

1. (3 pts) What is the cosmological constant? Why did Einstein consider the introduction of the cosmological constant "the biggest blunder in my life"?

2. (4 pts) What is the expression for the deceleration parameter  $q$  in terms of the scale factor  $a$  of the universe? Starting from the Hubble equation  $d(a)/dt = H * a$  derive the equation  $[d(H)/dt] / H^2 = - (1 + q)$

3. (3 pts) Explore the site *hetdex.org* and discuss three basic techniques to probe the universe at different times.