



The function  $f : x \mapsto p \sin^2 2x + q$  is defined for  $0 \leq x \leq \pi$ , where  $p$  and  $q$  are positive constants. The diagram shows the graph of  $y = f(x)$ .

- (i) In terms of  $p$  and  $q$ , state the range of  $f$ . [2]

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- (ii) State the number of solutions of the following equations.

- (a)  $f(x) = p + q$  [1]

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- (b)  $f(x) = q$  [1]

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- (c)  $f(x) = \frac{1}{2}p + q$  [1]

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**(iii)** For the case where  $p = 3$  and  $q = 2$ , solve the equation  $f(x) = 4$ , showing all necessary working. [5]

[illegible]