Short- and Long-Term Behavior

For each of the following functions, (a) sketch the "important" features of the graph, (b) locate any roots, if any, and (c) describe the long term behavior of the function. Be ready to answer the following two questions about each graph:

(1) What would you see if you were zoomed in at the origin?

(2) What would you see if you were on the moon looking back at the earth?

"Ribboning" functions (think about equations of graphs that would be upper and lower bounds)

1. A ribbon about a line - $f(x) = x + \sin x$

2. A ribbon about a curve - $f(x) = x^2 + \sin x$

3. Size matters - $f(x) = \sin x + \frac{1}{10}\cos(10x)$

Asymptotic behavior (vertical, horizontal, slant – are all asymptotes lines?)

1. $f(x) = 6x + \frac{1}{x} = \frac{6x^2 + 1}{x}$

2. $f(x) = \frac{x^3 - 3x}{x + 7}$

Local (and End) Behavior (exponential functions can mess you up – think about domain and range)

1. $f(x) = 2^{-\frac{1}{x^6}}$

2. $f(x) = \cos\left(2^{\sin x}\right)$

3. $f(x) = \sin\left(x + \frac{1}{x^2}\right)$

End Behavior (again, exponential functions can mess you up)

1. $f(x) = x^5 - 2x^4 - x^2 + 3x - 1.01^x$