6. The circle C has equation

$$x^2 + y^2 - 6x + 10y + k = 0$$

where k is a constant.

(a) Find the coordinates of the centre of C.

(2)

Given that C does not cut or touch the x-axis,

(b) find the range of possible values for k.

(3)

$x^2+y^2-6x+10y+k=0$

$(x-3)^2-9+(y+5)^2-25+k=0$

So centre is at $(3,-5)$ and $r^2=34-k \Rightarrow r=\sqrt{(34-k)}$

(b) The (radius)^2 must be >0 So $34-k>0 \Rightarrow k<34$

Also the circle must not touch or cut the x axis so $r<$ the distance of the centre from the x axis (which is 5)

So $\sqrt{(34-k)}<5$

$34-k<25$

$k>9$

So the range for k is $9<k<34$.