



Universiteit
Leiden
The Netherlands

Division points in arithmetic

Javan Peykar, A.

Citation

Javan Peykar, A. (2021, January 5). *Division points in arithmetic*. Retrieved from <https://hdl.handle.net/1887/138941>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/138941>

Note: To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/138941> holds various files of this Leiden University dissertation.

Author: Javan Peykar, A.

Title: Division points in arithmetic

Issue Date: 2021-01-05

Division points in arithmetic

Proefschrift

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus prof. mr. C.J.J.M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op dinsdag 5 januari 2021
klokke 11:15 uur

door

Abtien Javan Peykar

geboren te Apeldoorn

in 1989

Promotor: Prof. dr. P. Stevenhagen

Copromotor: Prof. dr. H. W. Lenstra

Promotiecommissie:

Prof. dr. B. de Smit

Prof. dr. R. van Luijk

Prof. dr. S. J. Edixhoven

Dr. A. Perucca Université du Luxembourg

Dr. P. Moree Max Planck Institute for Mathematics

Contents

1 Radical Galois groups and cohomology	1
1.1 Introduction	1
1.2 Maximal radical extensions of number fields	6
1.3 Continuous cochain cohomology	12
1.4 Topological group extensions	17
1.5 On profinite groups	19
1.6 Roots of unity and cohomology	20
1.7 Orbits of natural extensions	21
1.8 Cohomology of the Tate module	31
1.9 Galois groups of maximal radical extensions	34
1.10 Lifting	42
1.11 The main theorem	47
2 Reductions of multiplicative subgroups of number fields	51
2.1 Introduction	51
2.2 Haar measure on profinite groups	56
2.3 Chebotarev density theorem for infinite extensions	58
2.4 Existence of the density	60

2.5	Galois representations on radical groups	67
2.6	Rationality of the density	74
2.7	Main theorem	77
2.8	Applications	86
3	Reductions of the Mordell-Weil group over number fields	89
3.1	Introduction	89
3.2	Division in modules	94
3.3	Dividing points on elliptic curves	98
3.4	Abelian division fields	104
3.5	Galois representation on torsion points	111
3.6	Kummer theory	120
3.7	Galois representations on division points	132
3.8	Existence of the density	132
3.9	Rationality of the density	138
3.10	Main theorem	143
Bibliography		147
Samenvatting		151
Dankwoord		153
Curriculum vitae		155