Home task 2

A lens has an exit pupil radius of 10 mm and the image plane, in air, is 100 mm from the exit pupil. The lens suffers only form one aberration, coma, with $W_{131} = 2.5$ wavelengths.

a) Plot the wavefront aberration for pupil coordinates of $(-10 < X < 10,\, Y = 0)$ mm and $(-10 < Y < 10,\, X = 0)$.
b) Derive an expression for the transverse ray aberration for a ray which passes through the point (X, Y) in the exit pupil. Take $\eta = 1$.
c) Complete the table below for rays which pass through points around the circumference of a ring of radius 6 mm centered at the centre of the exit pupil.

(X, Y) (mm)	$(+6, 0)$	$(+\frac{6}{\sqrt{2}}, +\frac{6}{\sqrt{2}})$	$(0, +6)$	$(+\frac{6}{\sqrt{2}}, -\frac{6}{\sqrt{2}})$	$(-6, 0)$	$(-\frac{6}{\sqrt{2}}, -\frac{6}{\sqrt{2}})$	$(0, -6)$	$(-\frac{6}{\sqrt{2}}, +\frac{6}{\sqrt{2}})$
$TA_y = \epsilon_y$								
$TA_x = \epsilon_x$								

Plot your results on a spot diagram, where ϵ_y is plotted against ϵ_x. By inspection, fill out this ring of rays. On the same spot diagram, plot the transverse aberrations of rings of rays of radius 2, 4, 8, and 10 mm in the exit pupil. Mark the tangential coma and the sagittal coma on your spot diagram.