Math 217 - October 4, 2010

- Complex roots
- Mechanical vibrations

1. Given the factorization, find the general solution to the differential equation.

$$r^3 - 3r^2 + 4r - 2 = (r-1)(r^2 - 2r + 2)$$
$$y''' - 3y'' + 4y' - 2y = 0$$

2. Given the factorization, find the general solution to the differential equation.

$$r^6 - 16r^5 + 165r^4 - 1060r^3 + 4360r^2 - 9688r + 10388$$
$$= (r^2 - 6r + 14)^2(r^2 - 4r + 53)$$
$$y^{(6)} - 16y^{(5)} + 165y^{(4)}1060y''' + 4360y'' - 9688y' + 10388y = 0$$

3. Find the Taylor series for the functions, centered at 0.
   (a) $e^x =$
   (b) $\cos x =$
   (c) $\sin x =$

Lecture Problems

4. Each of the differential equations below come from a mechanical spring situation. For each differential equation, determine the mass, the damping constant and the spring constant.
   (a) $x'' + 9x = 0$
   (b) $x'' + 4x' + 9x = 0$
   (c) $x'' + 6x' + 9x = 0$
   (d) $x'' + 10x' + 9x = 0$
   (e) $mx'' + cx' + kx = 0$

5. Determine the general solution for each of the differential equations:
   (a) $x'' + 9x = 0$
   (b) $x'' + 4x' + 9x = 0$
   (c) $x'' + 6x' + 9x = 0$
   (d) $x'' + 10x' + 9x = 0$
   (e) $mx'' + cx' + kx = 0$

6. Write each of the solutions below as $C\cos(\omega_0 t - \alpha)$ for some values of C, ω_0 and α.
   (a) $3\cos 5t + 3\sqrt{3}\sin 5t =$
   (b) $-2\cos 13t - 2\sqrt{3}\sin 13t =$
   (c) $13\cos 7t + 6\sin 7t =$
   (d) $13\cos 7t - 6\sin 7t =$
   (e) $-13\cos 7t + 6\sin 7t =$
   (f) $-13\cos 7t - 6\sin 7t =$