$$= \begin{pmatrix} 1/6 \\ 5/6 \end{pmatrix} + \begin{pmatrix} 5/2 \\ 3/2 \end{pmatrix} = \begin{pmatrix} 8/3 \\ 7/3 \end{pmatrix}$$ (check, see opposite)

2/2

e) To find P'

$$P' = t(P) = \begin{pmatrix} 7/2 & 1/2 \\ -7/2 & 5/2 \end{pmatrix} \begin{pmatrix} 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 5/2 \\ 3/2 \end{pmatrix} = \begin{pmatrix} 5/2 \\ 3/2 \end{pmatrix}$$

$$\frac{A'X'}{X'P'} = \frac{|X'-A'|}{|P'-X'|} = \frac{|(8/3, 7/3) - (3, 4)|}{|(5/2, 3/2) - (8/3, 7/3)|} = \frac{|(-1/3, -5/3)|}{|(-1/6, -5/6)|} = \frac{\sqrt{(-1/3)^2 + (-5/3)^2}}{\sqrt{(-1/6)^2 + (-5/6)^2}} = 2$$

Hence X' divides the line $A'P'$ in the ratio 2:1

5/5

18/20

2) $C_1 : x^2 + y^2 - 3y = 0$

This circle passes through the origin, and therefore inversion in the unit circle turns this circle into a line

$C_1 : x^2 + (y - 3/2)^2 = (3/2)^2$

The radius of C_1 is 1.5, and C_1 passes through the origin, hence C_1 pierces the unit circle in two places. To find those points of intersection Put $x^2 + y^2 = 1$ into the equation for C_1.

$$x^2 + y^2 - 3y = 0$$

$$1 - 3y = 0 \Rightarrow y = 1/3$$

The inversion of C_1 turns it into the line $y = 1/3$ (since the points of intersection of the unit circle and C_1 are points on the line).

$C_2 : x^2 + y^2 + 3x/2 - y = 0$

equivalently $(x + 3/4)^2 + (y - 1/2)^2 = 13/16$

This circle too passes through the origin. It has centre $(-3/4, 1/2)$, radius $\sqrt{13}/4$, and since $|(3/4, 1/2)| + \sqrt{13}/4 = \sqrt{13}/2 > 1$, this circle too intersects with the unit circle, and inversion sends the points of intersection to points on the line. Put $x^2 + y^2 = 1$ into the equation for C_2

$$1 + 3x/2 - y = 0$$

$$y = 3x/2 + 1,$$