Complex Systems Boot Camp

1) Sketch the polynomial functions:

a) $p(x) = x^2$ b) $p(x) = (x-2)^2$ c) $p(x) = (x+4)^2$

d) $p(x) = x^2 - 9$ e) $p(x) = \frac{1}{2}x^2$ f) $p(x) = 3(x-2)^2$

g) $p(x) = 3(x-2)^2 - 5$ h) $p(x) = -2x^2$ i) $p(x) = -x^2 + 5$

j) $p(x) = x^3 + x^2 - 6x$ k) $p(x) = (x+4)^3$ l) $p(x) = x - x^3$

2) Which of the graphs in the problem (1) have the same exact shape even though they lie in different locations of the coordinate plane.

3) Without graphing determine whether the polynomial $-2x^{10} + \pi x^7 - e x^2 + 6$ opens up or down.

4) Without graphing determine whether the polynomial $-2x^7 - x^2 + 6$ rises to left or right.

5) What are the roots of the polynomial: $\pi (x-e)^5 (x+3)^2 (4x-11) x$

6) Sketch the trigonometric functions:

a) $f(x) = -\sin x$ b) $f(x) = 2\sin x$ c) $f(x) = \frac{1}{2}\sin x$

d) $f(x) = \sin x \, (x - \frac{\pi}{4})$ e) $f(x) = \sin 2x$ f) $f(x) = \sin x \, (2x + \frac{\pi}{2})$

g) $f(x) = 3 + \sin x$

7) Find the amplitude, period, frequency and phase of $f(x) = \sqrt{26} \, \sin(\pi x + \frac{\pi^2}{3})$.

8) Describe how the graph of $f(x) = 6 \cos(\frac{1}{3} x + \frac{\pi}{9}) - 7$ can be obtained geometrically from the graph of the function $f(x) = \cos x$.

9) The graph of $f(x) = \pi \cos 7x$ is the same as the graph of: a) $\pi \sin(-7x)$ b) $\pi \cos(-7x)$

10) Sketch $f(x) = x + \sin x$

11) Sketch $f(x) = e^{2x}$.

12) Sketch $f(x) = 3 - e^x$.

13) Sketch $f(x) = \ln(x+2)$.

14) Describe how the graph of $f(x) = 2\sinh(x-3)$ can be obtained geometrically from the graph of the function $f(x) = \sinh x$.

15) Calculate   a) $\ln e^\pi$ b) $\ln 1$.