(warning: some of the following words might not be familiar to you – don't panic!, this material will be covered in class this week)

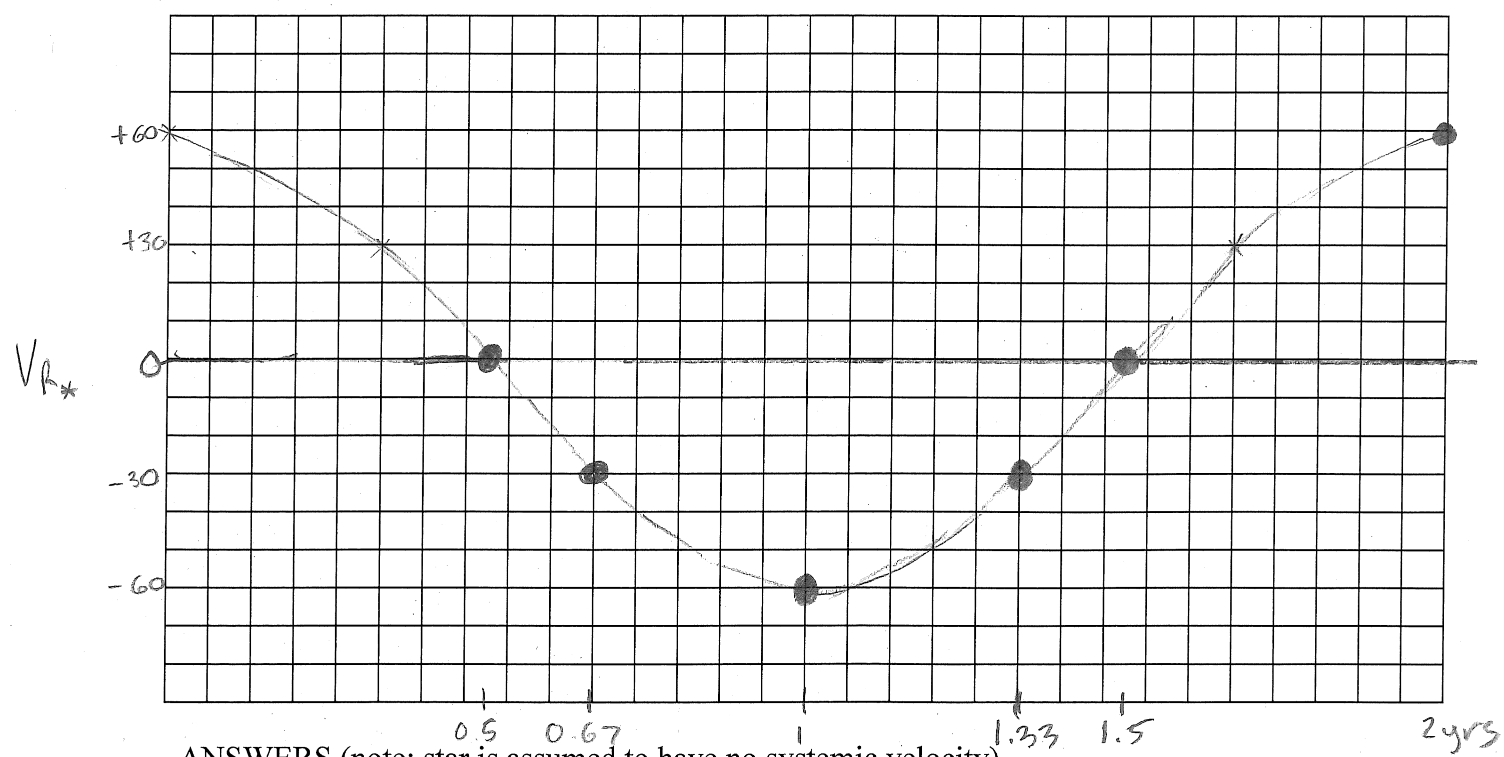
Over the past 2 years, Prof. Bailyn has taken spectrographic observations of the star 'Microscopium Ω' using a powerful telescope in Chile. This is a small star (only $0.25M_\odot$), which has a prominent spectral line at a wavelength of 6000 Å. He thinks that there might be a planet orbiting this star, because the spectral line changes wavelength between observations. He's too busy to fully analyze the data, however, and hands you the following chart (and some graph paper) with instructions to determine the **mass of the planet** orbiting this star.

The following equations might be helpful:

$a^3 = P^2M$ $\quad v = 2\pi a/P$ $\quad \Delta\lambda/\lambda_o = v/c$ $\quad v_*M_* = v_pM_p$

$c = 3x10^8$ m/s $\quad 1$ AU $= 1.5x10^{11}$ m $\quad 1$ yr $= 3x10^7$ seconds

Observation Date	Wavelength (Å)	Time (years)	Δλ	Velocity (m/s)
July 2, 2005	6000.0000	0.5	0	0
Aug 31, 2005	5999.9994	0.67	-0.0006	-30
Jan 1, 2006	5999.9988	1	-0.0012	-60
May 2, 2006	5999.9994	1.33	-0.0006	-30
Jan 1, 2007	6000.0012	2	+0.0012	+60



ANSWERS (note: star is assumed to have no systemic velocity)

$a = (P^2M)^{1/3} = (4*0.25)^{1/3} = 1$ AU

Vr (planet) $= 2\pi a/P = 2\pi 1.5x10^{11} / 2x3x10^7 = 15$ km/s

$M_p = M_* (v_*/v_p) = 2.5x10^{-1} (6x10^1/15x10^3) = 15/15x10^3 = 1x10^{-3} M_\odot$ = 1 Jupiter Mass Planet!!