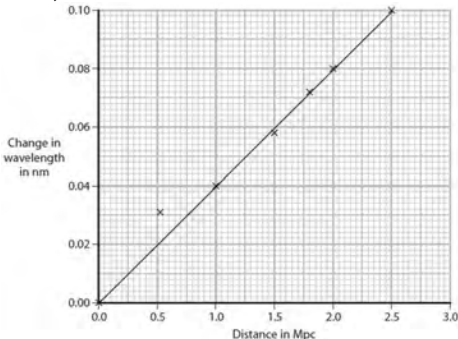


Question number	Answer	Notes	Marks
8 (a)	increase in wavelength (of wave); due to source/galaxy moving away (from observer)/eq;	allow decrease in frequency allow stretching wavelength allow observer moving away from source/galaxy	2 exp
(b) (i)	point at (0.5,0.03) identified;	reject if more than one point circled	1
(ii)	straight line drawn within 1 small square of each data point; 	allow ecf from (i)	1
(iii)	change in wavelength = 0.03 (nm); substitution OR rearrangement; evaluation; e.g. change in wavelength = 0.03 (nm) $0.03/660 = v/300\,000$ OR $v = \Delta\lambda/\lambda \times c$ (v =) 14 (km/s)	allow ecf from (ii) correct within ½ small square allow ecf from incorrect reading of $\Delta\lambda$ if clear from working -1 for POT error award if seen anywhere in working allow 13.6... (km/s)	3
(iv)	any two from: MP1. change in wavelength increases with distance (from Earth or Milky Way); MP2. idea that (recession) velocity increases with distance (from Earth or Milky Way); MP3. galaxies are all moving away from each other;	allow red-shift for change in wavelength	2

Total for Question 8 = 9 marks