

*Questions 1 (parts a and b); 2 (parts a and b).*

## **1. Image Quality (F15 Final Q7)**

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A 200mm x 300mm monochrome monitor is to be viewed at a distance of 500mm. It's desired that the image quality match the resolution of the eye (angular resolution of the eye  $1 \text{ arc min} = \frac{1}{60} \text{ degrees}$ ). The image was captured on a 10mm x 15mm detector.

The camera is designed using the hyperfocal condition so that objects between 2m and infinity meet the above image quality or blur condition.

- a. What is the approximate resolution of the system in pixels (assume the blur size equals the pixel size)?
- b. What is the required  $f/\#$  for the imaging lens given that the focal length of the lens is approximately 15.8mm?

## 2. Reverse Telephoto Zoom Lens

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Design a two-element reverse telephoto zoom lens:

Focal length ranges                    30-80mm

Lens configuration                    Two-element zoom lens

Reverse-telephoto configuration (negative-positive)

Element focal lengths                 $f_1 = -50\text{mm}$ ,  $f_2 = +50\text{mm}$

Assume an object at infinity. Both elements are thin lenses in air.

- a. Provide the equations for the element separation and the back focal distance as a function of the system focal length.
- b. Plot the lens positions as a function of the system focal length (between 30mm and 80mm with at least a 10mm interval).