3.

$$\mathbf{A} = \begin{pmatrix} 5k & k-3 \\ k+2 & k-1 \end{pmatrix}$$

where k is a constant.

Given that $\det \mathbf{A} = 5$

(a) determine the value of k

(3)

(b) Hence determine $\mathbf{A}^{-1}$, giving your answer in the form $\frac{1}{10}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

where a, b, c and d are integers to be found.

(2)

The transformation represented by $\mathbf{A}$ transforms the square S onto the square S'

Given that the sides of S have length 1.3

(c) determine the area of S'

(1)

The diagonals of S' intersect at the point $(-8, 6)$

(d) Determine, in simplest form, the coordinates of the point where the diagonals of S intersect.

(2)

(Total for Question 3 is 8 marks)

---

4. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

$$\mathrm{f}(x) = \frac{3}{2}x^3 - 6\sqrt{x} + \frac{1}{x} \qquad x > 0$$

(a) Determine $\mathrm{f}'(x)$

(2)

The equation $\mathrm{f}(x) = 0$ has a root α in the interval $[0.25, 0.35]$

(b) Using 0.25 as a first approximation to α, apply the Newton–Raphson process once to $\mathrm{f}(x)$ to determine a second approximation to α, giving your answer to 3 decimal places.

(2)

The equation $\mathrm{f}(x) = 0$ has a root β in the interval $[1.65, 1.7]$

(c) Use linear interpolation once on the interval $[1.65, 1.7]$ to determine an approximation to β, giving your answer to 3 decimal places.

(3)

(Total for Question 4 is 7 marks)