

MINISTRY OF SCIENCE AND HIGHER EDUCATION
OF THE RUSSIAN FEDERATION

SOUTHERN FEDERAL UNIVERSITY

Vladimir S. Pilidi

ANALYTIC GEOMETRY

Textbook

Rostov-on-Don – Taganrog
Southern Federal University Press
2020

UDC 514.122+514.123(075.8)

BBC 22.151.5

P32

*Published by decision of the educational-methodical commission
of the I. I. Vorovich Institute of Mathematics, Mechanics, and Computer Science
of the Southern Federal University (minutes No. 9 dated September 8, 2020)*

Reviewers:

Doctor of physical and mathematical sciences,
professor of the Department of Applied Mathematics
of the Platov South-Russian State Polytechnic University (NPI),
Professor A.E. Pasenchuk;

Candidate of physical and mathematical sciences,
associate professor of the Department of Algebra and Discrete Mathematics
of the Southern Federal University,
Associate professor A.V. Kozak

Pilidi, V. S.

P32 Analytic geometry : textbook / V.S. Pilidi ; Southern Federal University.
– Rostov-on-Don ; Taganrog : Southern Federal University Press, 2020. –
195 p.
ISBN 978-5-9275-3576-7

The book contains material on analytic geometry included in the university discipline "Algebra and Geometry". In addition to detailed presentation of theoretical material, there are given problems in the volume that is quite sufficient both for practical classes and for students' independent work. Most problems are provided with detailed solutions. The book is addressed to students of the educational program "Theoretical Computer Science and Information Technologies" and can also be used by students of other educational programs.

UDC 514.122+514.123(075.8)

BBC 22.151.5

ISBN 978-5-9275-3576-7

© Southern Federal University, 2020
© Pilidi V.S., 2020

Contents

1 Straight lines on the plane	4
1.1 Coordinates on the plane	4
1.1.1 Definition of coordinates	4
1.1.2 Distance between two points	7
1.1.3 Midpoint of a Segment	8
1.1.4 Vectors on the coordinate plane	9
1.2 Straight line on the plane	17
1.2.1 Equations of straight lines	17
1.2.2 Special cases of equations of straight lines	20
1.2.3 Distance of a point from a line	21
1.2.4 Intercepts	24
1.2.5 Pencils of straight lines	27
1.2.6 Normal equations of straight lines	29
1.3 Polar coordinates	32
1.4 Some tasks on straight lines on the plane	34
2 Second order curves on the plane	37
2.1 The circle	37
2.2 The ellipse	43

Contents 193

2.2.1	Definition and equation of the ellipse	43
2.2.2	Directrices	48
2.2.3	Tangent to the ellipse	50
2.2.4	Parametric equations of the ellipse	53
2.3	The hyperbola	54
2.3.1	Definition and equation of the hyperbola	54
2.3.2	Directrices	60
2.3.3	Tangent to the hyperbola	62
2.4	The parabola	64
2.5	Polar equations of second order curves	68
3	Analytic geometry in the space	70
3.1	Cartesian coordinates in the space	70
3.1.1	Distance between two points	72
3.1.2	Vectors in the space	73
3.2	Plane in the space	86
3.2.1	Equation of the plane	86
3.2.2	Special cases of equations of planes	89
3.2.3	Distance of a point from a plane	91
3.2.4	Equation of the plane in the intercept form	94
3.2.5	Pencils and bundles of planes	95
3.2.6	Normal equation of the plane	98
3.3	Straight line in the space	99
3.4	Some tasks on straight lines and planes in the space	107
4	Problems	110

4.1	Straight lines on the plane	110
4.2	Second order curves on the plane	114
4.3	Analytic geometry in the space	124
5	Answers and solutions	134
5.1	Straight lines on the plane	134
5.2	Second order curves on the plane	141
5.3	Analytic geometry in the space	164