## COMPUTER SCIENCE TRIPOS Part IA – 2025 – Paper 3

## 3 Introduction to Graphics (fz261)

- (a) Explain what a pinhole camera model is (you may draw a diagram if needed), and what the camera origin in ray tracing corresponds to in the pinhole model. [2 marks]
- (b) Assuming a Phong shading model and no recursion for computing indirect illumination or shadows, what is the time complexity of a ray tracing algorithm and why? You should analyze it by considering the necessary loops and their structure. [5 marks]
- (c) Explain the shadow rays. What is the colour of a pixel if it is in shadow, assuming a Phong shading model and no recursion for computing indirect illumination?
  [3 marks]
- (d) In the Phong shading model, explain all circumstances where the specular and diffuse components can become zero. [4 marks]
- (e) How does the specular highlight differ from diffuse reflection in the Phong shading model? You do not need to write the formula. [2 marks]
- (f) In ray tracing, how would you compute an approximate full spectrum of colours instead of RGB values for each pixel? What is the time complexity in this case? [4 marks]