

Part IIA 2022

Module 3G4: Medical Imaging & 3D Computer Graphics

Numerical Answers

1. (b) (i) $n - 1$ rotations of $\Delta\theta$
(ii) $2R \sin(\phi/2)$
(iii) $k + n - 2$ rotations of $\Delta\theta$
2. (b) (i) $[0 \ 1 \ 0 \ 0]^t$, $\frac{1}{16}[-1 \ 9 \ 9 \ -1]^t$ and $[0 \ 0 \ 1 \ 0]^t$
(ii) $\frac{1}{6}[1 \ 4 \ 1 \ 0]^t$, $\frac{1}{48}[1 \ 23 \ 23 \ 1]^t$ and $\frac{1}{6}[0 \ 1 \ 4 \ 1]^t$
(iii) weights $[0 \ 1 \ 0 \ 0]^t$, $\frac{1}{2}[0 \ 1 \ 1 \ 0]^t$ and $[0 \ 0 \ 1 \ 0]^t$

$$\text{basis matrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$$

3. (d) (iii) $\sim 41\%$
4. (b) (i) 30°
(ii) $n = 2 \times 10^5 \text{ km}$, $f = 6 \times 10^5 \text{ km}$
(c) (i) moon $(0, 4/\sqrt{2}, -4/\sqrt{2}) \times 10^5 \text{ km}$, sun $(1.5/\sqrt{2}, 0, 1.5/\sqrt{2}) \times 10^8 \text{ km}$
(iii) 35.3°