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

(a) Prove that

$$2\operatorname{cosec} 2A - \cot A \equiv \tan A \qquad A \neq \frac{n\pi}{2} \qquad n \in \mathbb{Z}$$

(4)

(b) Hence solve, for $0 \leqslant \theta \leqslant \frac{\pi}{2}$

(i) $2\operatorname{cosec} 4\theta - \cot 2\theta = \sqrt{3}$

(ii) $\tan\theta + \cot\theta = 5$

Give your answers to 3 significant figures.

(5)

(Total for Question 5 is 9 marks)

6.

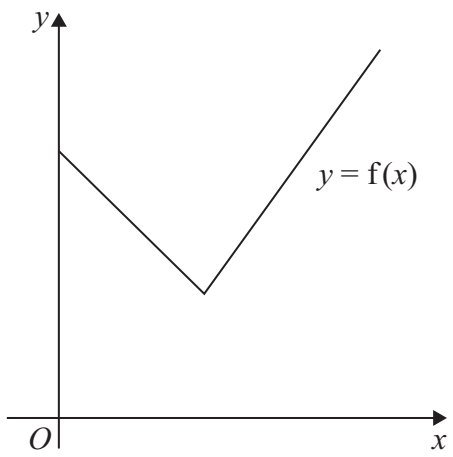


Figure 1

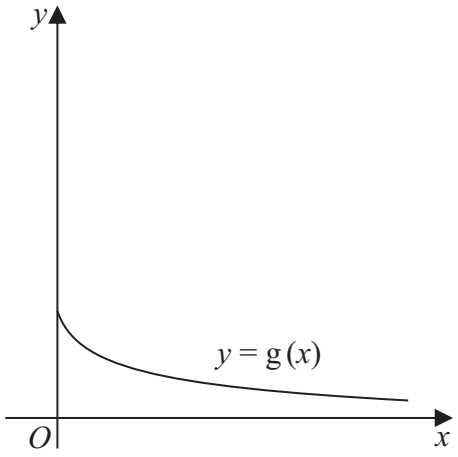


Figure 2

Figure 1 shows a sketch of part of the graph $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = 2|3 - x| + 5 \qquad x \geqslant 0$$

Figure 2 shows a sketch of part of the graph $y = \mathrm{g}(x)$, where

$$\mathrm{g}(x) = \frac{x+9}{2x+3} \qquad x \geqslant 0$$

(a) Find the value of $\mathrm{fg}(1)$

(2)

(b) State the range of g

(2)

(c) Find g^{-1}

(3)

Given that the equation $\mathrm{f}(x) = k$, where k is a constant, has exactly two roots,

(d) state the range of possible values of k.

(3)

(Total for Question 6 is 10 marks)