A Book of Lemmas

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This is an unfinished manuscript. Please send all comments and corrections to the author at:
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Preface

"Begin at the beginning," the King said gravely, "and go on till you come to the end: then stop."
— Lewis Carroll, *Alice in Wonderland*

About This Book

I wrote this book as a set of personal notes to collect important geometric configurations, beautiful problems, and practice making Asymptote diagrams.

I have tried to give credit everywhere I could, but some of the problems I have only seen in translation or in problem sets, so they might not have appropriate competition labels. If you have any comments about the problems or suggestions for new ones, feel free to email me.

Unless otherwise stated, all proofs and solutions are my own.

Acknowledgements

I would like to thank my professors Jacek Dymel, Dominik Burek, and Tomasz Kobos for teaching me geometry.

Recomendations

This book assumes a certain familiarity with the foundations of Olympiad geometry. Particularly:

- Evan Chen's book [Che16]

  is a great resource for starting your olympiad geometry journey as it introduces all of the foundamental concepts

Other great resources:

- Evan Chen's Olympiad Articles
- Yufei Zhao's Math Olympiad training handouts
- Muricana

For those you migth have to learn Polish but oh the sacrifices we make for love.

- lemacisko
- Homepage of Dominik Burek

Notes on notation

In this book I've included the following notation:

- $(P_1P_2P_3\dots)$ means the circumcircle of $P_1, P_2, P_3, \dots$
- $P_1 - P_2 - P_3 - \dots$ means line $P_1, P_2, P_3, \dots$
  (hence those points are collinear)
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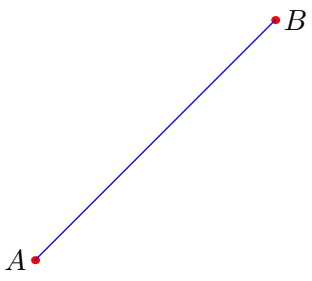
Further more we assume the following notation:

- I_A, I_B, I_C are the circumcenters of A-, B-, C- excircles respectively



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Part I

Orthocenter Lemmas

Bibliography

[Che16] Evan Chen. *Euclidean Geometry in Mathematical Olympiads*. 2016. ISBN: 978-0883858394.