

The Complete AMC 12

Curated from past competitions • Difficulty-ordered • All major topics

ALGEBRA

1

ALGEBRA

EASY

If $x + y = 4$ and $xy = 3$, what is $x^2 + y^2$?

- A 6
 - B 8
 - C 10
 - D 12
 - E 16
-

2

ALGEBRA

EASY

What is the sum of all real values of x satisfying $|x - 2| = 3$?

- A 1
 - B 4
 - C 5
 - D 7
 - E -1
-

3

ALGEBRA

EASY

If $2^x = 8$ and $3^y = 27$, what is xy ?

- A 6
- B 7
- C 9
- D 12
- E 3

4

ALGEBRA

EASY

The roots of $x^2 - 5x + 6 = 0$ are p and q . What is $p^2 + q^2$?

- A 11
- B 13
- C 12
- D 25
- E 6

5

ALGEBRA

EASY

If $f(x) = 2x^2 - 3x + 1$, what is $f(2)$?

- A 1
- B 3
- C 5
- D 7
- E 9

6

ALGEBRA

MEDIUM

For how many integer values of k does the equation $x^2 + kx + 9 = 0$ have two distinct real roots?

- A 2
- B 4
- C 5
- D 6
- E Infinite

7

ALGEBRA

MEDIUM

If $a + b = 5$, $b + c = 7$, and $a + c = 6$, what is $a + b + c$?

- A 7
- B 8
- C 9
- D 10
- E 6

8

ALGEBRA

MEDIUM

Let $P(x) = x^3 - 2x + 1$. What is $P(-1)$?

- A 0
- B 1
- C 2
- D -2
- E -1

9

ALGEBRA

MEDIUM

The sum of two numbers is 20 and their product is 75. What is the positive difference of the two numbers?

- A 5
- B 10
- C 8
- D 6
- E 4

10

ALGEBRA

MEDIUM

If the equations $x^2 + ax + 1 = 0$ and $x^2 + x + a = 0$ have a common root, which of the following is a possible value of a ?

- A -1
- B 2
- C 0
- D 1
- E 3

11

ALGEBRA

HARD

The polynomial $x^3 + bx + c$ has three distinct real roots, one of which is 2. If the product of the other two roots is -3, what is c ?

- A 6
- B -6
- C 3
- D -3
- E 12

12

ALGEBRA

HARD

If $x^2 - y^2 = 48$ and $x - y = 4$, what is $x + y$?

- A 12
- B 16
- C 10
- D 8
- E 6

13

ALGEBRA

HARD

How many real solutions does $x^4 - 5x^2 + 4 = 0$ have?

- A 1
- B 2
- C 3
- D 4
- E 0

14

ALGEBRA

HARD

For real x , what is the minimum value of $x^2 - 4x + 7$?

- A 1
- B 3
- C 5
- D 7
- E 0

GEOMETRY

15

GEOMETRY

EASY

In a right triangle with legs 5 and 12, what is the length of the hypotenuse?

- A 13
- B 15
- C 17
- D 11
- E 14

16

GEOMETRY

EASY

A circle has area 16π . What is its circumference?

- A 4π
- B 8π
- C 16π
- D 2π
- E 6π

17

GEOMETRY

EASY

Two angles of a triangle are 55° and 75° . What is the third angle?

- A 40°
- B 50°
- C 55°
- D 60°
- E 45°

18

GEOMETRY

MEDIUM

What is the area of an equilateral triangle with side length 6?

- A $9\sqrt{3}$
- B $12\sqrt{3}$
- C $6\sqrt{3}$
- D 18
- E 9

19

GEOMETRY

MEDIUM

A rectangle has perimeter 36 and area 80. What is the length of its diagonal?

- A $\sqrt{162}$
- B $\sqrt{164}$
- C 14
- D $\sqrt{324}$
- E 13

20

GEOMETRY

MEDIUM

In circle O, chord AB has length 8 and is 3 units from the center. What is the radius?

- A 5
- B 4
- C 6
- D $\sqrt{41}$
- E $\sqrt{73}$

21

GEOMETRY

MEDIUM

What is the area of a trapezoid with parallel sides 6 and 10 and height 4?

- A 32
- B 40
- C 24
- D 48
- E 16

22

GEOMETRY

MEDIUM

A regular hexagon has side length 4. What is its area?

- A $24\sqrt{3}$
- B $12\sqrt{3}$
- C 48
- D $16\sqrt{3}$
- E $32\sqrt{3}$

23

GEOMETRY

HARD

Triangle ABC has vertices A(0,0), B(6,0), C(2,4). What is its area?

- A 12
- B 10
- C 8
- D 14
- E 16

24

GEOMETRY

HARD

In right triangle ABC with the right angle at C, $\tan A = 3/4$. What is $\sin A$?

- A $3/5$
- B $4/5$
- C $3/4$
- D $4/3$
- E $1/2$

25

GEOMETRY

HARD

Two circles with radii 5 and 3 have centers 10 apart. How many common external tangent lines do they have?

- A 0
- B 1
- C 2
- D 3
- E 4

26

GEOMETRY

HARD

The diagonal of a cube is $6\sqrt{3}$. What is the cube's volume?

- A 216
- B 64
- C 125
- D 512
- E 343

27

GEOMETRY

HARD

A sector of a circle has radius 6 and central angle 120° . What is the area of the sector?

- A 12π
- B 6π
- C 8π
- D 9π
- E 10π

28

GEOMETRY

HARD

In $\triangle ABC$, $AB=13$, $BC=14$, $CA=15$. What is the area?

- A 84
- B 72
- C 91
- D 78
- E 96

NUMBER THEORY

29

NUMBER THEORY

EASY

What is the greatest common divisor of 48 and 180?

- A 6
- B 12
- C 18
- D 24
- E 36

30

NUMBER THEORY

EASY

How many positive divisors does 36 have?

- A 6
- B 7
- C 8
- D 9
- E 10

31

NUMBER THEORY

MEDIUM

What is the units digit of 7^{53} ?

- A 1
- B 3
- C 7
- D 9
- E 5

32

NUMBER THEORY

MEDIUM

What is the remainder when $100!$ is divided by 103?

- A 0
- B 1
- C 2
- D 100
- E 102

33

NUMBER THEORY

MEDIUM

Find the number of positive integers less than 100 that are divisible by 3 or 5.

- A 40
- B 46
- C 47
- D 53
- E 57

34

NUMBER THEORY

MEDIUM

What is the LCM of 12 and 18?

- A 36
- B 24
- C 72
- D 48
- E 216

35

NUMBER THEORY

HARD

What is the sum of all positive integers n such that n^2 divides 240?

- A 1
- B 5
- C 6
- D 8
- E 13

36

NUMBER THEORY

HARD

How many trailing zeros does $50!$ have?

- A 10
- B 12
- C 13
- D 14
- E 15

37

NUMBER THEORY

HARD

What is the smallest positive integer n such that $2n$ is a perfect square and $3n$ is a perfect cube?

- A 144
- B 72
- C 216
- D 108
- E 324

38

NUMBER THEORY

HARD

How many ordered pairs (a, b) of positive integers satisfy $a + b = 20$ and $\gcd(a, b) = 4$?

- A 1
- B 2
- C 3
- D 4
- E 5

39

NUMBER THEORY

HARD

What is the product of all prime divisors of 360?

- A 15
- B 30
- C 18
- D 10
- E 6

40

NUMBER THEORY

HARD

If p and q are primes with $p < q$ and $p + q = 60$, what is $p \cdot q$?

- A 551
- B 527
- C 391
- D 539
- E 481

COMBINATORICS

41

COMBINATORICS

EASY

In how many ways can 5 books be arranged on a shelf?

- A 20
- B 60
- C 120
- D 24
- E 100

42

COMBINATORICS

EASY

How many ways can a committee of 3 be chosen from 8 people?

- A 24
- B 56
- C 168
- D 336
- E 24

43

COMBINATORICS

MEDIUM

A 3-digit number is formed using digits 1–7 with no repetition. How many such numbers are divisible by 5?

- A 20
- B 30
- C 35
- D 42
- E 15

44

COMBINATORICS

MEDIUM

How many 5-letter strings can be made from the letters {A, B, C, D} if repetition is allowed?

- A 20
- B 256
- C 512
- D 1024
- E 625

45

COMBINATORICS

MEDIUM

In how many ways can you arrange the letters of MISSISSIPPI?

- A 34650
- B 11880
- C 7920
- D 19800
- E 39600

46

COMBINATORICS

MEDIUM

How many ways can 4 boys and 3 girls sit in a row if all girls must sit together?

- A 720
- B 1008
- C 720
- D 144
- E 5040

47

COMBINATORICS

HARD

How many non-negative integer solutions does $x + y + z = 10$ have?

- A 55
- B 66
- C 78
- D 91
- E 105

48

COMBINATORICS

HARD

From a group of 6 men and 4 women, a committee of 4 is selected. In how many ways can the committee have at least 2 women?

- A 105
- B 90
- C 100
- D 115
- E 80

49

COMBINATORICS

HARD

In how many ways can 3 red, 3 blue, and 3 green balls be arranged in a row if no two balls of the same color are adjacent?

- A 252
- B 1680
- C 1260
- D 10
- E 2880

50

COMBINATORICS

HARD

A box contains 5 red and 5 blue marbles. If 3 are drawn without replacement, what is the number of outcomes with exactly 2 red marbles?

- A 40
- B 30
- C 50
- D 25
- E 45

51

COMBINATORICS

HARD

10 points lie on a circle. How many chords can be drawn?

- A 40
- B 45
- C 50
- D 55
- E 35

52

COMBINATORICS

HARD

How many diagonals does a convex polygon with 12 sides have?

- A 54
- B 66
- C 60
- D 72
- E 48

TRIGONOMETRY

53

TRIGONOMETRY

EASY

What is $\sin(30^\circ) + \cos(60^\circ)$?

- A $\frac{1}{2}$
- B 1
- C $\sqrt{2}$
- D $\frac{3}{2}$
- E 0

54

TRIGONOMETRY

EASY

Simplify: $\sin^2\theta + \cos^2\theta$.

- A $\sin 2\theta$
- B 2
- C 0
- D 1
- E $\cos 2\theta$

55

TRIGONOMETRY

MEDIUM

What is the exact value of $\sin(75^\circ)$?

- A $(\sqrt{6} + \sqrt{2})/4$
- B $(\sqrt{6} - \sqrt{2})/4$
- C $(\sqrt{3} + 1)/2$
- D $\sqrt{3}/2$
- E $(\sqrt{2} + 1)/2$

56

TRIGONOMETRY

MEDIUM

If $\sin \theta = 5/13$ and θ is in the first quadrant, what is $\tan \theta$?

- A $5/12$
- B $12/13$
- C $5/13$
- D $12/5$
- E $13/5$

57

TRIGONOMETRY

MEDIUM

In $\triangle ABC$, $a = 7$, $b = 5$, $C = 60^\circ$. What is c ?

- A $\sqrt{39}$
- B $\sqrt{41}$
- C $\sqrt{59}$
- D $\sqrt{61}$
- E $\sqrt{63}$

58

TRIGONOMETRY

MEDIUM

What is the period of $y = 2\sin(3x)$?

- A $\pi/3$
- B $2\pi/3$
- C 2π
- D 3π
- E 6π

59

TRIGONOMETRY

HARD

What is the value of $\cos(\pi/12)$?

- A $(\sqrt{6} + \sqrt{2})/4$
- B $(\sqrt{6} - \sqrt{2})/4$
- C $(\sqrt{3} + \sqrt{2})/4$
- D $(\sqrt{2} + 1)/3$
- E $\sqrt{6}/4$

60

TRIGONOMETRY

HARD

Solve $2\sin^2 x - \sin x - 1 = 0$ for $x \in [0, 2\pi)$. How many solutions are there?

- A 1
- B 2
- C 3
- D 4
- E 0

61

TRIGONOMETRY

HARD

What is $\sin(10^\circ) \cdot \sin(50^\circ) \cdot \sin(70^\circ)$?

- A $1/6$
- B $1/8$
- C $1/4$
- D $1/3$
- E $\sqrt{3}/8$

62

TRIGONOMETRY

HARD

In $\triangle ABC$, using the Law of Sines, if $a/\sin A = 2R$, which of the following is true?

- A R is the inradius
- B R is the circumradius
- C $R = a \cdot \sin A$
- D $R = 1/(2a \cdot \sin A)$
- E $R = a/(\sin A + \sin B)$

PRECALCULUS

63

PRECALCULUS

MEDIUM

What is the sum of an infinite geometric series with first term 6 and common ratio $1/3$?

- A 7
- B 8
- C 9
- D 10
- E 12

64

PRECALCULUS

MEDIUM

What are the asymptotes of $f(x) = (2x+1)/(x-3)$?

- A $x=3, y=2$
- B $x=-\frac{1}{2}, y=3$
- C $x=3, y=-2$
- D $x=-3, y=2$
- E $x=2, y=3$

65

PRECALCULUS

MEDIUM

If $f(x) = x^2$ and $g(x) = x + 1$, what is $f(g(x))$?

- A x^2+1
- B x^2+2x+1
- C $(x+1)^2+x$
- D x^2+x+1
- E $2x^2+1$

66

PRECALCULUS

HARD

The graph of $y = a \cdot b^x$ passes through (0,4) and (2,36). What is b ?

- A 2
- B 3
- C 4
- D 6
- E 9

67

PRECALCULUS

HARD

How many x -intercepts does $f(x) = x^4 - x^2$ have?

- A 1
- B 2
- C 3
- D 4
- E 0

68

PRECALCULUS

HARD

What is the domain of $f(x) = \sqrt{4-x^2}$?

- A $(-2, 2)$
- B $[-2, 2]$
- C $(-\infty, -2] \cup [2, \infty)$
- D all reals
- E $(-2, 2]$

69

PRECALCULUS

HARD

If a parabola has vertex $(2, -3)$ and passes through $(0, 5)$, what is its equation?

- A $y = 2(x-2)^2 - 3$
- B $y = 3(x-2)^2 - 3$
- C $y = 4(x-2)^2 - 3$
- D $y = (x-2)^2 - 3$
- E $y = 2x^2 - 3$

70

PRECALCULUS

HARD

What is the inverse of $f(x) = (3x-1)/(x+2)$?

- A $(2x+1)/(3-x)$
- B $(x+1)/(3x-2)$
- C $(2x-1)/(x+3)$
- D $(x+2)/(3x+1)$
- E $(2x+1)/(x-3)$

SEQUENCES & SERIES

71

SEQUENCES & SERIES

EASY

What is the 10th term of the arithmetic sequence 3, 7, 11, 15, ...?

- A 37
- B 39
- C 41
- D 43
- E 35

72

SEQUENCES & SERIES

MEDIUM

Find the sum of the first 20 terms of the arithmetic sequence 5, 8, 11, ...

- A 620
- B 650
- C 610
- D 640
- E 630

73

SEQUENCES & SERIES

MEDIUM

A geometric sequence has first term 2 and common ratio 3. What is the sum of the first 5 terms?

- A 242
- B 244
- C 240
- D 248
- E 236

74

SEQUENCES & SERIES

MEDIUM

The 4th term of a geometric sequence is 40 and the 7th term is 320. What is the common ratio?

- A 2
- B 3
- C 4
- D $\frac{1}{2}$
- E 5

75

SEQUENCES & SERIES

HARD

What is $1 + 2 + 3 + \dots + 100$?

- A 4950
- B 5000
- C 5050
- D 5100
- E 4900

76

SEQUENCES & SERIES

HARD

The sum of an infinite geometric series is 15 and its first term is 3. What is the common ratio?

- A $3/5$
- B $4/5$
- C $2/5$
- D $1/5$
- E $1/2$

77

SEQUENCES & SERIES

HARD

If $a_n = 3n^2 - 2n + 1$, what is $a_1 + a_2 + a_3$?

- A 30
- B 33
- C 36
- D 39
- E 27

78

SEQUENCES & SERIES

HARD

In an arithmetic sequence, the 5th term is 23 and the 10th term is 48. What is the first term?

- A 1
- B 3
- C 2
- D 5
- E 4

79

COMPLEX NUMBERS

MEDIUM

What is $|3 + 4i|$?

- A 4
- B 5
- C 6
- D 7
- E 3

80

COMPLEX NUMBERS

MEDIUM

What is i^{47} ?

- A 1
- B -1
- C i
- D $-i$
- E 0

81

COMPLEX NUMBERS

MEDIUM

What is $(2+3i)(2-3i)$?

- A $4+9i$
- B $4-9i$
- C 13
- D -5
- E 7

82

COMPLEX NUMBERS

HARD

If $z = 1+i$, what is z^4 ?

- A -4
- B 4
- C $4i$
- D $-4i$
- E 2

83

COMPLEX NUMBERS

HARD

Express $(3-2i)/(1+i)$ in the form $a+bi$.

- A $\frac{1}{2}-5i/2$
- B $\frac{1}{2}+5i/2$
- C $\frac{1}{2}+5i$
- D $-\frac{1}{2}+5i/2$
- E $\frac{5}{2}-i/2$

84

COMPLEX NUMBERS

HARD

How many solutions does $z^2 = -1$ have in the complex numbers?

- A 0
- B 1
- C 2
- D 4
- E Infinite

85

FUNCTIONS

MEDIUM

If $f(x) = 3x - 2$ and $g(x) = x^2$, what is $g(f(2))$?

- A 8
- B 12
- C 16
- D 4
- E 9

86

FUNCTIONS

MEDIUM

What is the inverse of $f(x) = 5x + 3$?

- A $(x-3)/5$
- B $(x+3)/5$
- C $5x-3$
- D $1/(5x+3)$
- E $(x+5)/3$

87

FUNCTIONS

HARD

How many functions $f: \{1,2,3\} \rightarrow \{1,2,3,4\}$ are injective (one-to-one)?

- A 12
- B 18
- C 24
- D 36
- E 48

88

FUNCTIONS

HARD

For $f(x) = x^2$ and $g(x) = \sqrt{x}$ ($x \geq 0$), what is the domain of $f \circ g$?

- A $[0, \infty)$
- B $(0, \infty)$
- C $(-\infty, \infty)$
- D $[-1, 1]$
- E $\emptyset$

89

FUNCTIONS

HARD

Which of the following is an odd function?

- A $f(x) = x^2 + 1$
- B $f(x) = x^3 + x$
- C $f(x) = |x| + 1$
- D $f(x) = x^2 + x$
- E $f(x) = 2x^2$

90

FUNCTIONS

HARD

The function $f(x) = [2x]$ (floor function). What is $f(3/2)$?

- A 1
- B 2
- C 3
- D 0
- E 1.5

PROBABILITY

91

PROBABILITY

EASY

A fair coin is flipped 3 times. What is the probability of getting exactly 2 heads?

- A $1/8$
- B $1/4$
- C $3/8$
- D $1/2$
- E $5/8$

92

PROBABILITY

MEDIUM

A bag has 4 red and 6 blue marbles. Two are drawn without replacement. $P(\text{both red})$?

- A $2/15$
- B $4/25$
- C $1/6$
- D $3/15$
- E $4/15$

93

PROBABILITY

MEDIUM

Rolling two fair dice, what is $P(\text{sum} = 7)$?

- A $1/6$
- B $5/36$
- C $7/36$
- D $1/4$
- E $2/9$

94

PROBABILITY

HARD

$P(A)=0.4$, $P(B)=0.5$, $P(A \cap B)=0.2$. What is $P(A \cup B)$?

- A 0.7
- B 0.6
- C 0.8
- D 0.9
- E 0.5

95

PROBABILITY

HARD

From 5 cards labeled 1–5, two are drawn without replacement. $P(\text{both prime})$?

- A $3/10$
- B $1/5$
- C $2/5$
- D $3/5$
- E $1/10$

LOGS & EXPONENTS

96

LOGS & EXPONENTS

MEDIUM

What is $\log_2(32)$?

- A 3
- B 4
- C 5
- D 6
- E 16

97

LOGS & EXPONENTS

MEDIUM

Simplify: $\log_{10}(100) + \log_{10}(10)$.

- A 3
- B 4
- C 5
- D 2
- E 10

98

LOGS & EXPONENTS

HARD

If $\log_a(b)=3$ and $\log_b(c)=2$, what is $\log_a(c)$?

- A 5
- B 6
- C 8
- D 4
- E 3

99

LOGS & EXPONENTS

HARD

Solve for x: $3^{(2x-1)} = 9^{(x+1)}$.

- A 2
- B 3
- C 4
- D 5
- E 1

What is the value of $\log_2(3) \cdot \log_3(4) \cdot \log_4(8)$?

- A $3/2$
- B 2
- C 3
- D 4
- E 1

Answer Key

1. C	2. B	3. C	4. B	5. B
6. D	7. C	8. C	9. B	10. A
11. A	12. A	13. D	14. B	15. A
16. B	17. B	18. A	19. A	20. A
21. A	22. A	23. A	24. A	25. C
26. A	27. A	28. A	29. B	30. D
31. C	32. A	33. B	34. A	35. D
36. B	37. B	38. D	39. B	40. A
41. C	42. B	43. B	44. D	45. A
46. A	47. B	48. D	49. C	50. C
51. B	52. A	53. B	54. D	55. A
56. A	57. A	58. B	59. A	60. C
61. B	62. B	63. C	64. A	65. B
66. B	67. C	68. B	69. A	70. A
71. B	72. A	73. A	74. A	75. C
76. B	77. B	78. B	79. B	80. D
81. C	82. A	83. A	84. C	85. C
86. A	87. C	88. A	89. B	90. C
91. C	92. A	93. A	94. A	95. A
96. C	97. A	98. B	99. A	100. C