

GRE Mathematics Practice Test 50

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 9 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. Let $f(x) = \log(1 + 10x)$. Find $f^{(2)}(0)$.

- (A) $(-1)^1 1! 10^2$
- (B) $2 \left((-1)^1 1! 10^2 \right)$
- (C) $\frac{1}{2} \left((-1)^1 1! 10^2 \right)$
- (D) $\frac{1}{10} \left((-1)^1 1! 10^2 \right)$
- (E) $-(-1)^1 1! 10^2$

2. The roots r, s of $x^2 - 52x + 276 = 0$ are counted with multiplicity. Find $r^2 + s^2$.

- (A) 2152
- (B) 2151
- (C) 2153
- (D) 2150
- (E) 2154

3. Let $f(x, y) = e^{10x+2y}$. Find $\partial^2 f / \partial x^1 \partial y$ at $(0, 0)$.

- (A) $5 \left(2 \cdot 10^1 \right)$
- (B) $\frac{1}{2} \left(2 \cdot 10^1 \right)$
- (C) $2 \cdot 10^1$
- (D) $2 \left(2 \cdot 10^1 \right)$
- (E) $\frac{1}{5} \left(2 \cdot 10^1 \right)$

Questions 4–6

4. X, Y are independent Poisson variables with means 22 and 23. Given $X+Y = 24$, find $E[X \mid X+Y]$.

- (A) $\frac{352}{15}$
- (B) $\frac{206}{15}$
- (C) $\frac{88}{15}$
- (D) $\frac{191}{15}$
- (E) $\frac{176}{15}$

5. If $y' + 10y = 2e^{-10x}$ and $y(0) = 6$, find $y(1)$.

- (A) $-\frac{8}{e^{10}}$
- (B) $\frac{4}{e^{10}}$
- (C) $\frac{8}{e^{10}}$
- (D) $\frac{8}{e^{10}} + 1$
- (E) $\frac{16}{e^{10}}$

6. For real t , let $M(t) = \begin{pmatrix} t-46 & 6 & 0 \\ 0 & t-46 & 1 \\ 0 & 0 & t-46 \end{pmatrix}$. At $t = 46$, what is $\text{rank } M(t)$?

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

Questions 7–9

7. Find the directional derivative of $f(x, y, z) = x^2 + 10y^2 + 2z^2$ at $(1, 1, 1)$ in the direction $(1, 6, 0)$.

- (A) $-\frac{122\sqrt{37}}{37}$
- (B) $1 + \frac{122\sqrt{37}}{37}$
- (C) $\frac{244\sqrt{37}}{37}$
- (D) $\frac{61\sqrt{37}}{37}$
- (E) $\frac{122\sqrt{37}}{37}$

8. X, Y are independent, with variances 22 and 23. Find $\text{Cov}(X + 2Y, 3X - Y)$.

- (A) 26
- (B) 8
- (C) 14
- (D) 32
- (E) 20

9. Evaluate $\int_0^{\pi/2} \sin^5 t \cos^{21} t \, dt$.

- (A) $66 \left(\frac{2! 10!}{2 \cdot 13!} \right)$
- (B) $2 \left(\frac{2! 10!}{2 \cdot 13!} \right)$
- (C) $\frac{1}{2} \left(\frac{2! 10!}{2 \cdot 13!} \right)$
- (D) $13 \left(\frac{2! 10!}{2 \cdot 13!} \right)$
- (E) $\frac{2! 10!}{2 \cdot 13!}$

Questions 10–12

10. Let $u = (9, 2)^T$ and $v = (1, 0)^T$. Find the squared norm of the orthogonal projection of v onto $\text{span}(u)$.

- (A) $\frac{247}{170}$
- (B) $\frac{81}{85}$
- (C) $\frac{166}{85}$
- (D) $\frac{77}{170}$
- (E) $\frac{417}{170}$

11. If $y' = 10y$, $y(0) = 1$, what is the coefficient of x^2 in the Maclaurin series of y ?

- (A) 50
- (B) 100
- (C) 25
- (D) -50
- (E) 51

12. X has density cx^{22} on $0 < x < 1$ and zero elsewhere. Find the normalizing constant c .

- (A) 9
- (B) 16
- (C) 23
- (D) 30
- (E) 37

Questions 13–15

13. Evaluate $\int_0^1 \int_0^x x^{10} y^2 \, dy \, dx$.

- (A) $\frac{1}{39}$
- (B) $\frac{1}{56}$
- (C) $\frac{1}{42}$
- (D) $\frac{1}{14}$
- (E) $\frac{1}{33}$

14. An idempotent 52×52 real matrix P has rank 4. What is $\text{tr } P$?

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

15. Two solutions of $y'' + 10x^1 y' + 2y = 0$ have Wronskian $W(0) = 1$. Find $W(1)$.

- (A) e^{-5}
- (B) $\frac{2}{e^5}$
- (C) $\frac{1}{2e^5}$
- (D) $-\frac{1}{e^5}$
- (E) $e^{-5} + 1$

Questions 16–18

16. Independent exponential waiting times X, Y have rates 22 and 24. Find $P(X < Y)$.

- (A) $\frac{11}{69}$
- (B) $\frac{11}{23}$
- (C) $\frac{12}{23}$
- (D) $\frac{17}{23}$
- (E) $\frac{11}{46}$

17. Let $\mathbf{F} = (10y^2, z^2, x^2)$. Find $(\nabla \times \mathbf{F})(1, 1, 1) \cdot (0, 0, 1)$.

- (A) -10
- (B) -20
- (C) -19
- (D) -40
- (E) 20

18. For $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$ and $b = \begin{bmatrix} 46 \\ 6 \\ 52 \end{bmatrix}$, let x minimize $\|Ax - b\|^2$. Find x_2 .

- (A) 5
- (B) 7
- (C) 4
- (D) 6
- (E) 8

Questions 19–21

19. Evaluate $\int_0^1 x^{10}(1-x)^1 dx$.

- (A) $6 \left(\frac{10! 1!}{12!} \right)$
- (B) $12 \left(\frac{10! 1!}{12!} \right)$
- (C) $11 \left(\frac{10! 1!}{12!} \right)$
- (D) $\frac{10! 1!}{12!}$
- (E) $\frac{1}{2} \left(\frac{10! 1!}{12!} \right)$

20. $X_1, \dots, X_{22}$ are independent with common mean and variance 24. With $\bar{X}$ their sample mean, find $E[\sum_i (X_i - \bar{X})^2]$.

- (A) 504
- (B) 840
- (C) 168
- (D) 336
- (E) 672

21. Let C be the unit circle $x^2 + y^2 = 1$, $z = 2$, counterclockwise viewed from above. Evaluate $\int_C -10y(x^2 + y^2) dx + (10x(x^2 + y^2)) dy$.

- (A) 10π
- (B) -20π
- (C) 40π
- (D) 20π
- (E) $1 + 20\pi$

Questions 22–24

22. What is the coefficient of x^2 in $(x + 9)^4$?

- (A) 486
- (B) 484
- (C) 487
- (D) 488
- (E) 485

23. The region $0 \leq x \leq 1$, $0 \leq y \leq 10x^2$ is revolved about the x -axis. Find its volume.

- (A) 10π
- (B) -20π
- (C) $1 + 20\pi$
- (D) 20π
- (E) 40π

24. A continuous $f : \mathbb{R} \rightarrow \mathbb{R}$ satisfies $f(q) = q^{17}$ for every rational q . Find $f(2)$.

- (A) 2^{16}
- (B) 2^{19}
- (C) 2^{20}
- (D) 2^{18}
- (E) 2^{17}

Questions 25–27

25. Find the coefficient of x^2 in the Taylor series of $(1 - 10x)^{-2}$ at zero.

- (A) $2(3 \cdot 10^2)$
- (B) $\frac{1}{10}(3 \cdot 10^2)$
- (C) $\frac{1}{3}(3 \cdot 10^2)$
- (D) $3 \cdot 10^2$
- (E) $\frac{2}{3}(3 \cdot 10^2)$

26. A matrix A satisfies $(A - 47I)(A - 49I) = 0$, and its minimal polynomial has degree two. If $A^2 = uA + vI$, find u .

- (A) 97
- (B) 94
- (C) 98
- (D) 95
- (E) 96

27. The solution of $y' = 10x^1y^2$, $y(0) = 1$, has its first positive singularity at which x ?

- (A) $\frac{2\sqrt{5}}{5}$
- (B) $\frac{1}{5}$
- (C) $\sqrt{5}$
- (D) $\frac{\sqrt{10}}{10}$
- (E) $\frac{\sqrt{5}}{5}$

Questions 28–30

28. Find the radius of convergence of $\sum_{k=1}^{\infty} k^{17} x^k / 17^k$.

- (A) 12
- (B) 7
- (C) 22
- (D) 17
- (E) 27

29. Find the arc length of $r(t) = (10t, 2t)$ for $0 \leq t \leq 1$.

- (A) $1 + 2\sqrt{26}$
- (B) $\sqrt{26}$
- (C) $4\sqrt{26}$
- (D) $-2\sqrt{26}$
- (E) $2\sqrt{26}$

30. Let $V = \begin{bmatrix} 1 & 46 & 2116 \\ 1 & 48 & 2304 \\ 1 & 51 & 2601 \end{bmatrix}$. Find $\det V$.

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

Questions 31–33

31. Evaluate $\int_0^1 \int_x^1 10y^2 \, dy \, dx$.

- (A) $\frac{10}{3}$
- (B) $\frac{5}{4}$
- (C) $\frac{5}{2}$
- (D) $\frac{5}{6}$
- (E) 5

32. On $[0, 1]$, f is 17 on rationals and $1/17$ on irrationals. Find its upper Darboux integral minus its lower Darboux integral.

- (A) $\frac{322}{17}$
- (B) $\frac{288}{17}$
- (C) $\frac{576}{17}$
- (D) $\frac{144}{17}$
- (E) $\frac{305}{17}$

33. Find the curvature at $t = 0$ of $r(t) = (2t, 10t^2)$.

- (A) $\frac{5}{2}$
- (B) 5
- (C) 10
- (D) -5
- (E) 6

Questions 34–36

34. Let $u = (1, 2, \dots, 52)^T$, $v = (1, 1, \dots, 1)^T$, and $B = I + uv^T$. Find $\det B$.

- (A) 1378
- (B) 1381
- (C) 1377
- (D) 1379
- (E) 1380

35. For $D = \{(x, y) : x^2 + y^2 \leq 10\}$, evaluate $\iint_D (x^2 + y^2)^1 dA$.

- (A) 50π
- (B) 25π
- (C) 100π
- (D) $\frac{100\pi}{3}$
- (E) 5π

36. A set with 17 elements has the discrete topology. How many of its subsets are simultaneously open and closed?

- (A) 2^{16}
- (B) 2^{18}
- (C) 2^{19}
- (D) 2^{17}
- (E) 2^{20}

Questions 37–39

37. A lamina occupies $0 \leq x \leq 1$, $0 \leq y \leq 10x$ and has density $\rho(x, y) = 1$. Find its centroid coordinate $\bar{x}$.

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

38. Let D be a diagonal 52×52 real matrix with distinct diagonal entries. What is the dimension of the space of matrices X satisfying $XD = DX$?

- (A) 53
- (B) 51
- (C) 50
- (D) 52
- (E) 54

39. Find the coefficient of x^4 in $\cos(10x)/(1 - 1x^2)$.

- (A) $\frac{1100}{3}$
- (B) $-\frac{1103}{3}$
- (C) $\frac{1250}{3}$
- (D) $\frac{1103}{3}$
- (E) 8824

Questions 40–42

40. The circle $|z| = 2$ is traversed counterclockwise. What is $\frac{1}{2\pi i} \int_{|z|=2} \frac{e^z}{z^{18}} dz$?

- (A) $1/18!$
- (B) $17!$
- (C) $1/17!$
- (D) $1/34!$
- (E) $1/16!$

41. Let $F(x) = \int_0^x (x-t)^1 e^{10t} dt$. Find $F^{(2)}(0)$.

- (A) 0
- (B) $\frac{1}{2}$
- (C) 10
- (D) 2
- (E) 1

42. What is the remainder when $x^2 + 1$ is divided by $x - 47$?

- (A) 2210
- (B) 2211
- (C) 2208
- (D) 2209
- (E) 2212

Questions 43–45

43. For $f(x) = x^2 e^{10x}$, find $f^{(4)}(0)$.

- (A) $\frac{1}{12} \left(\frac{4! 10^2}{2} \right)$
- (B) $2 \left(\frac{4! 10^2}{2} \right)$
- (C) $\frac{4! 10^2}{2}$
- (D) $\frac{1}{2} \left(\frac{4! 10^2}{2} \right)$
- (E) $\frac{1}{5} \left(\frac{4! 10^2}{2} \right)$

44. Find the residue of $z^{17}/(z-1)^2$ at $z = 1$.

- (A) 12
- (B) 27
- (C) 7
- (D) 17
- (E) 22

45. For $T = \{x, y, z \geq 0 : x + y + z \leq 1\}$, evaluate $\iiint_T x^{10} y^1 dV$.

- (A) $\frac{1}{22}$
- (B) $\frac{10! 1!}{14!}$
- (C) $14 \left(\frac{10! 1!}{14!} \right)$
- (D) $6 \left(\frac{10! 1!}{14!} \right)$
- (E) $\frac{1}{6} \left(\frac{10! 1!}{14!} \right)$

Questions 46–48

46. Let $P = \text{diag}(\underbrace{1, \dots, 1}_3, \underbrace{0, \dots, 0}_{50})$. What is the dimension of the space of 53×53 real matrices X satisfying $PX = X$?

- (A) 161
- (B) 157
- (C) 158
- (D) 160
- (E) 159

47. For which positive integer m does $\sum_{j=2}^{\infty} \frac{(-1)^j (x-10)^j}{j^{\frac{1}{3}} (\log j)^m}$ converge absolutely at $x = 9$? Give the least such m , or 0 if none exists.

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

48. How many integers in $\{1, \dots, 132\}$ are divisible by 2 or 3?

- (A) 30
- (B) 146
- (C) 59
- (D) 88
- (E) 117

Questions 49–51

49. Evaluate $\iiint_B 10(x^2 + y^2 + z^2)^1 dV$, where B is the unit ball.

- (A) 8π
- (B) 16π
- (C) 4π
- (D) -8π
- (E) $1 + 8\pi$

50. Let $R = (\mathbb{Z}/40\mathbb{Z})/([10])$, where $([10])$ is the ideal generated by $[10]$. How many elements does R have?

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

51. Evaluate $\lim_{x \rightarrow 0} (1 + 10x)^{1/(1x)}$.

- (A) e^{10}
- (B) $e^{\frac{1}{10}}$
- (C) e^{11}
- (D) e^{100}
- (E) 10

Questions 52–54

52. Let $F_0 = 0$, $F_1 = 1$, and $F_{k+2} = F_{k+1} + F_k$. How many binary strings of length 22 have no adjacent 1s?

- (A) F_{25}
- (B) F_{23}
- (C) F_{24}
- (D) F_{26}
- (E) F_{22}

53. Evaluate $\int_0^{\log 2} e^x (e^x + 10)^2 dx$.

- (A) $\frac{12^3 - 11^3}{3}$
- (B) $3 \left(\frac{12^3 - 11^3}{3} \right)$
- (C) $\frac{12^3}{3}$
- (D) $12^2 - 11^2$
- (E) $-\frac{12^3 - 11^3}{3}$

54. What is the largest integer k such that 2^k divides $55!$?

- (A) 51
- (B) 49
- (C) 48
- (D) 50
- (E) 52

Questions 55–57

55. The function $y(x)$ satisfies $y^3 + 10y = 1x$ and $y(0) = 0$. Find $y'(0)$.

- (A) $\frac{1}{13}$
- (B) $\frac{1}{10}$
- (C) 0
- (D) 10
- (E) $-\frac{1}{10}$

56. Apply one Newton iteration to solve $x^2 - 22 = 0$, starting at $x_0 = 1$. What is x_1 ?

- (A) 23
- (B) $\frac{27}{2}$
- (C) $\frac{25}{2}$
- (D) $\frac{23}{4}$
- (E) $\frac{23}{2}$

57. Let $F(x) = \int_0^{x^2} e^{10t} dt$. Find $F'(1)$.

- (A) $20e^{10}$
- (B) e^{10}
- (C) $2e^{10}$
- (D) $\frac{e^{10}}{2}$
- (E) e^{20}

Questions 58–60

58. In the ring $\mathbb{Z}/300\mathbb{Z}$, how many elements are units?

- (A) 78
- (B) 79
- (C) 80
- (D) 81
- (E) 82

59. If $y'' + 4y = 0$, $y(0) = 10$, and $y'(0) = 6$, find $y(\pi/4)$.

- (A) -3
- (B) 4
- (C) 6
- (D) $\frac{3}{2}$
- (E) 3

60. Bisection starts with an interval of length 2^{22} . After 24 interval halvings, what is the maximum distance from the final midpoint to a root remaining in the interval?

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

Questions 61–63

- 61.** If $f(x, y) = \log(x^2 + y^2)$, $x = e^{10t} \cos(2t)$, and $y = e^{10t} \sin(2t)$, find $d^2 f/dt^2$ at $t = 1$.
- (A) 0
 - (B) 20
 - (C) 208
 - (D) 400
 - (E) 4
- 62.** A permutation consists of disjoint cycles of lengths 4 and 6 and fixes all other points. What is its order?
- (A) 13
 - (B) 14
 - (C) 12
 - (D) 10
 - (E) 11
- 63.** Under $x = u + 10v$, $y = u - 2v$, what is the area of the image of $0 \leq u, v \leq 1$?
- (A) 144
 - (B) 12
 - (C) 8
 - (D) 20
 - (E) $\frac{1}{12}$

Questions 64–66

64. What is the least positive multiplicative inverse of 2 modulo 45?

- (A) 9
- (B) 23
- (C) 16
- (D) 30
- (E) 37

65. Let $f(x, y) = x^2 + 20xy + (102)y^2$. What is the product of the eigenvalues of the Hessian of f ?

- (A) 102
- (B) 8
- (C) 4
- (D) 2
- (E) 408

66. In $R = \mathbb{F}_2[x]/(x^{10})$, how many elements are there?

- (A) 2^{12}
- (B) 2^{10}
- (C) 2^9
- (D) 2^{13}
- (E) 2^{11}

Answer Key

Practice Test 50 / Questions 1–66

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

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