for CDS.So I tried various sets, nx =40 dt=0.003, nx = 50 dt = 0.002, nx = 60 dt = 0.001, nx = 70 dt = 0.0005, it seems unnecessary for it to have higher grid when the exact value is found for nx = 50 dt = 0.002

		nx = 50 dt = 0.002 is suitable. I based it off the DCFL value and how the CDS lies on the exact line

  - For CDS, the nx = 70 seems to get closer to the exact line. So I keep trying

	 Nx = 200 seems to get the UDS on line	 DCFL is close to 1	 Nx=500 with DCFL almost 1, but the uds is not touching.	Nx = 300 would be a suitable valu dt=0.0001 I based it off the DCFL value and how the CDS lies on the exact line