How I spent last summer

William Fayers
School of Mathematics and Physics,
University of Lincoln

October 17, 2023

Abstract

In this article, I shall discuss how I spent last summer.

Introduction

Preparation is described in Section 1, beginning in Section 2, and summer proper in Section 3. Section 4 contains a photo showing a capybara that I saw when I visited the capybara cafe in Tokyo.

Note: Everything written about in this document is entirely fictional and not intentionally based on any true events.

1 Preparation

Prepare for summer:

1. Get fit
   (a) Jogging
   (b) Press-ups
   (c) Learn to swim
2. Buy summer clothes
3. Buy tickets

2 May

Apart from recreational activities, in May I also did some maths, as described in Subsection 2.3.

2.1 May weather

It was raining *a lot*. This phenomenon is explained in [1, Section 4].

2.2 Reading books

Because of what is described in Subsection 2.1, we stayed indoors and read the book [2].

2.3 Maths

I was also revising some maths for A-level exams, like the following.

Theorem 1. *The solutions of a quadratic equation* $ax^2 + bx + c = 0$ *are given by the formulae*

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \textit{and} \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}.$$

Lemma 1. *A finite sum* $\sum_{i=0}^{k} r^i a_0$ *of a geometric progression with ratio* $r \neq 1$ *is equal to*

$$a_0 \left(\frac{1 - r^{k+1}}{1 - r} \right).$$

Proof. We have

$$(1 - r)(1 + r + r^2 + \cdots + r^k) = 1 - r^{k+1},$$

which is verified by expanding brackets:

$$\begin{aligned} &(1 + r + r^2 + \cdots + r^k) - r(1 + r + r^2 + \cdots + r^k) \\ &\quad = 1 + r + r^2 + \cdots + r^k - r - r^2 - \cdots - r^k - r^{k+1} = 1 - r^{k+1}. \end{aligned}$$

Dividing both sides of formula (3) by $r - 1$ and multiplying by a_0 we have

$$a_0 + ra_0 + r^2 a_0 + r^3 a_0 + \cdots + r^k a_0 = a_0 \left(\frac{1 - r^{k+1}}{1 - r} \right).$$

□

Theorem 2. *The infinite sum* $\sum_{i=0}^{\infty} r^i a_0$ *of a geometric progression with ratio* r *satisfying* $0 < r < 1$ *is equal to* $\frac{a_0}{1-r}$.

Proof. The sum $\sum_{i=0}^{\infty} r^i a_0$ is equal to the limit of the partial sums $\sum_{i=0}^{k} r^i a_0$ as k tends to ∞. By Lemma 1,

$$\sum_{i=0}^{k} r^i a_0 = a_0 \left(\frac{1 - r^{k+1}}{1 - r} \right).$$

When $0 < r < 1$, the term r^{k+1} tends to 0 as k tends to ∞. Hence the result. □

3 Summer proper

After exams, we watched football matches on TV. At the moment the table in group E looks as in Table 1.

Table 1: Euro 2016. Group E

Pos	Team	Pld	W	D	L	GD	Pts	Qualification
1	Italy	3	2	0	1	+2	6	Qualified
2	Belgium	3	2	0	1	+2	6	Qualified
3	Republic of Ireland	3	1	1	1	0	4	Round of 16
4	Sweden	3	0	1	2	-2	1	

4 Photo

Figure 1 shows the capybara cafe from Tokyo

Figure 1: Capybara Cafe

References

[1] A. Nother, Recent advances in weather prediction, *J. Adv. Weather* **76**, no. 3 (2013), 23-45.

[2] S. Someone, *A great book*, Lincoln, 2014.

[3] C. Capybara, Cafe Capybara introduction page, *Cafe Capybara*, 2023.