<u> Task 1:</u>

Part a)

1. For an estimate of the Reynold's number of the system, the velocity is inlet velocity, the density is 998.2, the dynamic viscosity is 0.001003 and the hydraulic diameter is the diameter of the cylinder (0.2 m).

The Reynold's number is thus 398.0857





Contours of Velocity Magnitude (m/s) (Time=3.6000e+03)

Nov 27, 2015 ANSYS Fluent 14.5 (2d, pbns, lam, transient)

Contour plot of Y-component of velocity



Contours of Y Velocity (m/s) (Time=3.6000e+03)

Nov 27, 2015 ANSYS Fluent 14.5 (2d, pbns, lam, transient)

Contour plot of static pressure



Contours of Static Pressure (pascal) (Time=3.6000e+03)

Nov 27, 2015 ANSYS Fluent 14.5 (2d, pbns, lam, transient)

3. Line plot of the X-component of velocity along the vertical line of x = 50 cm







Part b)

1. For an estimate of the Reynold's number of the system, the velocity is inlet velocity, the density is 1.225, the dynamic viscosity is 0.000017894 and the hydraulic diameter is the diameter of the cylinder (0.2 m).

The Reynold's number is thus 6845.87





Contour plot of Y-component of velocity



Contour plot of static pressure



3. Line plot of the X-component of velocity along the vertical line of x = 50 cm



Nov 18, 2015 ANSYS Fluent 14.5 (2d, pbns, ske, transient)

Line plot of the X-component of velocity along the vertical line of x = 150 cm



<u>Task 2:</u>

1. Contour plot of velocity magnitude



Contour plot of Y-component of velocity



Contour plot of static pressure

3.51e-03		ANSYS
3.14e-03		R14.5
2.77e-03		
2.40e-03		
2.038-03		
1.000-03		
9140-04		
5.438-04		
1.72e-04		
-1.99e-04		
-5.70e-04		
-9.41e-04		
-1.31e-03		
-1.68e-03		
-2.05e-03		
-2.42e-U3		
-2.80e-03		
-3.178-03		
-3.91e-03		
-0.316-03		
Contours of Static Pressure	(pascal) (Time=6.0000e+02)	Nov 27, 2015
		ANSYS Fluent 14.5 (2d, pbns, lam, transient)

2. Calculation of the lift that the fluid exert on the whole "half fish"

Forces - Direction Vector	(0 1 0) Forces (n)		
Zone	Pressure	Viscous	Total
edge1	-0.00024300523	-6.4963979e-06	-0.00024950162
edge2	1.3979685e-05	1.0474066e-05	2.445375e-05
edge3	1.3642593e-05	-7.808444e-07	1.2861749e-05
edge4	7.4824075e-06	3.3730973e-07	7.8197172e-06
edge5	0	3.9250193e-07	3.9250193e-07
Net	-0.00020790054	3.9266351e-06	-0.00020397391

edge1 is the bottom straight edge if the fish for which the pressure contribution is negative while the net pressure contribution for the remaining faces is positive (which are above the x-axis). Thus, the net force is exerted in negative y-direction. It is apparent from the pressure contour plot as well.

See the zoomed in static pressure plot for the same:



<u>Task 3:</u>

1. Mesh of the system



2. Contour plot of velocity magnitude on the x-y plane



Contour plot of pressure on x-y plane



X-component of velocity on the vertical plane (parallel to the y-z plane and with a circular cross section) at x = 25 cm.



<u> Task 4:</u>

1. Contour plot of the x-component of velocity at the inlet



2. Contour plot of velocity magnitude on the x-y plane



Nov 25, 2015 ANSYS Fluent Release 16.0 (3d, pbns, lam, transient)

Contour plot of pressure on the x-y plane

6.60e-03		ANSYS
6.70-00		
5./8e-03		Academic
5.37e-03		
4.97e-03		
4.56e-03		
4.15e-03		
3.74e-03		
3.33e-03		
2.92e-03		
2.51e-03		
2.10e-03		
1.69e-03		
1.28e-03		
8.73e-04		
4.64e-04		
5.50e-05		
-3.54e-04		
-7.63e-04		Ϋ́Υ Ϋ́Υ
-1.17e-03		Z X
-1.58e-03		••••
Contours of Static Pressure (pa	ascal) (Time=3.0000e+02)	Nov 25, 2015
		ANSYS Fluent Release 16.0 (3d, pbns, lam, transient)





UDF used:

```
#include "udf.h"
DEFINE_PROFILE(inlet_x_velocity, thread, position)
{
real x[ND_ND];
real y;
real z;
             /*For three dimensional profile*/
face_t f;
begin_f_loop(f, thread)
{
F_CENTROID(x,f,thread);
y = x[1];
z = x[2];
F_PROFILE(f, thread, position) = 0.004-0.004*y*y/(0.6*0.6)-0.004*z*z/(0.6*0.6); /*Additional z term for 3D*/
}
end_f_loop(f, thread)
}
```