6.

$$\mathrm{f}(x) = \frac{ax + b}{x + 2}; \quad x \in \mathbb{R}, x \neq -2,$$

where a and b are constants and $b > 0$.

(a) Find $\mathrm{f}^{-1}(x)$.

(2)

(b) Hence, or otherwise, find the value of a so that $\mathrm{ff}(x) = x$.

(2)

The curve C has equation $y = \mathrm{f}(x)$ and $\mathrm{f}(x)$ satisfies $\mathrm{ff}(x) = x$.

(c) On separate axes sketch

(i) $y = \mathrm{f}(x)$,

(3)

(ii) $y = \mathrm{f}(x - 2) + 2$.

(3)

On each sketch you should indicate the equations of any asymptotes and the coordinates, in terms of b, of any intersections with the axes.

The normal to C at the point P has equation $y = 4x - 39$. The normal to C at the point Q has equation $y = 4x + k$, where k is a constant.

(d) By considering the images of the normals to C on the curve with equation $y = \mathrm{f}(x - 2) + 2$, or otherwise, find the value of k.

(5)