

GRE Mathematics Practice Test 74

Bridge to Standard

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 bridge toward standard practice, with routine multi-step questions and a smaller number of challenging concepts. This is cycle 14 of 19, position 4 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. The solution of $y' = 15x^2y^2$, $y(0) = 1$, has its first positive singularity at which x ?

- (A) $\frac{10^{\frac{2}{3}}}{10}$
- (B) $\frac{5^{\frac{2}{3}}}{5}$
- (C) $\sqrt[3]{5}$
- (D) $\frac{15^{\frac{2}{3}}}{15}$
- (E) $\frac{1}{5}$

2. Let $u = (14, 3)^T$ and $v = (1, 0)^T$. Find the squared norm of the orthogonal projection of v onto $\text{span}(u)$.

- (A) $\frac{1007}{410}$
- (B) $\frac{401}{205}$
- (C) $\frac{196}{205}$
- (D) $\frac{597}{410}$
- (E) $\frac{187}{410}$

3. For which positive integer m does $\sum_{j=2}^{\infty} \frac{(-1)^j(x-15)^j}{j^{\frac{2}{3}}(\log j)^m}$ converge absolutely at $x = 14$? Give the least such m , or 0 if none exists.

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

Questions 4–6

4. X, Y are independent, with variances 31 and 32. Find $\text{Cov}(X + 2Y, 3X - Y)$.
- (A) 29
(B) 47
(C) 38
(D) 11
(E) 20
5. Let $f(x, y) = x^2 + 30xy + (228)y^2$. What is the product of the eigenvalues of the Hessian of f ?
- (A) 3
(B) 6
(C) 12
(D) 228
(E) 912
6. An idempotent 76×76 real matrix P has rank 3. What is $\text{tr } P$?
- (A) 4
(B) 5
(C) 3
(D) 2
(E) 1

Questions 7–9

7. The solution of $y' = 15x^3y^2$ has $y(0) = 1/16$. Find $y(1)$.

- (A) $\frac{4}{49}$
- (B) $\frac{53}{49}$
- (C) $-\frac{4}{49}$
- (D) $\frac{8}{49}$
- (E) $\frac{2}{49}$

8. X has density cx^{31} on $0 < x < 1$ and zero elsewhere. Find the normalizing constant c .

- (A) 42
- (B) 32
- (C) 22
- (D) 52
- (E) 12

9. If $y' = 15y$, $y(0) = 1$, what is the coefficient of x^3 in the Maclaurin series of y ?

- (A) $-\frac{1125}{2}$
- (B) $\frac{1125}{2}$
- (C) $\frac{1127}{2}$
- (D) 1125
- (E) $\frac{1125}{4}$

Questions 10–12

10. For $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$ and $b = \begin{bmatrix} 70 \\ 10 \\ 80 \end{bmatrix}$, let x minimize $\|Ax - b\|^2$. Find x_2 .

- (A) 8
- (B) 11
- (C) 12
- (D) 9
- (E) 10

11. For $\mathbf{F} = (15x^3, y^3, z^3)$, find $\nabla \cdot \mathbf{F}$ at $(1, 2, 1)$.

- (A) 60
- (B) 120
- (C) 30
- (D) 61
- (E) -60

12. Independent exponential waiting times X, Y have rates 31 and 33. Find $P(X < Y)$.

- (A) $\frac{31}{192}$
- (B) $\frac{33}{64}$
- (C) $\frac{31}{128}$
- (D) $\frac{31}{64}$
- (E) $\frac{95}{128}$

Questions 13–15

13. Let $F(x) = \int_0^x (x - t)^2 e^{15t} dt$. Find $F^{(3)}(0)$.

- (A) $\frac{1}{2}$
- (B) 30
- (C) 0
- (D) 6
- (E) 2

14. What is the coefficient of x^3 in $(x + 14)^5$?

- (A) 1961
- (B) 1959
- (C) 1962
- (D) 1960
- (E) 1958

15. For $T = \{x, y, z \geq 0 : x + y + z \leq 1\}$, evaluate $\iiint_T x^{15} y^2 dV$.

- (A) $\frac{15! 2!}{20!}$
- (B) $\frac{1}{6} \left(\frac{15! 2!}{20!} \right)$
- (C) $\frac{1}{48}$
- (D) $20 \left(\frac{15! 2!}{20!} \right)$
- (E) $6 \left(\frac{15! 2!}{20!} \right)$

Questions 16–18

16. $X_1, \dots, X_{31}$ are independent with common mean and variance 33. With $\bar{X}$ their sample mean, find $E[\sum_i (X_i - \bar{X})^2]$.

- (A) 1320
- (B) 660
- (C) 330
- (D) 1650
- (E) 990

17. For $f(x) = x^3 e^{15x}$, find $f^{(5)}(0)$.

- (A) $\frac{2}{15} \left(\frac{5! 15^2}{2} \right)$
- (B) $\frac{5! 15^2}{2}$
- (C) $\frac{1}{20} \left(\frac{5! 15^2}{2} \right)$
- (D) $\frac{1}{60} \left(\frac{5! 15^2}{2} \right)$
- (E) $2 \left(\frac{5! 15^2}{2} \right)$

18. A matrix A satisfies $(A - 71I)(A - 73I) = 0$, and its minimal polynomial has degree two. If $A^2 = uA + vI$, find u .

- (A) 144
- (B) 146
- (C) 145
- (D) 143
- (E) 142

Questions 19–21

19. Let C be $x^2/9 + y^2 = 1$, oriented counterclockwise. Evaluate $\int_C (-y) dx + (15x) dy$.
- (A) 96π
(B) 48π
(C) 24π
(D) -48π
(E) $1 + 48\pi$
20. A permutation of 33 objects is chosen uniformly. Let Z be the number of fixed points. Find $E[Z]$.
- (A) 3
(B) 1
(C) 2
(D) 4
(E) 0
21. The region $0 \leq x \leq 1$, $0 \leq y \leq 15x^3$ is revolved about the x -axis. Find its volume.
- (A) $-\frac{225\pi}{7}$
(B) $1 + \frac{225\pi}{7}$
(C) $\frac{450\pi}{7}$
(D) $\frac{225\pi}{7}$
(E) $\frac{225\pi}{14}$

Questions 22–24

22. Let $V = \begin{bmatrix} 1 & 70 & 4900 \\ 1 & 72 & 5184 \\ 1 & 75 & 5625 \end{bmatrix}$. Find $\det V$.

- (A) 30
- (B) 28
- (C) 32
- (D) 31
- (E) 29

23. Find the upward flux of $\mathbf{F} = (0, 0, z)$ through $z = 15x^2 + 3y^2$, $0 \leq x, y \leq 1$.

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

24. Which subset of $\mathbb{R}$ is compact, with 26 fixed as displayed?

- (A) $26\mathbb{Z}$
- (B) $\{26/k : k \geq 1\}$
- (C) $\mathbb{Q} \cap [0, 26]$
- (D) $(0, 26)$
- (E) $\{0\} \cup \{26/k : k \geq 1\}$

Questions 25–27

25. For $y' = 15y(1 - y/3)$, what is the derivative of the right-hand side with respect to y at the positive equilibrium?

- (A) -14
- (B) -30
- (C) 15
- (D) -15
- (E) $-\frac{15}{2}$

26. Let $u = (1, 2, \dots, 76)^T$, $v = (1, 1, \dots, 1)^T$, and $B = I + uv^T$. Find $\det B$.

- (A) 2925
- (B) 2928
- (C) 2926
- (D) 2929
- (E) 2927

27. Find the total outward flux of $\mathbf{F} = (15x^3, y^3, z^3)$ through the boundary of $[0, 1]^3$.

- (A) $\frac{17}{2}$
- (B) 18
- (C) 17
- (D) -17
- (E) 34

Questions 28–30

28. For $a_k = (-1)^k + 26/k$, find $\limsup_{k \rightarrow \infty} a_k - \liminf_{k \rightarrow \infty} a_k$.

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

29. Let $F(x) = \int_0^{x^3} e^{15t} dt$. Find $F'(1)$.

- (A) e^{45}
- (B) $45e^{15}$
- (C) $\frac{e^{15}}{3}$
- (D) $3e^{15}$
- (E) e^{15}

30. Let D be a diagonal 76×76 real matrix with distinct diagonal entries. What is the dimension of the space of matrices X satisfying $XD = DX$?

- (A) 75
- (B) 74
- (C) 78
- (D) 77
- (E) 76

Questions 31–33

31. Solve $y'' - 33y' + 270y = 0$ with $y(0) = 1$, $y'(0) = 0$. Find $y(1)$.

- (A) $(-6 + 5e^3)e^{15}$
- (B) $\frac{(6 - 5e^3)e^{15}}{2}$
- (C) $(6 - 5e^3)e^{15} + 1$
- (D) $(12 - 10e^3)e^{15}$
- (E) $(6 - 5e^3)e^{15}$

32. For which real a is $f(x) = x^a$ in $L^{26}(0, 1)$?

- (A) All real a
- (B) $a > 0$
- (C) $a < 1/26$
- (D) $a > -1/26$
- (E) $a \geq -1/26$

33. Evaluate $\sum_{j=0}^{\infty} \frac{1}{(15 + 3j)(18 + 3j)}$.

- (A) $\frac{1}{15}$
- (B) $\frac{1}{45}$
- (C) $\frac{1}{18}$
- (D) $\frac{1}{3}$
- (E) $\frac{1}{5}$

Questions 34–36

34. What is the remainder when $x^2 + 1$ is divided by $x - 71$?

- (A) 5041
- (B) 5044
- (C) 5043
- (D) 5042
- (E) 5040

35. Evaluate $\int_0^1 \frac{x^2}{1 + 15x^3} dx$.

- (A) $-\frac{4 \log(2)}{45}$
- (B) $\log(16)$
- (C) $\frac{4 \log(2)}{45}$
- (D) $\frac{4 \log(2)}{3}$
- (E) $\frac{4 \log(2)}{15}$

36. $T : \mathbb{R} \rightarrow \mathbb{R}$ has Lipschitz constant at most $1/26$. If $x_1 = T(x_0)$ and $|x_1 - x_0| \leq 1$, what is the sharp upper bound on $|T^3(x_0) - x_*|$, where x_* is its fixed point?

- (A) $\frac{1}{16900}$
- (B) $\frac{1}{33800}$
- (C) $\frac{1}{16901}$
- (D) $\frac{1}{16899}$
- (E) $\frac{1}{50700}$

Questions 37–39

37. Evaluate $\int_0^{\log 2} e^x(e^x + 15)^3 dx$.

- (A) $17^3 - 16^3$
- (B) $-\frac{17^4 - 16^4}{4}$
- (C) $\frac{17^4}{4}$
- (D) $\frac{17^4 - 16^4}{4}$
- (E) $4 \left(\frac{17^4 - 16^4}{4} \right)$

38. Let $P = \text{diag}(\underbrace{1, \dots, 1}_4, \underbrace{0, \dots, 0}_{73})$. What is the dimension of the space of 77×77 real matrices X satisfying $PX = X$?

- (A) 309
- (B) 306
- (C) 308
- (D) 310
- (E) 307

39. Two solutions of $y'' + 15x^1y' + 3y = 0$ have Wronskian $W(0) = 1$. Find $W(1)$.

- (A) $\frac{1}{2e^{\frac{15}{2}}}$
- (B) $\frac{2}{e^{\frac{15}{2}}}$
- (C) $e^{-\frac{15}{2}}$
- (D) $-\frac{1}{e^{\frac{15}{2}}}$
- (E) $e^{-\frac{15}{2}} + 1$

Questions 40–42

40. How many zeros, counted with multiplicity, does $z^{21} + 24z + 1$ have in $|z| < 1$?

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

41. Near $(0, 0)$, $z = z(x, y)$ satisfies $z + 15z^2 = x + 3y$ and $z(0, 0) = 0$. Find $z_{xy}(0, 0)$.

- (A) -3
- (B) -45
- (C) -30
- (D) 90
- (E) -90

42. A 3×3 matrix A has characteristic polynomial $(t - 70)(t + 1)(t - 2)$. What is $\text{tr}(A^2)$?

- (A) 4904
- (B) 4905
- (C) 4906
- (D) 4907
- (E) 4903

Questions 43–45

43. A lamina occupies $0 \leq x \leq 1$, $0 \leq y \leq 15x$ and has density $\rho(x, y) = x$. Find its centroid coordinate $\bar{x}$.

- (A) $\frac{3}{8}$
- (B) $\frac{3}{4}$
- (C) $\frac{3}{2}$
- (D) $\frac{7}{4}$
- (E) $-\frac{3}{4}$

44. A meromorphic function has 23 zeros and 2 poles inside a positively oriented simple closed contour, counted with multiplicity, and no zeros or poles on it. Find $\frac{1}{2\pi i} \int f'(z)/f(z) dz$.

- (A) 14
- (B) 7
- (C) 28
- (D) 21
- (E) 35

45. Evaluate $\int_0^1 \int_x^1 15y^3 dy dx$.

- (A) $\frac{15}{2}$
- (B) 5
- (C) $\frac{3}{4}$
- (D) 3
- (E) $\frac{15}{4}$

Questions 46–48

46. In the additive group $\mathbb{Z}/102\mathbb{Z}$, find the order of $[2]$.

- (A) 53
- (B) 49
- (C) 50
- (D) 51
- (E) 52

47. Evaluate $\int_0^{\pi/2} \sin^7 t \cos^{31} t \, dt$.

- (A) $816 \left(\frac{3! 15!}{2 \cdot 19!} \right)$
- (B) $\frac{1}{2} \left(\frac{3! 15!}{2 \cdot 19!} \right)$
- (C) $2 \left(\frac{3! 15!}{2 \cdot 19!} \right)$
- (D) $\frac{3! 15!}{2 \cdot 19!}$
- (E) $19 \left(\frac{3! 15!}{2 \cdot 19!} \right)$

48. Let $F_0 = 0$, $F_1 = 1$, and $F_{k+2} = F_{k+1} + F_k$. How many binary strings of length 31 have no adjacent 1s?

- (A) F_{32}
- (B) F_{33}
- (C) F_{34}
- (D) F_{31}
- (E) F_{35}

Questions 49–51

49. For the curve $x = t^3$, $y = t^4 + 15t$, find d^2y/dx^2 at $t = 1$.

- (A) -5
- (B) $-\frac{26}{3}$
- (C) $-\frac{26}{9}$
- (D) $\frac{34}{9}$
- (E) $\frac{19}{3}$

50. How many invertible 2×2 matrices over $\mathbb{F}_{43}$ are there with determinant 1?

- (A) $\frac{(43^2 - 43^0)(43^2 - 43^0)}{42}$
- (B) $\frac{(43^2 - 43^1)(43^2 - 43^2)}{42}$
- (C) $\frac{(43^2 - 43^0)(43^2 - 43^1)}{42}$
- (D) $\frac{43^2 43^2}{42}$
- (E) $\frac{(43^2 - 43^0)}{42}$

51. Evaluate $\int_0^\infty x^3 e^{-15x} dx$.

- (A) $15 \left(\frac{3!}{15^4} \right)$
- (B) $50625 \left(\frac{3!}{15^4} \right)$
- (C) $\frac{1}{15} \left(\frac{3!}{15^4} \right)$
- (D) $\frac{3!}{15^4}$
- (E) $\frac{1}{3} \left(\frac{3!}{15^4} \right)$

Questions 52–54

52. Apply one Newton iteration to solve $x^2 - 31 = 0$, starting at $x_0 = 1$. What is x_1 ?

- (A) 26
- (B) 6
- (C) 16
- (D) 21
- (E) 11

53. Evaluate $\lim_{x \rightarrow 0} (1 + 15x)^{1/(2x)}$.

- (A) $e^{\frac{2}{15}}$
- (B) 15
- (C) e^{16}
- (D) $e^{\frac{15}{2}}$
- (E) e^{225}

54. How many permutations in S_{76} consist of one 4-cycle and 72 fixed points?

- (A) $2 \cdot 3 \cdot 5^3 \cdot 19 \cdot 37 \cdot 73$
- (B) $2 \cdot 3^2 \cdot 5^2 \cdot 19 \cdot 37 \cdot 73$
- (C) $2^2 \cdot 3 \cdot 5^2 \cdot 19 \cdot 37 \cdot 73$
- (D) $3 \cdot 5^2 \cdot 19 \cdot 37 \cdot 73$
- (E) $2 \cdot 3 \cdot 5^2 \cdot 19 \cdot 37 \cdot 73$

Questions 55–57

55. Find the curvature at $t = 0$ of $r(t) = (3t, 15t^2)$.

- (A) $\frac{20}{3}$
- (B) $\frac{13}{3}$
- (C) $\frac{10}{3}$
- (D) $\frac{5}{3}$
- (E) $-\frac{10}{3}$

56. Bisection starts with an interval of length 2^{31} . After 33 interval halvings, what is the maximum distance from the final midpoint to a root remaining in the interval?

- (A) $\frac{1}{8}$
- (B) $\frac{1}{24}$
- (C) $\frac{9}{16}$
- (D) $\frac{7}{8}$
- (E) $\frac{1}{16}$

57. Evaluate $\int_C (3x^2 + 15y) dx + (15x + 3y^2) dy$, where C is the line segment from $(0, 0)$ to $(5, 1)$.

- (A) 201
- (B) 202
- (C) $\frac{201}{2}$
- (D) -201
- (E) 402

Questions 58–60

58. How many subgroups does the cyclic group of order 888 have?

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

59. Find the coefficient of x^3 in the Taylor series of $(1 - 15x)^{-2}$ at zero.

- (A) $-4 \cdot 15^3$
- (B) $4 \cdot 15^3$
- (C) $\frac{1}{4} (4 \cdot 15^3)$
- (D) $\frac{3}{4} (4 \cdot 15^3)$
- (E) $\frac{1}{15} (4 \cdot 15^3)$

60. What is the least positive multiplicative inverse of 2 modulo 63?

- (A) 52
- (B) 12
- (C) 32
- (D) 42
- (E) 22

Questions 61–63

61. Evaluate $\iiint_{x^2+y^2+z^2 \leq 15} (x^2 + y^2 + z^2)^2 dV$.
- (A) $\frac{1}{3} \left(\frac{4\pi 15^{\frac{7}{2}}}{7} \right)$
(B) $\frac{7}{75} \left(\frac{4\pi 15^{\frac{7}{2}}}{7} \right)$
(C) $7 \left(\frac{4\pi 15^{\frac{7}{2}}}{7} \right)$
(D) $\frac{1}{2} \left(\frac{4\pi 15^{\frac{7}{2}}}{7} \right)$
(E) $\frac{4\pi 15^{\frac{7}{2}}}{7}$
62. How many residues x modulo 102 satisfy $9x \equiv 36 \pmod{102}$?
- (A) 3
(B) 2
(C) 4
(D) 5
(E) 1
63. Let $f(x, y) = e^{15x+3y}$. Find $\partial^3 f / \partial x^2 \partial y$ at $(0, 0)$.
- (A) $\frac{1}{5} (3 \cdot 15^2)$
(B) $\frac{1}{3} (3 \cdot 15^2)$
(C) $5 (3 \cdot 15^2)$
(D) $\frac{1}{25} (3 \cdot 15^2)$
(E) $3 \cdot 15^2$

Questions 64–66

64. How many truth assignments to $p, q, r_1, \dots, r_{29}$ make $p \Rightarrow q$ false?

- (A) 2^{29}
- (B) 2^{31}
- (C) 2^{30}
- (D) 2^{32}
- (E) 2^{28}

65. Evaluate $\int_0^1 x^{14}(\log x)^2 dx$.

- (A) $\frac{1}{3} \left(\frac{(-1)^2 2!}{15^3} \right)$
- (B) $\frac{225}{2} \left(\frac{(-1)^2 2!}{15^3} \right)$
- (C) $-\frac{(-1)^2 2!}{15^3}$
- (D) $15 \left(\frac{(-1)^2 2!}{15^3} \right)$
- (E) $\frac{(-1)^2 2!}{15^3}$

66. The field K has 3^{15} elements. Find $[K : \mathbb{F}_3]$.

- (A) 13
- (B) 15
- (C) 17
- (D) 14
- (E) 16

Answer Key

Practice Test 74 / Questions 1–66

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

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