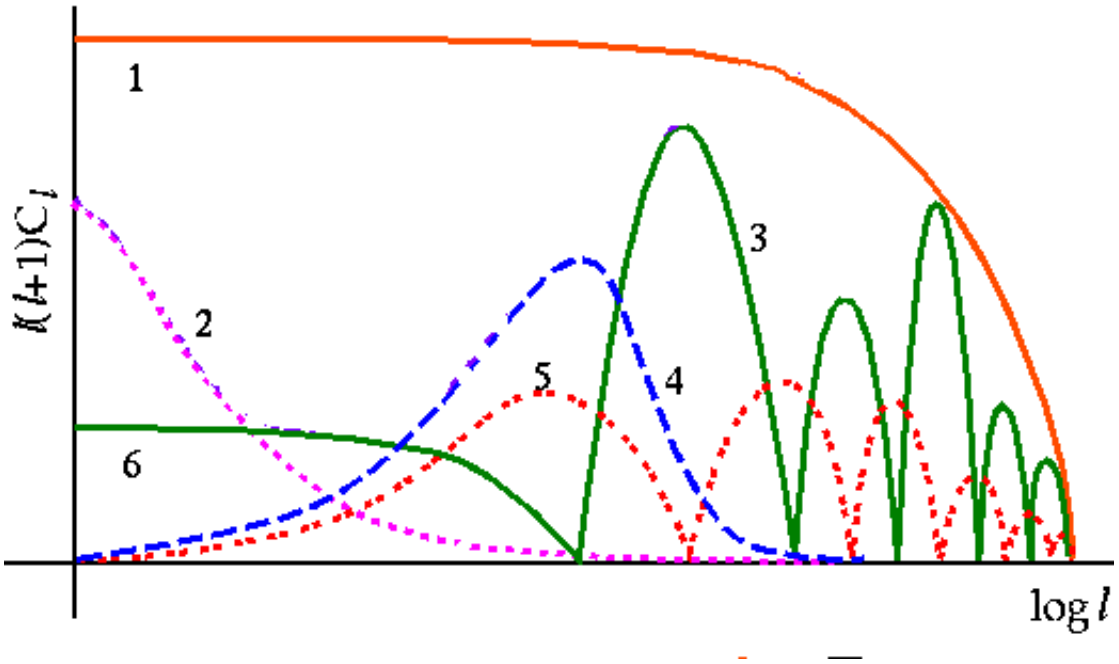
Homework 4:
(Due: 11/1/07)

1. Dodelson pg. 258 #8 (Obtain the correct functional form assuming there being no dark energy. The overall number only needs to match up to an order of magnitude.)

2. The figure below explicitly shows the various contributions to (or effects on) the temperature anisotropy spectrum in terms of $l(l+1)C_l$. Using the formulae discussed in class, justify (i.e. identify and discuss) each of the curves contributing to (or effecting) the spectrum. For example, curve labeled 2 corresponds to the envelope of the late time integrated Sachs-Wolfe effect while curve labeled 1 corresponds to a damping envelope (you still need to provide formulae for these).



3. Consider the differential equation

$$y'' + p(x)y' + q(x)y = 0$$

on the interval $a \leq x \leq b$. Suppose we know two solutions $y_1(x)$ and $y_2(x)$ such that

$$y_1(a) = 0 \qquad y_2(a) \neq 0$$
$$y_1(b) \neq 0 \qquad y_2(b) = 0$$

Give the solution of the equation

$$y'' + p(x)y' + q(x)y = f(x)$$

which obeys the conditions $y(a) = y(b) = 0$ in the form

$$y(x) = \int_a^b G(x, x')f(x')dx'$$

where $G(x, x')$ is the Green's function which involves only the solutions y_1 and y_2 and assumes different functional forms for $x' < x$ and $x' > x$. Illustrate by solving

$$y''(x) + k^2 y(x) = f(x)$$
$$y(a) = y(b) = 0$$

[hint: Since $G(x, x')$ satisfies

$$\partial_x^2 G(x, x') + p(x)\partial_x G(x, x') + q(x)G(x, x') = \delta(x - x')$$

by construction, integrate this equation to obtain conditions for $G(x, x')$.]