3 The integral I_n is defined by $I_n = \int_0 \left(1+x^2\right)\,\mathrm{d}x$.

(a) By considering $\frac{\mathrm{d}}{\mathrm{d}x}\left(x(1+x^2)^n\right)$, or otherwise, show that

$$(2n+1)I_n = 2^n + 2nI_{n-1}.$$ [5]

(b) Find the exact value of I_{-2}. [4]