

Lectures on Challenging Mathematics

UC3 Geometry An Invitation to Computational Mathematics

Winter 2017

Zuming Feng
Phillips Exeter Academy and IDEA Math
zfeng@exeter.edu

©Copyright 2008 – 2017 Idea Math

“Cogito ergo Sum” – “I think, therefore I am”

René Descartes (1596-1650)

©Copyright 2008 – 2017 Idea Math

Idea Math

Internal Use

Contents

1	Geometry Knowledge	3
1.1	Practices in geometry computations (part 1)	3
1.1.1	Mixed exercises 1	3
1.1.2	Revisiting special angles (part 1)	3
1.2	Practices in geometry computations (part 2)	5
1.2.1	Mixed exercises 2	5
1.2.2	Revisiting the centers of a triangle	5
1.3	Practice in geometry calculations (part 3)	7
1.3.1	Mixed exercises 3	7
1.3.2	Revisiting special angles (part 2)	7
1.4	Practices in geometry computations (part 4)	9
1.4.1	Mixed exercises 4	9
1.4.2	Area, similarity, and Ceva (part 1)	9
1.5	Power-of-a-point theorem (part 1)	11
1.5.1	Power-of-a-point theorem (part 1)	11
1.5.2	Revisiting special angles (part 3)	11
1.6	Practice in geometry calculations (part 5)	13
1.6.1	Mixed exercises 5	13
1.6.2	Area, similarity, and Ceva (part 2)	13
1.7	Practice in geometry calculations (part 6)	15
1.7.1	Mixed exercises 6	15
1.7.2	Revisiting arcs and angles	15
1.8	Practice in geometry calculations (part 7)	17
1.8.1	Mixed exercises 7	17
1.8.2	Area, similarity, and Ceva (part 3)	17
1.9	Power-of-a-point theorem (part 2)	19
1.9.1	Power-of-a-point theorem (part 2)	19
1.9.2	Tangent circles	20
1.10	Practice in geometry calculations (part 8)	21
1.10.1	Mixed exercises 8	21
1.10.2	Area, similarity, and Ceva (part 4)	21

2	Geometry Challenges	23
2.1	Geometry project 1: Selected medium level geometry problems from AIME	23
2.2	Challenges in geometry calculations (part 1)	24
2.3	Geometric project 2: Tangent circles	25
2.4	Challenges in geometry calculations (part 2)	26
2.5	Geometry project 3: Folding, unfolding, and 3-D visions	27