

1. (a) Prove by **contradiction** that $\log 7$ is an irrational number.

(5)

Given that x, a and b are positive real numbers, with $a > b$ and $x^2 > ab$

(b) use proof by **contradiction** to show that,

$$\frac{x+a}{\sqrt{x^2+a^2}} - \frac{x+b}{\sqrt{x^2+b^2}} > 0$$

(8)

(c) Given that,

$$P = T^2 - 1 \text{ and } T = 2^q - 1, q \in \mathbb{N}$$

prove that 2^{q+1} is a factor of P .

(2)