



# MATH425

## Quantum Field Theory

### Homework Sheet 3

Academic Year 2025/26

Dr Yannick Ulrich

<https://math425.yannickulrich.com>

Issued: 5 December 2025

Due: 12 December 2025

---

#### Homework 1: Particle annihilation (20 Pts.)

Consider the process  $e^+e^- \rightarrow \gamma\gamma$  in QED.

- a) (3 Pts.) Draw the diagrams contributing to this process and evaluate them using the QED Feynman rules.
- b) (10 Pts.) Calculate  $|\mathcal{M}|^2$  with  $m = 0$ .
- c) (5 Pts.) Calculate  $d\sigma/d(\cos\theta)$ .
- d) (2 Pts.) Is the total cross section defined? If so, what is it? If not, why not?

You may use computer algebra to calculate integrals or simplify expressions. When you do, please make sure to clearly mark it as such.