

Math 217 - October 4, 2010

Solutions

- 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) $3 \cos 5t + 3\sqrt{3} \sin 5t = 6 \cos(5t - \pi/3)$

(b) $-2 \cos 13t - 2\sqrt{3} \sin 13t = 4 \cos(13t - 4\pi/3)$

(c) $13 \cos 7t + 6 \sin 7t =$

(d) $13 \cos 7t - 6 \sin 7t =$

(e) $-13 \cos 7t + 6 \sin 7t =$

(f) $-13 \cos 7t - 6 \sin 7t =$