

Honors HW3 MATH 2501 Fall 2018 (20 points)

Define the “forward difference operator” (also known as the “discrete derivative”) Δ acting on a function $f(x)$ by

$$\Delta f(x) = f(x+1) - f(x).$$

Let a be a number and let $k = 0, 1, 2, \dots$. Define the “rising factorial” $(a)_k$ by

$$(a)_k = a(a+1)(a+2)(a+3)\dots(a+k-1).$$

1. Let $f(x) = x + 3$. Compute $\Delta f(x)$.
2. Let $g(x) = x^2 + 2x - 4$. Compute $\Delta g(x)$.
3. Let $h(x) = x$ and let $\ell(x) = x^2$. Compute $\Delta h(x)$, compute $\Delta \ell(x)$, and compute $\Delta [h(x)\ell(x)]$. Compare your answer to the last computation to

$$\ell(x)\Delta[h(x)] + h(x)\Delta[\ell(x)].$$

Are they the same?

4. Compute $(3)_2$.
5. Compute $(2)_3$.