Question 3 **(7 marks)**

Consider the definite integral $\int_0^1 \dfrac{x^2}{(1+x^2)^2}\,dx$.

(a) By using the substitution $x = \tan u$, show that $\int_0^1 \dfrac{x^2}{(1+x^2)^2}\,dx = \int_a^b \sin^2 u\,du$ and state the values of a, b. (4 marks)

(b) Hence evaluate $\int_0^1 \dfrac{x^2}{(1+x^2)^2}\,dx$ exactly. (3 marks)