

# Name Index

Read the symbol ► as 'see'.

- Abel, N. H. 403  
 Abu'l-Wafa 104  
 Adelard 106  
 Aepinus, F. 323  
 Al-Mamun 103  
 Al-Mansur 103  
 Al-Rashid, Harun 103  
 Al-Tusi 103  
 Alberti, L. B. 114–115, 118, 119  
 Alexander (the great) 95  
 Alexandrov, A. D. 241  
 Alhazen 106  
 Amman, J. 129, 132  
 Apollonius 96, 97, 99, 108, 126, 140  
 Appel, K. 353  
 Archimedes 35, 37, 41, 44, 79, 103–105,  
 108, 126, 140, 156, 214, 369  
 Aristaeus 96  
 Aristotle 35, 95, 101, 105–107, 136, 359  
 Augustine 100
- Badoureau, A. 178, 289  
 Barbaro, D. 132  
 Barlow, W. 324  
 Bertrand, J. 281, 372, 389  
 Bilinski, S. 156  
 Biot, J. B. 234  
 Birkhoff, G. D. 352  
 Boethius 101  
 Bolker, E. 242  
 Bolyai, F. 45  
 Boullé, C. de 168  
 Bradwardine, T. 168  
 Brahe, T. 140  
 Bramante, D. 126  
 Bravais, A. 321, 322, 372  
 Bricard, R. 47, 239  
 Bring, E. S. 403
- Browder, F. E. 314  
 Brückner, M. 237, 268  
 Brunelleschi, F. 111, 112, 119, 136  
 Burnside, W. 331
- Campanus 106, 108, 121  
 Candalla, F. F. 140  
 Cardano, G. 402  
 Carnot, L. N. M. 234  
 Carroll, L. 205  
 Carter, S. 385  
 Catalan, E. C. 179, 321, 367  
 Cauchy, A. L. 200, 207, 213, 224, 228,  
 233, 259, 286, 372, 389  
 Cayley, A. 171, 191, 258, 318, 329, 349  
 Ch'in Shih Huang 24  
 Chalcidius 100, 105  
 Chang Heng 25  
 Cheops ► Khufu  
 Cicero 100  
 Commandino, F. 109, 136, 140  
 Connelly, R. 242, 243  
 Constantine 102  
 Conway, J. H. 407  
 Coxeter, H. S. M. 76, 77, 79, 139, 178,  
 219, 269, 407  
 Crum Brown, A. 192  
 Cundy, H. M. 75  
 Curie, P. 323  
 Cyrano de Bergerac 9
- Dali, S. 2  
 Dalton, J. 52  
 De Morgan, A. 349  
 Dehn, M. 47  
 Delafosse, G. 321  
 Deligne, P. 245  
 Democritus 29, 35, 38, 44, 51

- Descartes, R. 181, 187, 188, 190, 206, 214  
 Donatello 112, 115  
 Dress, A. W. M. 286  
 Du Val, P. 269  
 Duccio 111  
 Dürer, A. 122, 126–128, 132, 156, 207  
 Dürre, K. 353  
 Dyck, W. von 318  
  
 Empedocles 51  
 Eratosthenes 44  
 Escher, M. C. 2, 171, 251, 258  
 Euclid 19, 60, 61, 64, 66, 77, 86, 91, 96, 97, 99, 101, 103–106, 108, 114, 119, 121, 123, 126, 151, 183, 184, 188, 206, 220, 222, 227, 360  
 Eudemus 72, 100  
 Eudoxus 29, 37, 41, 44, 106  
 Euler, L. 142, 182, 189, 190, 195, 200, 206, 207, 213, 214, 241, 291  
  
 Fedorov, E. S. 156, 324  
 Fejes Toth, L. 407  
 Fermat, P. 64  
 Ferrari, L. 402  
 Fibonacci 121  
 Flather, H. T. 269  
 Fontana, N. 402  
 Foucher de Careil 182  
 Franklin, P. 352  
 Freudenthal, H. 228  
 Friedrich, W. 324  
 Fritz, K. von 30, 31  
 Frobenius, G. 331  
 Fuller, R. B. 2, 6, 7  
  
 Galen 106  
 Galileo 17, 140, 149  
 Galois, E. 403  
 Gauss, C. F. 47, 64, 215  
 Geminus 100  
 Gerard 106  
 Gergonne, J. D. 201, 328  
 Gerling, C. L. 47  
 Gerwien, P. 45  
  
 Giotto 111  
 Girard, A. 186  
 Gluck, H. 241  
 Goldbach, C. 189  
 Goldberg, M. 222, 225  
 Grötzsch, H. 346  
 Grünbaum, B. 284–286, 346, 368, 370  
 Guglielmini, D. 319  
 Guthrie, F. 348  
  
 Haeckel, E. 5  
 Haken, W. 353  
 Hamilton, W. R. 318, 349  
 Haüy, R. J. 319  
 Heath, T. L. 32, 73  
 Heawood, P. J. 350  
 Heesch, H. 352  
 Hermite, C. 403  
 Heron 80, 98, 99, 103, 104, 108  
 Hess, E. 386  
 Hessel, J. F. C. 204, 321  
 Hilbert, D. 47, 60, 227, 404  
 Hill, M. J. M. 47  
 Hilton, H. 324, 407  
 Hipparchus 97  
 Hippasus 32, 71  
 Hirschvogel, A. 128  
 Hooke, R. 319  
 Hoppe, R. 207  
 Huygens, C. 319  
 Hypsicles 96, 97, 99, 101, 108  
  
 Iamblichus 71, 100  
 Isidorus 101  
  
 Jamnitzer, W. 55, 128–132, 152, 156, 171, 252  
 Johnson, N. 86, 87  
 Jordan, C. 318, 322  
 Justinian 102  
  
 Kagan, V. F. 47  
 Kelvin ► Thomson, W.  
 Kempe, A. B. 348, 349

- Kepler, J. 10, 55, 71, 81, 83, 91, 139, 189, 204, 207, 209, 214, 249, 251, 256, 286, 359, 367  
     biography 139–142  
 Keyser, J. de 127, 132  
 Khaefre 18  
 Khufu 18  
 Klein, F. 324, 404  
 Knipping, P. 324  
 Koestler, A. 147  
 Koptsik, V. A. 407  
 Kuiper, N. H. 245  
  
 L'Huilier, S. A. J. 202, 206  
 Lagrange, J. L. 233, 403  
 Lao Tsu 40  
 Laue, M. von 324  
 Lebesgue, H. 181, 200  
 Legendre, A. M. 191, 198, 200, 206, 210, 224, 233, 234, 253, 257  
 Leibniz, G. W. 61, 182, 214  
 Lencker, H. 128  
 Leonardo 123, 144  
 Leonardo of Pisa ► Fibonacci  
 Lesavre, J. 178  
 Leucippus 51  
 Listing, J. B. 206, 208, 210  
 Liu Hui 24, 25, 38, 44  
 Longuet-Higgins, H. C. 178  
 Longuet-Higgins, M. S. 178  
  
 MacKinnon, N. 122  
 MacLane, S. 314  
 Maksimov, I. G. 245  
 Malus, E. L. 233  
 Masaccio 112  
 Masolino 112  
 Mason, P. 222  
 Mästlin, M. 140, 147  
 Maurolico, F. 109  
 Menkaure 18  
 Mercier, R. 178  
 Miller, J. C. P. 269  
 Miller, J. C. P. 91, 178  
 Möbius, A. F. 208, 209, 321, 349  
 Mohammed 102  
  
 Monge, G. 18  
 Morton, H. R. 385  
 Moser, W. O. J. 407  
  
 Napoleon Bonaparte 18, 233  
 Neudörfer, J. 122  
 Neufchâtel, J. 122  
 Newton, I. 9  
 Nichomachus 101  
  
 Ore, O. 352  
  
 Pacioli, L. 108, 122–126, 128, 132, 144, 152, 156, 168, 171, 386, 402  
     portrait of Pl. 5, 122  
 Paley, W. 9  
 Pappus 79, 86, 91, 96, 99, 104, 108, 140, 156  
 Peckham, J. 106  
 Pederson, J. 1  
 Petrie, F. 19  
 Petrie, J. F. 79, 269  
 Piero della Francesca 118–122, 126, 132  
 Pitsch, J. 178  
 Plato 10, 35, 41, 51, 57, 58, 71, 77, 80, 95, 97  
 Plotinus 100, 136  
 Plutarch 37, 54, 100  
 Poincaré, L. 10, 178, 179, 200, 204, 206, 209, 233, 251–253, 256, 257, 282, 286, 322, 392  
 Proclus 100, 108, 140, 183, 220  
 Prouhet, E. 187  
 Ptolemy 97, 99, 104–106, 127, 136  
 Ptolemy I 95  
 Pythagoras 29, 33, 71, 95  
  
 Radolt, E. 108  
 Reynolds, C. N. 352  
 Richmond, H. W. 63  
 Robertson, S. A. 385  
 Robinson, J. 55  
 Romé de l'Isle, J. B. L. 319  
 Röntgen, W. C. 324  
 Ruffini, P. 403  
  
 Schattschneider, D. 238

- Schoenberg, I. J. 235  
 Schoenflies, A. M. 324, 407  
 Schopenhauer, A. 221  
 Scipione 126  
 Seneferu 18  
 Shephard, G. C. 368, 370  
 Shubnikov, A. V. 407  
 Skilling, J. 178, 355  
 Socrates 74  
 Sohncke, L. 321, 323  
 Staudt, K. G. C. von 210, 213  
 Steffen, K. 245  
 Steinitz, E. 235  
 Stemple, J. 352  
 Stewart, I. 376  
 Stoer, L. 128  
 Suidas 74  
 Sullivan, D. 245  
  
 Tait, P. G. 340  
 Tartaglia ► Fontana, N.  
 Thabit 103, 106  
 Thales 29  
 Theaetetus 72, 74  
 Theodocius 102  
 Thomson, W. (Lord Kelvin) 81  
 Thurston, W. 407  
  
 Uccello, P. 115, 171  
  
 van der Waerden, B. L. ► Waerden  
 Vasari, G. 115, 118  
 Viator, J. 126  
 Viète, F. 403  
 von Dyck, W. ► Dyck  
 von Fritz, K. ► Fritz  
 von Laue, M. ► Laue  
 von Staudt, K. G. C. ► Staudt  
  
 Waerden, B. L. van der 28  
 Wagner, D. B. 40  
 Walker, W. 238  
 Wallace, W. 45  
 Waterhouse, W. C. 51, 72  
 Weber, H. 318  
 Wenninger, M. 179  
  
 Wheeler, A. H. 268  
 Whitney, H. 343  
 Winn, C. E. 352  
 Wunderlich, W. 222, 225  
  
 Zalgaller, V. A. 86, 355  
 Zamberti, B. 108, 132  
 Zamberti, G. 132  
 Zeno 34

# Subject Index

Read the symbols ► and ▷ as 'see' and 'see also' respectively.

3-cycle 346

abstraction 58

acoptic ► polyhedron, acoptic

*Almagest* 97, 99, 103, 132

*Analemma* 132

angle

▷ solid angle

–, complementary 183

–, dihedral 13

–, exterior 183

–, plane 13

measurement of 182

antiprism 6, 13, 85, 156, 163

with star polygon base 175

Archimedean solids 79–86, 91, 99, 104, 116, 127, 132, 156–167, 174, 179, 181, 197, 225, 249, 327, 367, 384, *Fig. 2.21*, Pl. 2,3,

▷ cub-octahedron,

▷ great rhomb-cub-octahedron,

▷ great rhomb-icosi-dodecahedron,

▷ icosi-dodecahedron,

▷ rhomb-cub-octahedron,

▷ rhomb-icosi-dodecahedron,

▷ snub cube,

▷ snub dodecahedron,

▷ truncated cube,

▷ truncated dodecahedron,

▷ truncated icosahedron,

▷ truncated octahedron,

▷ truncated tetrahedron

enumeration of 162–167

fragments of 86

*Ars Magna* 402

astronomy 96

augmentation 124, 194

axioms 60

–, Archimedean 42

–, Euclidean 61, 62, 220

group 316–317

of congruence 226

of continuity 42, 60

axis 291

–, principal 293

–, rotation-reflection 306

–, secondary 293

–,  $n$ -fold 292

bellows conjecture 245

*Book of Data* 103

*Book on the Measurement of Plane and Solid Figures* 103

*Book on What Scribes and Businessmen Need From Arithmetic* 104

*Book on What the Artisan Needs From Geometry* 104

brick 202

Burnside's lemma 331

Campanus' sphere 106, 116, 124

Catalan solids 367, *Fig. 10.7*

Cauchy's lemma 229, 235

cavity 203, 207

Cayley's formula 257

ch'i blocks 25,

▷ ch'ien-tu,

▷ cube, ch'i block,

▷ pieh-nao,

▷ yang-ma

ch'ien-tu 25

cheiral 301

circumsphere 52

- colouring 331
  - type 331
  - , perfect 400–401
  - , proper 337
    - with 2 colours 338
    - with 3 colours 341
    - with 4 colours 348
    - with 5 colours 350
    - with 6 colours 347
  - equivalence of 329
  - symmetry of 393–396
- Commentary on the Nine Chapters* 24
- Comparison of the Dodecahedron with the Icosahedron* 96
- complete icosahedron ► icosahedron, complete
- compound 327, 359, Pl. 11–16
  - , regular 364, 385, 389
  - 2 dodecahedra 360
  - 2 tetrahedra ► stella octangula
  - 3 cubes 362
  - 3 octahedra 362
  - 4 cubes 363
  - 4 octahedra 363
  - 4 tetrahedra 364
  - 5 cubes 360
  - 5 octahedra 263
  - 5 tetrahedra 263
    - cheiral 301
    - symmetry of 311
  - component of 359
  - cube+octahedron 152
  - dodecahedron+icosahedron 152
- configuration 350
  - , reducible 350
  - , unavoidable 352
- congruence
  - ▷ equivalence relation as in Kepler 149
- congruent by dissection 45
- connectedness 210
- construction
  - of cube 68
  - of dodecahedron 69
  - of equilateral triangle 62
  - of icosahedron 70
  - of octahedron 67
  - of pentagon 63
  - of perpendicular 62
  - of tetrahedron 66
    - with rusty compasses 104
- convex 252
- convex hull 281
- counting theorem 330
- covering number
  - ▷ density
  - of polygon 250
  - of polyhedron 250, 258
- crinkle 243
- crystal 4, 202, 203, 318, 366
  - class 321
  - and symmetry 318–324
  - pyrite 71, Pl. 1
  - quartz 73
  - striated 301
- crystallographic restriction 321
- cub-octahedron 3, 80, 86, 104, 124, 163, 176, 257, 372, 373, 375, 382, 384, 391
- cube 152, 181, 373, 382,
  - ▷ Platonic solids
  - ch'i block 25
  - colouring of 336, 396
  - construction of 68
  - facets of 281
  - in Piero exercise 119
  - puzzle 329
  - stellations of (none) 261
  - symmetry of 296, 308
  - with ears 173
- cubic equation 402
- cuneiform tablet 23
- curvature 216
- cyclotomic equation 64
- De Caelo et Mundo* 105
- De Nive Sexangula* 149, 152, 156
- De Pictura* 114
- De Prospectiva Pingendi* 119
- deficiency ► solid angle, deficiency
- definition 59
- degenerate ► polyhedron, degenerate

- Dehn invariant 48
- Della Pittura* 114
- deltahedron 75, 86, *Fig. 2.18*,  
 ▷ dodecahedron, Siamese,  
 ▷ octahedron  
 –, Mason's 222, 241, *Fig. 6.4*  
 icosahedron stellation 271
- density 258,  
 ▷ covering number  
 of polygon 258
- Descartes' theorem 187
- devil's staircase 36, 44
- dice 327
- dihedral angle ► angle, dihedral
- dipyramid 367  
 colouring of 396  
 symmetry of 302
- discharging procedure 353
- Divina Proportione* 124, 144, 156, 385
- dodecahedron 122, 152, 181,  
 ▷ great dodecahedron,  
 ▷ great stellated dodecahedron,  
 ▷ Platonic solids,  
 ▷ small stellated dodecahedron  
 –, Goldberg's 222  
 –, Siamese 6, 75, 87, 367, *Fig. 2.18*  
 –, rhombic ► rhombic polyhedron, do-  
 decahedron  
 ancient 71  
 and calendar 3  
 construction of 69, 282, 360  
 facets of 282  
 stellations of 261  
 with ears 173
- eared cube 173
- eared dodecahedron 173
- echinus 168
- edge 13, 189, 191, 192
- edge-stellation ► stellation, edge
- edge-transitive ► transitive, edge
- elementary ► polyhedron, elementary
- Elements* 30, 57, 63, 96, 97, 99, 103,  
 106, 108, 114, 151, 183, 220, 376, 384  
 –, book I 60, 61, 100, 122, 140  
 –, book II 122
- , book III 100
- , book IV 100
- , book V 122
- , book VI 122
- , book X 74, 122
- , book XI 66, 184, 226
- , book XII 106, 109
- , book XIII 72, 74, 101, 122
- , book XIV 96, 101, 108
- , book XV 101, 108, 109, 121  
 restoration of 108
- enantiomorphism 84, 301
- epipedal ► polyhedron, epipedal
- equidecomposable 45
- equivalence  
 – class 219  
 – relation 219  
 congruence 221, 226, 247  
 similarity 221  
 stereo-isomerism 225
- Euclidean tools 61, 64, 103
- Euler's algorithm 197
- Euler's formula 190, 193, 233, 252, 257,  
 327, 346, 352  
 exceptions to 201
- face 13, 192  
 –, adjacent 13
- face-stellation ► stellation, face
- face-transitive ► transitive, face
- facetting 281
- Fermat prime 64
- flag 372
- flag-transitive ► transitive, flag
- fleximer 247
- fold-out ► net
- fool's gold ► crystal, pyrite
- four-colour problem 348
- frustum 21  
 volume of 98, 103
- fundamental region 375
- Gauss-Bonnet formula 216
- genus 209
- geodesic 215
- geodesic dome 2

- golden ratio 68, 74, 124, 151, 168  
golden rectangle 70, 124  
graph theory 192  
great dodecahedron 252, 258, 261, 265,  
270, 282, *Fig. 7.3*  
skeletal form 282  
great icosahedron 254, 258, 263, 270,  
282, *Fig. 7.4*  
great rhomb-cub-octahedron 81, 167, 373  
great rhomb-icosi-dodecahedron 167  
great stellated dodecahedron 169, 258,  
261, 265, 270, 282, *Fig. 4.16*  
Greeks  
▷ Pythagoreans  
and infinity 34  
and proof 29  
group 316  
– isomorphism 317  
– presentation 318  
– table 317  
 $C_{2h}$  315  
 $D_2$  316  
 $D_3$  317  
 $S_4$  315  
–, colour 399, 400  
–, colour-preserving 400  
–, normal 401, 403  
–, permutation 403  
axioms of 316–317  
identity 316
- Harmonices Mundi* 139, 141, 168  
Hausdorff metric 376  
heptahedron ► polyhedron, heptahedron  
Heronian formula 98  
honeycomb 79  
House of Wisdom 102
- icosahedron 152, 252, 254, 375, 383,  
▷ great icosahedron,  
▷ Platonic solids  
–, complete 270, 371, Pl. 10  
–, rhombic ► rhombic polyhedron, ico-  
hedron  
–, triakis 270  
construction of 70
- Dymaxion map 7  
facets of 282  
fragments of 86  
skeletal form 282  
spaceship 9  
stellations of 3, 262, 267–281, 289  
symmetry of 296  
with golden rectangles 70, 124  
icosi-dodecahedron 81, 86, 124, 164, 257,  
384, 391  
icosian calculus 318  
identity  
of a group ► group, identity  
symmetry ► symmetry, identity  
incommensurability 30, 57  
Indian rule 103, 127  
intarsia 116  
inversion ► symmetry, inversion  
isogonal ► transitive, vertex  
isohedral ► transitive, face  
isomer 225  
–, configurational 225  
–, rotational 247  
–, stereo 225, 373  
counting of 330  
isomerism 88, 191  
isomorphism  
of groups 317  
of polyhedra 373  
isotoxal ► transitive, edge
- Jordan curve theorem 212
- kaleidocycle 238  
Kelvin's solid ► truncated octahedron  
Kempe chain 350  
Kepler–Poincaré polyhedron ► star poly-  
hedron  
koihedron ► polyhedron, koihedron
- lattice 320, 321  
*Lectures on the Icosahedron* 404  
*Liber Abbaci* 121
- main sequence ► stellation, main sequence  
marquetry 116



- Mathematical Collection* 79, 99, 156  
 mazzocchio 116  
 mensuration 17  
 method of exhaustion 41, 106  
*Metrica* 98  
 midsphere 144  
 Miller's solid 89, 156, 225, 366, 369,  
     *Fig. 2.30*  
     symmetry of 296  
 mirror plane 300  
*Mo Ching* 33  
 Möbius strip 208  
 model 226, 292, 302, 308, 327,  
     ▷ net  
     –, straw framework 239  
     net  
         flexible polyhedron 244  
         icosahedral die 4  
         rhomb-cub-octahedral die 4  
         ring of tetrahedra 237  
         Wunderlich octahedron 221  
     tips for making 13–15  
 Moscow papyrus ► papyrus, Moscow  
*Mysterium Cosmographicum* 139, 140,  
     142–147  
  
 Neoplatonism 100, 136  
 net 127, 206, 225,  
     ▷ model  
*Nine Chapters* 24, 28, 38  
 non-separating curve 207  
  
 octahedron 86, 152, 176, 254, 373, 375,  
     382,  
     ▷ Platonic solids  
     –, flexible (Bricard) 239  
     –, jumping 221  
     colouring of 337, 395  
     construction of 67  
     facets of 281  
     in Piero exercise 119  
     stellations of 261  
     symmetry of 295  
*On Risings* 97  
*Optica* 105  
 orbit-stabiliser theorem 332, 389, 408  
  
 ostrea 168  
  
 papyrus 19  
     –, Moscow 21  
     –, Rhind 20  
 paradox  
     –, Zeno 34  
 parallel postulate 220  
 parameter space 376  
 pentagram 168, 250  
     and incommensurability 31  
     density of 258  
 permutation 398  
*Perspectiva Corporum Regularium* 128,  
     156, 252  
 perspective  
     –, artificial 106, 112  
     –, atmospheric 105, 112  
     –, inverted 110  
     –, linear 111  
     –, natural 106, 111  
     –, reversed 110  
 Petrie polygon 284  
 Petrie–Coxeter polyhedron ► honeycomb  
*Phaenomena* 97  
 pieh-nao 25, 47  
 plane angle ► angle, plane  
*Planisphaerium* 97, 99, 132  
 Platonic solids 2, 9, 51–57, 80, 86, 96,  
     99, 101, 104, 106, 116, 121, 124, 127,  
     130, 132, 141, 148, 153, 174, 181, 259,  
     366, 372, 384, 385, 388, 389, 391, *Fig. 2.3*,  
     ▷ cube,  
     ▷ dodecahedron,  
     ▷ icosahedron,  
     ▷ octahedron,  
     ▷ regular polyhedron,  
     ▷ tetrahedron  
     colouring of 328–329  
     constructions of 66–70  
     cosmic figures 144  
     definition of 76  
     discovery of 70–74  
     edge stellation 249

Platonic solids (*continued*)

enumeration of

Descartes 188

Euclid 75

Euler 196

Poincaré 254

etymology 73

Euler's formula for 190

symmetry of 290

Poincaré formula 254

pole 297

polygon

–, Petrie 284

–, generalised 249

–, infinite 285

–, regular 168

–, simple 284

–, skew 284

–, spherical 184, 199, 228

area of 186

–, star 250

–, star-shaped 368

–, stellated 168

covering number of 250

density of 258

polyhedra

equality of 219, 247

polyhedron

▷ antiprism,

▷ Archimedean solids,

▷ Catalan solids,

▷ compound,

▷ deltahedron,

▷ dipyramid,

▷ Miller's solid,

▷ Platonic solids,

▷ prism,

▷ pyramid,

▷ regular polyhedron,

▷ rhombic polyhedron,

▷ sphenoid,

▷ star polyhedron,

▷ trapezohedron,

▷ uniform polyhedron

–, acoptic 286

–, degenerate 198, 204

–, elementary 86

–, epipedal 286

–, flexible 226, 243

–, impossible 2

–, isogonal ► transitive, vertex

–, isohedral ► transitive, face

–, isotoxal ► transitive, edge

–, quasiregular 391

–, regular-faced 86–92

–, semisolid (Kepler) 150, 173–174

–, shaky 222

–, simple 340

–, simplicial 340

–, star-shaped 368

covering number of 250, 258

croissant 208

cupola 86

definition of 205

Grünbaum 286

Kepler 150

Möbius 209

density of 258

heptahedron 176

koihedron 249

pyritohedron 319, 396

rotunda 86

*Polyhedron Models* 178

polynomial 402

postulate 60

*Practica Geometriae* 121

primitive concept 59

prism 13, 35, 85, 86, 156, 163, 369

ch'i block ► ch'ien-tu

Euler's formula for 190

in *Nine Chapters* 25

symmetry of 293, 301–308

with star polygon base 175

Proclus' theorem 183

proof 10, 29, 354

– by contradiction 30

– by induction 235, 348

–, analytic 100

–, existence 61

–, synthetic 100

- and computers 354
- how to read one 11
- pseudo rhomb-cub-octahedron ► Miller's solid
- pyramid 13, 35, 194,
  - ▷ tetrahedron
  - , Egyptian 17
  - , Giza 1, 18, 21
  - , step 18
  - , visual ► visual pyramid
  - ch'i block ► yang-ma
  - colouring of 331, 334, 396
  - devil's staircase 36
  - Euler's formula for 190
  - in *Nine Chapters* 25
  - symmetry of 292
  - volume of
    - Eudoxus 41
    - Liu Hui 38
  - with star polygon base 251
- pyrite ► crystal, pyrite
- pyritohedron ► polyhedron, pyritohedron
- Pythagoreans 32, 71, 96, 148
  - doctrine 30, 136
  - on music 141
- quadratic equation 402
- quasicrystal 4
- quasiregular ► polyhedron, quasiregular
- Quinque Corporibus Regularibus* 119, 124
- quintic equation 402
- radial projection 199
- radian 183
- radiolarian 5
- reduction 350
- reflection
  - in a plane ► symmetry, reflection
  - in a point ► symmetry, inversion
- regular polyhedron 172, 389,
  - ▷ compound,
  - ▷ honeycomb,
  - ▷ Platonic solids,
  - ▷ skeleton,
  - ▷ star polyhedron
- Cauchy on 259
- Coxeter on 77
- Poinsot on 251
- regular-faced ► polyhedron, regular-faced
- regularity 9, 74, 77, 372
  - and symmetry 366
  - and transitivity 367–372, 385
- Republic* 59, 100
- Rhind mathematical papyrus ► papyrus, Rhind
- rhomb-cub-octahedron 3, 83, 86, 124, 163, 176, 225, 366, 374, 382
- rhomb-icosi-dodecahedron 86, 87, 167, 342
- rhombic polyhedron 151–156, *Fig. 4.11*
  - dodecahedron
    - first kind 5, 83, 151, 319, 391, *Fig. 4.7*
    - second kind 156
  - icosahedron 156
  - rhombohedron 154, 156, 319, *Fig. 4.9*
  - triacontahedron 151, 156, 391, 395, *Fig. 4.7*
- rigidity conjecture 241
- rigidity theorem 228
- rotamer ► isomer, rotational
- rotation ► symmetry, rotation
- semisolid ► polyhedron, semisolid
- shaky ► polyhedron, shaky
- Siamese dodecahedron ► dodecahedron, Siamese
- simple ► polyhedron, simple
- simplicial ► polyhedron, simplicial
- singularity 208
- skeleton 116, 124, 282
  - , regular 284
- small stellated dodecahedron 169, 250, 258, 261, 265, 270, 282, *Fig. 4.16*
  - Escher sketch of 171
- snub cub-octahedron ► snub cube
- snub cube 85, 162, 370, 375
  - chiral 301
  - symmetry of 309
- snub dodecahedron 85, 163
  - symmetry of 311

- snub icosi-dodecahedron ► snub dodecahedron
- snub tetrahedron 85, 375
- solid angle 13, 189, 191, 228
- , right 185
  - , supplementary 185
- deficiency of 181, 185, 215
- measurement of 184
- space
- continuous 33
  - discrete 33
- species ► vertex, species
- sphenoid 237, 371, 385,
- ▷ tetrahedron
- spherical excess formula 186, 199, 217
- sponge ► honeycomb
- stabiliser 388
- star polyhedron 168–173, 203, 233, 256, 258, 311, 327, 367, 372, 385, 389, Pl. 8,9
- enumeration of
- Bertrand 281
  - Cauchy 259
- Steinitz' lemma 235
- stella octangula 124, 152, 169, 261, 362, 372, Pl. 11
- stellation
- , edge 168
  - , face 168, 263
  - main sequence 270
  - Miller's rules for 269
  - nomenclature 269
- stellation pattern 265
- of dodecahedron 266
  - of icosahedron 267
  - of rhombic polyhedra 391
- steradian 184
- stereo-isomer ► isomer, stereo
- striation 301
- Summa de Arithmetica* 122, 402
- summit ► vertex
- suspension 242
- symmetry 289, 290
- breaking 361
  - element 291, 314
  - group
  - notations 406
  - operation 291
  - , abstract 148
  - , algebraic 403
  - , bilateral 300
  - , colour 399
  - , colour-preserving 398
  - , compound 305–308
  - , cubic 308–311
  - , cyclic 292
  - , dihedral 293
  - , direct 290
  - , gauge 397
  - , geometric 148
  - , icosahedral 296, 311–312
  - , indirect 300
  - , octahedral 295
  - , prismatic 301–308
  - , rotation 148, 259
  - , tetrahedral 295
  - , unitary 148
- glide-reflection 306
- identity 291
- inversion 306, 314
- reflection 84, 300
- rotation 290
- systems of 292–300
- rotation-reflection 306, 321
- screw 322
- translation 306
- Tao Te Ching* 40
- tetrahedron 152, 254,
- ▷ Platonic solids,
  - ▷ sphenoid
- ch'i block ► pieh-nao
- colouring of 335, 395
- construction of 66
- facets of (none) 281
- rotating ring of 237
- skeletal form 284
- stellations of (none) 261
- symmetry of 295, 310
- The Comparison of the Five Figures* 96
- The Fifty-nine Icosahedra* 269
- Timaeus* 51, 71, 100, 105, 130

- topology 182, 206  
 totally transitive ► transitive, totally  
 transitive 367  
   –, edge 371  
   –, face 367  
   –, flag 372  
   –, totally 385  
   –, vertex 92, 174, 369,  
     ▷ antiprism,  
     ▷ Archimedean solids,  
     ▷ prism,  
     ▷ uniform polyhedron  
 trapezohedron 367  
   isosceles 302  
   scalene 304  
*Trattato d'Abaco* 119, 122  
 triakis icosahedron ► icosahedron, tri-  
   akis  
 truncated cub-octahedron ► great rhomb-  
   cub-octahedron  
 truncated cube 80, 165, 174, 374, 382  
 truncated dodecahedron 81, 165, 174  
 truncated icosahedron 6, 81, 124, 166  
 truncated icosi-dodecahedron ► great rhomb-  
   icosi-dodecahedron  
 truncated octahedron 124, 165, 374, 382  
   and Lord Kelvin 80  
 truncated tetrahedron 80, 124, 164  
   in Piero exercise 119  
 truncation 80, 124, 194  
 tunnel 207  
 type ► vertex, type  
  
 undefined term 59  
 uniform polyhedron 174–178, 249  
*Unterweysung der Messung* 126, 156  
  
 valence 191, 192  
 vertex 13, 191, 192  
   – figure 77, 251  
   – species 158  
   – type 158  
   deficiency of ► solid angle, deficiency  
 vertex-transitive ► transitive, vertex  
*Vielecke und Vielfache* 237, 267  
 visual pyramid 105, 111, 129  
  
 yang-ma 25