Open-ended Topics for Research Projects

1. 4-Dimensional geometry
2. Abacus
3. Ancient Greece and its mathematicians (or a particular mathematician and his contributions)
4. Mathematics of alternating current
5. Approximating π
6. Bernoulli Brothers
7. Bernoulli numbers
8. The Butterfly Theorem
9. Mathematics of chess
10. Collatz conjecture
11. Combinatorics: pick any combinatorial topic – there are so many to choose from!
12. Complex numbers
13. Computer graphics
14. Constructing regular polygons
15. Continued fractions
16. The cross ratio
17. Cryptography/cryptology (secure connections)
18. The Delian problem
19. DeMoivre’s formula and/or Chebyshev polynomials
20. Diophantine equations
21. Domino tiling problem: if you remove two opposite corners of a chessboard, can you cover what remains with $1 \times 2$ dominoes? This and other similar problems....
22. M.C. Escher
23. Euclid’s *Elements*
24. Euler’s formula: $e^{i\theta} = \cos \theta + i \sin \theta$
25. Euler line
26. Fermat’s last theorem / his “little theorem” / his work in general
27. Fibonacci sequence
28. Flatland (book)
29. Four-color theorem
30. Fractals
31. Gambling (e.g. Blackjack, lotteries, Poker, etc.)
32. Game theory
33. Martin Gardner
34. Golden ratio/golden spiral
35. Graph theory
36. Group theory (fun but may be difficult)
37. Indiana State Legislature’s attempt to make π a rational number
38. Mathematical induction
39. Infinite sets and cardinalities; Georg Cantor
40. Juggling and the mathematics behind the various juggling patterns
41. Klein bottle and Möbius band
42. Knight’s tours
43. Knitting
44. Knot theory
45. Latin squares
46. Lewis Carroll
47. Linear algebra
48. Linear programming
49. Logic & Truth Tables
50. Édouard Lucas
51. Magic squares
52. Math & architecture
53. Monte Carlo methods
54. Morley’s Theorem
55. Music
56. Non-Euclidean geometry
57. Optical illusions
58. Origami
59. Pascal’s Mystical Hexagram
60. Pappus’s Theorem
61. Perfect numbers
62. Clifford Pickover
63. Planiverse (book)
64. Platonic solids
65. Polygonal numbers and centered polygonal numbers
66. Prime numbers
67. Projective geometry and conic sections
68. Rubik’s cube
69. Russell’s paradox
70. The Simson Line
71. Spherical geometry and the flight of the airplane
72. “Squaring the circle”
73. Sudoku
74. Taxicab geometry
75. Tesselations
76. Theodorus of Cyrene
77. Topology
78. Tower of Hanoi puzzle
79. Trisection problem
80. Zero and other numbers - their history, discovery, and more