**TMUA 2021 Paper 1 Question 13**

The function f is such that, for every integer $n$

$$\int_n^{n+1} \mathrm{f}(x)\,\mathrm{d}x = n + 1$$

this tells us that the value of the integral between 2 consecutive integers is the value of the larger integer

Evaluate

$$\sum_{r=1}^{8} \left( \int_0^r \mathrm{f}(x)\,\mathrm{d}x \right)$$

When $r=2$ we have $\int_0^2 f(x)dx = \int_0^1 f(x)dx + \int_1^2 f(x)dx = 1 + 2 = 3$

A 36

B 84

C 120

D 165

E 204

F 288

| $r$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| $\int_0^r f(x)dx$ | 1 | 3 | 6 | 10 | 15 | 21 | 28 | 36 |

TABLE 1

note: this row contains the first 8 triangle numbers so we could use the formula for the sum of the first n triangle numbers i.e. $\frac{n(n+1)(n+2)}{6}$ with $n=8$

TABLE 1 shows the value of $\int_0^r f(x)dx$ for each $r$

Adding these values together gives 120

So the correct answer is C