Math 241 Project 1 **Due in Discussion on Tuesday 26 February 2013**

What to Submit:

For this project you will need to turn in a printout of what you typed into Matlab and the printouts of the plot windows for those questions asking you to plot.

For the eager: If you know how to publish an m-file you can put all the commands in the m-file and print out the published html document instead if you wish for +5 bonus points.

1. Clear Matlab completely with `clear all`.
2. Define the symbolic variables `x` and `t`.
3. Set `t` to be a real variable.
4. Add 10 and 17.
5. Factor the polynomial $x^5 - 3x^4 + x^3 + 5x^2 - 6x + 2$.
6. Solve the equation $x^2 + 4x - 1 = 0$.
7. Differentiate the function $f(x) = \frac{x^2}{x-1} + \cos(x^2)$.
8. Differentiate the function $f(x) = xe^{2x-1}$ and then plug in -1.
9. Integrate $f(x) = x^2 + x\cos(x)$.
10. Find the area under the graph of $f(x) = 9 - x^2$ and above the x-axis.
11. (a) Define the vectors $\bar{a} = 3\,\hat{\imath} + 2\,\hat{\jmath} - \hat{k}$ and $\bar{b} = \hat{\imath} + 3\,\hat{\jmath} + 2\,\hat{k}$.
    (b) Find the projection of $\bar{a}$ onto $\bar{b}$.
    (c) Find a unit vector perpendicular to both $\bar{a}$ and $\bar{b}$.
    (d) Find the sine of the angle between $\bar{a}$ and $\bar{b}$.
12. Define four points $P = (2, -1, 3)$, $Q = (0, 7, 9)$, $R = (4, -9, -3)$ and $S = (7, -6, -6)$ and then with two subtractions and one dot product all on one Matlab line show that the line through P and Q is perpendicular to the line through R and S.
13. Define two points $P = (1, -2, 3)$ and $Q = (2, -1, 3)$ and one vector $\bar{n} = 2\,\hat{\imath} + 2\,\hat{\jmath} + 3\,\hat{k}$ and then with one subtraction and one dot product all on one Matlab line show that Q is not contained in the plane containing P and normal to $\bar{n}$.
14. Define four points $P = (5, 0, 2)$, $Q = (1, 1, 1)$, $R = (0, 1, -2)$ and $S = (1, -2, -1)$ and then with five subtractions, two cross products and one dot product all on one Matlab line find the distance from S to plane containing the other three points.
15. (a) Define the vector valued function $\bar{r}(t) = \cos(t)\,\hat{\imath} + \cos(t)\,\hat{\jmath} + \sqrt{2}\sin(t)\,\hat{k}$.
    (b) Find the tangent vector $\bar{T}(t)$.
    (c) Find the acceleration vector $\bar{r}''(\pi/4)$.
16. Plot each of the following. For (b)-(e) make sure that you set the `view` as I did in the tutorial.
    (a) The function $f(x) = (x-2)^2(x-3)^2$.
    (b) The vector valued function $\bar{r}(t) = \sin(t)\,\hat{\imath} + t\,\hat{\jmath} + \cos(t)\,\hat{k}$ with $0 \le t \le 10\pi$.
    (c) The line segment joining $(1, -1, 0)$ and $(-5, 6, 10)$. Hint: What's the VVF?
    (d) The plane $x + y + 3z = 9$.
    (e) The plane $y + 4z = 10$.