

GRE Mathematics Practice Test 80

Standard-Level Target

English edition / 66 multiple-choice questions

66

Questions

170

Minutes

A–E

One correct choice

Instructions

Choose exactly one answer for each question. Do not use a calculator. Begin timing at Question 1. Use the space provided or separate scratch paper. The answer key follows Question 66; no solutions are included.

Angles are measured in radians. Unless specified otherwise, logarithms are natural, $\mathbb{N} = \{1, 2, 3, \dots\}$, and distances in $\mathbb{R}^n$ are Euclidean. I_n denotes the $n \times n$ identity matrix. Graphs are finite and simple unless stated otherwise.

Difficulty target

A mixed standard-level target, intended to approximate public GRE Mathematics practice in scope and overall demand. This is cycle 15 of 19, position 5 of 5; difficulty decreases within each cycle.

Difficulty labels are editorial targets, not ETS-equated ratings. No official scaled-score conversion is provided.

Coverage

Calculus / 33	Differential and integral calculus, sequences and series, several variables, vector calculus, and differential equations.
Algebra / 17	Elementary and linear algebra, groups, rings, fields, and number theory.
Additional / 16	Probability, statistics, analysis, topology, complex variables, discrete mathematics, and numerical methods.

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This series uses independently written question families and parameter variants. Related mathematical structures recur across forms; these are training forms, not 95 psychometrically independent official exams.

Scope reference: ETS, *GRE Mathematics Test Practice Book*, ETS official practice-book PDF. Questions are not taken from that book. This booklet is not published or endorsed by ETS.

Questions 1–3

1. If $f(x, y) = \log(x^2 + y^2)$, $x = e^{16t} \cos(2t)$, and $y = e^{16t} \sin(2t)$, find d^2f/dt^2 at $t = 1$.

- (A) 0
- (B) 32
- (C) 1024
- (D) 520
- (E) 4

2. What is the dimension of the real vector space of 82×82 symmetric matrices?

- (A) 3403
- (B) 3404
- (C) 3402
- (D) 3401
- (E) 3405

3. What is the maximum of x^2y^{16} over $x, y \geq 0$ subject to $x + y = 1$?

- (A) $18 \left(\left(\frac{2}{18} \right)^2 \left(\frac{16}{18} \right)^{16} \right)$
- (B) $\frac{8}{81}$
- (C) $\left(\frac{2}{18} \right)^{16} \left(\frac{16}{18} \right)^2$
- (D) $\frac{1}{2^{18}}$
- (E) $\left(\frac{2}{18} \right)^2 \left(\frac{16}{18} \right)^{16}$

Questions 4–6

4. A coin success probability p has uniform prior on $[0, 1]$. After observing 32 successes and 2 failures in independent tosses conditional on p , what is the predictive probability of success on the next toss?

- (A) $\frac{23}{24}$
- (B) $\frac{11}{24}$
- (C) $\frac{11}{36}$
- (D) $\frac{11}{12}$
- (E) $\frac{1}{12}$

5. Evaluate $\int_0^{\pi/2} \sin^5 t \cos^{33} t \, dt$.

- (A) $\frac{1}{2} \left(\frac{2! 16!}{2 \cdot 19!} \right)$
- (B) $19 \left(\frac{2! 16!}{2 \cdot 19!} \right)$
- (C) $153 \left(\frac{2! 16!}{2 \cdot 19!} \right)$
- (D) $2 \left(\frac{2! 16!}{2 \cdot 19!} \right)$
- (E) $\frac{2! 16!}{2 \cdot 19!}$

6. Let $A = \begin{bmatrix} 1 & 76 & 0 \\ 0 & 1 & 9 \\ 0 & 0 & 1 \end{bmatrix}$. What is the $(1, 2)$ entry of A^6 ?

- (A) 456
- (B) 454
- (C) 457
- (D) 458
- (E) 455

Questions 7–9

7. Evaluate $\iiint_{x^2+y^2+z^2 \leq 16} (x^2 + y^2 + z^2)^1 dV$.

(A) $\frac{1}{2} \left(\frac{4\pi 16^{\frac{5}{2}}}{5} \right)$

(B) $5 \left(\frac{4\pi 16^{\frac{5}{2}}}{5} \right)$

(C) $\frac{4\pi 16^{\frac{5}{2}}}{5}$

(D) $\frac{5}{48} \left(\frac{4\pi 16^{\frac{5}{2}}}{5} \right)$

(E) $\frac{1}{3} \left(\frac{4\pi 16^{\frac{5}{2}}}{5} \right)$

8. A random variable has mean 0 and variance 32. What upper bound does the Chebyshev inequality give for $P(|X| \geq 64)$?

(A) $\frac{129}{256}$

(B) $\frac{1}{128}$

(C) $\frac{1}{384}$

(D) $\frac{127}{128}$

(E) $\frac{1}{256}$

9. Near $(0, 0)$, $z = z(x, y)$ satisfies $z + 16z^2 = x + 2y$ and $z(0, 0) = 0$. Find $z_{xy}(0, 0)$.

(A) -128

(B) -64

(C) -32

(D) 64

(E) -2

Questions 10–12

10. An invertible 82×82 matrix A has determinant 4. Find $\det(A^T A)$.

- (A) 17
- (B) 16
- (C) 18
- (D) 14
- (E) 15

11. Evaluate $\lim_{x \rightarrow 0} \frac{e^{16x} - \sum_{j=0}^1 (16x)^j / j!}{x^2}$.

- (A) $\frac{1}{2} \left(\frac{16^2}{2!} \right)$
- (B) $-\frac{16^2}{2!}$
- (C) $2 \left(\frac{16^2}{2!} \right)$
- (D) $\frac{1}{16} \left(\frac{16^2}{2!} \right)$
- (E) $\frac{16^2}{2!}$

12. A box is chosen uniformly from two boxes. Box A contains 37 red and 39 blue balls; box B contains 39 red and 37 blue balls. One ball is drawn and is red. What is the conditional probability that A was chosen?

- (A) $\frac{113}{152}$
- (B) $\frac{37}{228}$
- (C) $\frac{37}{76}$
- (D) $\frac{39}{76}$
- (E) $\frac{37}{152}$

Questions 13–15

- 13.** Let C be $x^2/4 + y^2 = 1$, oriented counterclockwise. Evaluate $\int_C (-y) dx + (16x) dy$.
- (A) -34π
(B) 68π
(C) 17π
(D) $1 + 34\pi$
(E) 34π
- 14.** On the space P_{83} of real polynomials of degree at most 83, define $T(p) = p'$. What is the rank of T ?
- (A) 85
(B) 81
(C) 82
(D) 84
(E) 83
- 15.** Find the coefficient of x^2 in $e^{1x} \log(1 + 16x)$.
- (A) -128
(B) -112
(C) -96
(D) -224
(E) 112

Questions 16–18

16. Let $X_1, \dots, X_{37}$ be independent uniform random variables on $[0, 1]$. What is $E[\max_i X_i]$?

- (A) $\frac{75}{76}$
- (B) $\frac{1}{38}$
- (C) $\frac{37}{76}$
- (D) $\frac{37}{114}$
- (E) $\frac{37}{38}$

17. For the curve $x = t^2$, $y = t^3 + 16t$, find d^2y/dx^2 at $t = 1$.

- (A) $\frac{19}{2}$
- (B) $\frac{19}{4}$
- (C) -8
- (D) $-\frac{13}{4}$
- (E) $-\frac{13}{2}$

18. Subspaces U, V of $\mathbb{R}^{84}$ have dimensions 4 and 5. What is the largest possible value of $\dim(U \cap V)$?

- (A) 3
- (B) 4
- (C) 5
- (D) 2
- (E) 6

Questions 19–21

19. The region $0 \leq x \leq 1$, $0 \leq y \leq 16x^2$ is revolved about the x -axis. Find its volume.

- (A) $-\frac{256\pi}{5}$
- (B) $\frac{128\pi}{5}$
- (C) $1 + \frac{256\pi}{5}$
- (D) $\frac{256\pi}{5}$
- (E) $\frac{512\pi}{5}$

20. Independent trials have success probability $1/37$. Let T count trials up to and including the first success. Find $E[T]$.

- (A) 37
- (B) 13
- (C) 49
- (D) 61
- (E) 25

21. For $D = \{(x, y) : x^2 + y^2 \leq 16\}$, evaluate $\iint_D (x^2 + y^2)^1 dA$.

- (A) $\frac{256\pi}{3}$
- (B) 128π
- (C) 64π
- (D) 256π
- (E) 8π

Questions 22–24

22. Let V consist of real polynomials of degree at most 7 that vanish at 76, 77, and 79. Find $\dim V$.

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

23. Let $f(x, y) = x^2 + 32xy + (258)y^2$. What is the product of the eigenvalues of the Hessian of f ?

- (A) 4
- (B) 2
- (C) 1032
- (D) 8
- (E) 258

24. A continuous $f : \mathbb{R} \rightarrow \mathbb{R}$ satisfies $f(q) = q^{2^7}$ for every rational q . Find $f(2)$.

- (A) 2^{2^7}
- (B) 2^{2^6}
- (C) 2^{30}
- (D) 2^{28}
- (E) 2^{29}

Questions 25–27

25. Let $f(x) = \log(1 + 16x)$. Find $f^{(2)}(0)$.

- (A) $\frac{1}{16} \left((-1)^1 1! 16^2 \right)$
- (B) $-(-1)^1 1! 16^2$
- (C) $(-1)^1 1! 16^2$
- (D) $2 \left((-1)^1 1! 16^2 \right)$
- (E) $\frac{1}{2} \left((-1)^1 1! 16^2 \right)$

26. The roots r, s of $x^2 - 85x + 684 = 0$ are counted with multiplicity. Find $r^2 + s^2$.

- (A) 5855
- (B) 5856
- (C) 5857
- (D) 5859
- (E) 5858

27. For $f(x, y) = x^2 + 16xy + 2y^2$, what is its maximum directional derivative at $(1, -1)$?

- (A) $2\sqrt{85}$
- (B) 26
- (C) 340
- (D) -14
- (E) 12

Questions 28–30

28. Find the radius of convergence of $\sum_{k=1}^{\infty} k^{27} x^k / 27^k$.

- (A) 27
- (B) 18
- (C) 9
- (D) 36
- (E) 45

29. Evaluate $\lim_{x \rightarrow 0} (1 + 16x)^{1/(1x)}$.

- (A) e^{17}
- (B) e^{16}
- (C) 16
- (D) e^{256}
- (E) $e^{\frac{1}{16}}$

30. For real t , let $M(t) = \begin{pmatrix} t - 76 & 9 & 0 \\ 0 & t - 76 & 1 \\ 0 & 0 & t - 76 \end{pmatrix}$. At $t = 76$, what is $\text{rank } M(t)$?

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

Questions 31–33

31. If $y' + 16y = 2e^{-16x}$ and $y(0) = 6$, find $y(1)$.

- (A) $\frac{16}{e^{16}}$
- (B) $\frac{8}{e^{16}} + 1$
- (C) $-\frac{8}{e^{16}}$
- (D) $\frac{4}{e^{16}}$
- (E) $\frac{8}{e^{16}}$

32. On $[0, 1]$, f is 27 on rationals and $1/27$ on irrationals. Find its upper Darboux integral minus its lower Darboux integral.

- (A) $\frac{728}{27}$
- (B) $\frac{782}{27}$
- (C) $\frac{1456}{27}$
- (D) $\frac{364}{27}$
- (E) $\frac{755}{27}$

33. Let $F(x) = \int_0^{x^2} e^{16t} dt$. Find $F'(1)$.

- (A) $\frac{e^{16}}{2}$
- (B) e^{32}
- (C) $2e^{16}$
- (D) $32e^{16}$
- (E) e^{16}

Questions 34–36

34. Let $u = (15, 2)^T$ and $v = (1, 0)^T$. Find the squared norm of the orthogonal projection of v onto $\text{span}(u)$.

- (A) $\frac{1137}{458}$
- (B) $\frac{679}{458}$
- (C) $\frac{225}{229}$
- (D) $\frac{229}{454}$
- (E) $\frac{221}{458}$

35. Evaluate $\int_0^1 \int_x^1 16y^2 \, dy \, dx$.

- (A) 2
- (B) 4
- (C) 8
- (D) $\frac{4}{3}$
- (E) $\frac{16}{3}$

36. A set with 27 elements has the discrete topology. How many of its subsets are simultaneously open and closed?

- (A) 2^{30}
- (B) 2^{29}
- (C) 2^{28}
- (D) 2^{26}
- (E) 2^{27}

Questions 37–39

37. Find the total outward flux of $\mathbf{F} = (16x^2, y^2, z^2)$ through the boundary of $[0, 1]^3$.

- (A) 19
- (B) 36
- (C) 9
- (D) -18
- (E) 18

38. An idempotent 82×82 real matrix P has rank 5. What is $\text{tr } P$?

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

39. Evaluate $\int_0^1 \frac{x^1}{1 + 16x^2} dx$.

- (A) $\frac{\log(17)}{2}$
- (B) $\frac{\log(17)}{16}$
- (C) $-\frac{\log(17)}{32}$
- (D) $\log(17)$
- (E) $\frac{\log(17)}{32}$

Questions 40–42

40. Let $\zeta = e^{2\pi i/24}$. Find $\sum_{k=0}^{23} \zeta^k$.

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

41. Find the arc length of $r(t) = (16t, 2t)$ for $0 \leq t \leq 1$.

- (A) $1 + 2\sqrt{65}$
- (B) $2\sqrt{65}$
- (C) $4\sqrt{65}$
- (D) $\sqrt{65}$
- (E) $-2\sqrt{65}$

42. For $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$ and $b = \begin{bmatrix} 76 \\ 9 \\ 85 \end{bmatrix}$, let x minimize $\|Ax - b\|^2$. Find x_2 .

- (A) 7
- (B) 11
- (C) 8
- (D) 9
- (E) 10

Questions 43–45

43. Find the directional derivative of $f(x, y, z) = x^2 + 16y^2 + 2z^2$ at $(1, 1, 1)$ in the direction $(1, 6, 0)$.

- (A) $-\frac{194\sqrt{37}}{37}$
- (B) $\frac{97\sqrt{37}}{37}$
- (C) $\frac{194\sqrt{37}}{37}$
- (D) $1 + \frac{194\sqrt{37}}{37}$
- (E) $\frac{388\sqrt{37}}{37}$

44. An analytic function has real part $u(x, y) = x^2 - y^2 + 22x$ and satisfies $f(0) = 0$. Find $\text{Im } f(1 + i)$.

- (A) 24
- (B) 16
- (C) 32
- (D) 8
- (E) 40

45. For $x > 0$, $x^2y'' + (1 - 18)xy' + 32y = 0$, $y(1) = 0$, $y'(1) = 16$. Find $y(e)$.

- (A) $-\frac{8(1 - e^{14})e^2}{7}$
- (B) $-e^2 + e^{16}$
- (C) $\frac{8(1 - e^{14})e^2}{7}$
- (D) $\frac{e^{16}}{18}$
- (E) $e^2 + e^{16}$

Questions 46–48

46. What is the coefficient of x^2 in $(x + 15)^4$?

- (A) 1352
- (B) 1351
- (C) 1350
- (D) 1349
- (E) 1348

47. Evaluate $\int_0^{\log 2} e^x(e^x + 16)^2 dx$.

- (A) $18^2 - 17^2$
- (B) $\frac{18^3 - 17^3}{3}$
- (C) $-\frac{18^3 - 17^3}{3}$
- (D) $\frac{18^3}{3}$
- (E) $3\left(\frac{18^3 - 17^3}{3}\right)$

48. What is the coefficient of x^2 in $(1 + 2x)^{32}$?

- (A) 662
- (B) 1323
- (C) 3306
- (D) 1984
- (E) 2645

Questions 49–51

49. Two solutions of $y'' + 16x^1y' + 2y = 0$ have Wronskian $W(0) = 1$. Find $W(1)$.

- (A) $e^{-8} + 1$
- (B) $-\frac{1}{e^8}$
- (C) $\frac{2}{e^8}$
- (D) e^{-8}
- (E) $\frac{1}{2e^8}$

50. How many elements z of $\mathbb{F}_{2^{16}}$ satisfy $z^2 = z$?

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

51. For $y' = 16y(1 - y/2)$, what is the derivative of the right-hand side with respect to y at the positive equilibrium?

- (A) 16
- (B) -15
- (C) -8
- (D) -32
- (E) -16

Questions 52–54

52. How many edges does the complete bipartite graph $K_{32,34}$ have?

- (A) 726
- (B) 1812
- (C) 1088
- (D) 364
- (E) 1450

53. The solution of $y' = 16x^2y^2$ has $y(0) = 1/17$. Find $y(1)$.

- (A) $\frac{6}{35}$
- (B) $-\frac{3}{35}$
- (C) $\frac{3}{70}$
- (D) $\frac{3}{35}$
- (E) $\frac{38}{35}$

54. How many generators does the cyclic group of order 47 have?

- (A) 47
- (B) 45
- (C) 46
- (D) 48
- (E) 44

Questions 55–57

55. Evaluate $\int_0^1 \int_0^x x^{16} y^2 \, dy \, dx$.

- (A) $\frac{1}{60}$
- (B) $\frac{1}{20}$
- (C) $\frac{1}{51}$
- (D) $\frac{1}{80}$
- (E) $\frac{1}{57}$

56. How many functions from a set of 37 elements onto a set of 2 elements exist?

- (A) $2^{37} - 3$
- (B) 2^{36}
- (C) $2^{37} - 2$
- (D) 2^{37}
- (E) $2^{37} - 1$

57. Evaluate $\int_C (2x + 16y) \, dx + (16x + 2y) \, dy$, where C is the line segment from $(0, 0)$ to $(6, 1)$.

- (A) 133
- (B) 134
- (C) 266
- (D) -133
- (E) $\frac{133}{2}$

Questions 58–60

58. Let $R = (\mathbb{Z}/80\mathbb{Z})/([16])$, where $([16])$ is the ideal generated by $[16]$. How many elements does R have?

- (A) 14
- (B) 16
- (C) 18
- (D) 15
- (E) 17

59. Find the upward flux of $\mathbf{F} = (0, 0, z)$ through $z = 16x^2 + 2y^2$, $0 \leq x, y \leq 1$.

- (A) 6
- (B) 3
- (C) -6
- (D) 7
- (E) 12

60. How many nonnegative integer triples (a, b, c) satisfy $a + b + c = 37$?

- (A) 247
- (B) 1235
- (C) 494
- (D) 988
- (E) 741

Questions 61–63

61. Let C be the unit circle $x^2 + y^2 = 1$, $z = 2$, counterclockwise viewed from above. Evaluate $\int_C -16y(x^2 + y^2) dx + (16x(x^2 + y^2)) dy$.

- (A) -32π
- (B) $1 + 32\pi$
- (C) 64π
- (D) 32π
- (E) 16π

62. What is the largest integer k such that 2^k divides $85!$?

- (A) 82
- (B) 83
- (C) 81
- (D) 80
- (E) 79

63. Evaluate $\sum_{j=0}^{\infty} \frac{1}{(16 + 2j)(18 + 2j)}$.

- (A) $\frac{1}{18}$
- (B) $\frac{1}{2}$
- (C) $\frac{1}{32}$
- (D) $\frac{1}{16}$
- (E) $\frac{1}{8}$

Questions 64–66

64. A tree has 41 vertices. What is the sum of its vertex degrees?

- (A) 54
- (B) 80
- (C) 28
- (D) 132
- (E) 106

65. Evaluate $\int_0^1 x^{16}(1-x)^1 dx$.

- (A) $\frac{1}{2} \left(\frac{16! 1!}{18!} \right)$
- (B) $18 \left(\frac{16! 1!}{18!} \right)$
- (C) $17 \left(\frac{16! 1!}{18!} \right)$
- (D) $\frac{16! 1!}{18!}$
- (E) $9 \left(\frac{16! 1!}{18!} \right)$

66. In the ring $\mathbb{Z}/480\mathbb{Z}$, how many elements are units?

- (A) 130
- (B) 126
- (C) 129
- (D) 127
- (E) 128

Answer Key

Practice Test 80 / Questions 1–66

Question	Answer	Question	Answer	Question	Answer
1	A	23	D	45	A
2	A	24	A	46	C
3	E	25	C	47	B
4	D	26	C	48	D
5	E	27	A	49	D
6	A	28	A	50	B
7	C	29	B	51	E
8	B	30	B	52	C
9	B	31	E	53	D
10	B	32	A	54	C
11	E	33	C	55	A
12	C	34	C	56	C
13	E	35	B	57	A
14	E	36	E	58	B
15	B	37	E	59	A
16	E	38	D	60	E
17	D	39	E	61	D
18	B	40	D	62	C
19	D	41	B	63	C
20	A	42	D	64	B
21	B	43	C	65	D
22	D	44	A	66	E

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