

GRE Mathematics Practice Test 100

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 19 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. Evaluate $\int_0^{\infty} x^2 e^{-20x} dx$.

- (A) $20 \left(\frac{2!}{20^3} \right)$
- (B) $\frac{1}{2} \left(\frac{2!}{20^3} \right)$
- (C) $\frac{1}{20} \left(\frac{2!}{20^3} \right)$
- (D) $8000 \left(\frac{2!}{20^3} \right)$
- (E) $\frac{2!}{20^3}$

2. Let A be the 102×102 matrix whose diagonal entries are 99 and whose off-diagonal entries are 1. What is its smallest eigenvalue?

- (A) 100
- (B) 96
- (C) 99
- (D) 98
- (E) 97

3. Let $f(x, y) = x^2 + 40xy + (402)y^2$. What is the product of the eigenvalues of the Hessian of f ?

- (A) 402
- (B) 8
- (C) 2
- (D) 4
- (E) 1608

Questions 4–6

4. X has density cx^{42} on $0 < x < 1$ and zero elsewhere. Find the normalizing constant c .

- (A) 71
- (B) 43
- (C) 15
- (D) 29
- (E) 57

5. Solve $y'' - 42y' + 440y = 0$ with $y(0) = 1$, $y'(0) = 0$. Find $y(1)$.

- (A) $(11 - 10e^2)e^{20} + 1$
- (B) $(11 - 10e^2)e^{20}$
- (C) $\frac{(11 - 10e^2)e^{20}}{2}$
- (D) $(22 - 20e^2)e^{20}$
- (E) $(-11 + 10e^2)e^{20}$

6. Positive real numbers x, y satisfy $\log_2 x + \log_2 y = \log_2 1056$ and $x + y = 107$. Find xy .

- (A) 1054
- (B) 1056
- (C) 1055
- (D) 1058
- (E) 1057

Questions 7–9

7. Evaluate $\iiint_{x^2+y^2+z^2 \leq 20} (x^2 + y^2 + z^2)^1 dV$.

- (A) $\frac{1}{12} \left(\frac{4\pi 20^{\frac{5}{2}}}{5} \right)$
- (B) $\frac{1}{2} \left(\frac{4\pi 20^{\frac{5}{2}}}{5} \right)$
- (C) $5 \left(\frac{4\pi 20^{\frac{5}{2}}}{5} \right)$
- (D) $\frac{4\pi 20^{\frac{5}{2}}}{5}$
- (E) $\frac{1}{3} \left(\frac{4\pi 20^{\frac{5}{2}}}{5} \right)$

8. Independent exponential waiting times X, Y have rates 42 and 44. Find $P(X < Y)$.

- (A) $\frac{32}{43}$
- (B) $\frac{21}{43}$
- (C) $\frac{21}{86}$
- (D) $\frac{7}{43}$
- (E) $\frac{22}{43}$

9. Evaluate $\int_C (2x + 20y) dx + (20x + 2y) dy$, where C is the line segment from $(0, 0)$ to $(6, 1)$.

- (A) 158
- (B) $\frac{157}{2}$
- (C) -157
- (D) 157
- (E) 314

Questions 10–12

10. A sequence satisfies $u_0 = 96$ and $u_{k+1} = 1u_k + 11$ for all $k \geq 0$. Find u_3 .

- (A) 131
- (B) 129
- (C) 130
- (D) 128
- (E) 127

11. For which positive integer m does $\sum_{j=2}^{\infty} \frac{(-1)^j (x-20)^j}{j^{\frac{1}{3}} (\log j)^m}$ converge absolutely at $x = 19$? Give the least such m , or 0 if none exists.

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

12. $X_1, \dots, X_{42}$ are independent with common mean and variance 44. With $\bar{X}$ their sample mean, find $E[\sum_i (X_i - \bar{X})^2]$.

- (A) 2405
- (B) 3006
- (C) 602
- (D) 1804
- (E) 1203

Questions 13–15

13. Find the coefficient of x^4 in $\cos(20x)/(1 - 1x^2)$.
- (A) 155224
(B) $\frac{20000}{3}$
(C) $\frac{19403}{3}$
(D) $-\frac{19403}{3}$
(E) $\frac{19400}{3}$
14. A linear map $T : \mathbb{R}^{103} \rightarrow \mathbb{R}^{105}$ has rank 2. What is its nullity?
- (A) 102
(B) 103
(C) 99
(D) 100
(E) 101
15. The function $y(x)$ satisfies $y^3 + 20y = 1x$ and $y(0) = 0$. Find $y'(0)$.
- (A) $\frac{1}{20}$
(B) 0
(C) 20
(D) $\frac{1}{23}$
(E) $-\frac{1}{20}$

Questions 16–18

16. A permutation of 44 objects is chosen uniformly. Let Z be the number of fixed points. Find $E[Z]$.

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

17. Evaluate $\lim_{x \rightarrow 0} (1 + 20x)^{1/(1x)}$.

- (A) e^{20}
- (B) $e^{\frac{1}{20}}$
- (C) e^{21}
- (D) 20
- (E) e^{400}

18. What is the dimension of the real vector space of 102×102 symmetric matrices?

- (A) 5253
- (B) 5252
- (C) 5254
- (D) 5255
- (E) 5251

Questions 19–21

19. The region $0 \leq x \leq 1$, $0 \leq y \leq 20x^2$ is revolved about the x -axis. Find its volume.
- (A) $1 + 80\pi$
(B) 160π
(C) 80π
(D) -80π
(E) 40π
20. A coin success probability p has uniform prior on $[0, 1]$. After observing 42 successes and 2 failures in independent tosses conditional on p , what is the predictive probability of success on the next toss?
- (A) $\frac{43}{92}$
(B) $\frac{43}{138}$
(C) $\frac{43}{46}$
(D) $\frac{89}{92}$
(E) $\frac{3}{46}$
21. For $f(x, y) = x^2 + 20xy + 2y^2$, what is its maximum directional derivative at $(1, -1)$?
- (A) -18
(B) 580
(C) 34
(D) $2\sqrt{145}$
(E) 16

Questions 22–24

22. Let $A = \begin{bmatrix} 1 & 96 & 0 \\ 0 & 1 & 11 \\ 0 & 0 & 1 \end{bmatrix}$. What is the $(1, 2)$ entry of A^5 ?

- (A) 482
- (B) 481
- (C) 479
- (D) 480
- (E) 478

23. Evaluate $\int_0^1 \int_x^1 20y^2 \, dy \, dx$.

- (A) $\frac{5}{3}$
- (B) 10
- (C) 5
- (D) $\frac{5}{2}$
- (E) $\frac{20}{3}$

24. For which real a does $f_m(x) = x^{37m}/m^a$ converge uniformly to zero on $[0, 1]$?

- (A) All real a
- (B) $a < 0$
- (C) $a = 0$
- (D) $a > 1$
- (E) $a > 0$

Questions 25–27

25. Let $F(x) = \int_0^{x^2} e^{20t} dt$. Find $F'(1)$.

- (A) e^{20}
- (B) $40e^{20}$
- (C) $\frac{e^{20}}{2}$
- (D) $2e^{20}$
- (E) e^{40}

26. An invertible 102×102 matrix A has determinant 3. Find $\det(A^T A)$.

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

27. Evaluate $\iiint_B 20(x^2 + y^2 + z^2)^1 dV$, where B is the unit ball.

- (A) 8π
- (B) -16π
- (C) $1 + 16\pi$
- (D) 16π
- (E) 32π

Questions 28–30

28. For which real p does $\sum_{k=2}^{\infty} 1/[k(\log k)^{37p}]$ converge?

- (A) $p < 1/37$
- (B) All real p
- (C) $p > 0$
- (D) $p \geq 1/37$
- (E) $p > 1/37$

29. Find the upward flux of $\mathbf{F} = (0, 0, z)$ through $z = 20x^2 + 2y^2$, $0 \leq x, y \leq 1$.

- (A) $\frac{22}{3}$
- (B) $\frac{25}{3}$
- (C) $\frac{44}{3}$
- (D) $-\frac{22}{3}$
- (E) $\frac{11}{3}$

30. On the space P_{103} of real polynomials of degree at most 103, define $T(p) = p'$. What is the rank of T ?

- (A) 102
- (B) 104
- (C) 105
- (D) 103
- (E) 101

Questions 31–33

31. Find the arc length of $r(t) = (20t, 2t)$ for $0 \leq t \leq 1$.

- (A) $-2\sqrt{101}$
- (B) $4\sqrt{101}$
- (C) $2\sqrt{101}$
- (D) $1 + 2\sqrt{101}$
- (E) $\sqrt{101}$

32. How many accumulation points in $\mathbb{R}$ does $S = \{1/k : k \geq 1\} \cup \{37 + 1/k : k \geq 1\}$ have?

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

33. For $D = \{(x, y) : x^2 + y^2 \leq 20\}$, evaluate $\iint_D (x^2 + y^2)^1 dA$.

- (A) 200π
- (B) 400π
- (C) 100π
- (D) 10π
- (E) $\frac{400\pi}{3}$

Questions 34–36

34. Subspaces U, V of $\mathbb{R}^{104}$ have dimensions 2 and 3. What is the largest possible value of $\dim(U \cap V)$?

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

35. Evaluate $\sum_{j=0}^{\infty} \frac{1}{(20+2j)(22+2j)}$.

- (A) $\frac{1}{40}$
- (B) $\frac{1}{22}$
- (C) $\frac{1}{20}$
- (D) $\frac{1}{10}$
- (E) $\frac{1}{2}$

36. How many connected components does $\mathbb{R} \setminus \{1, 2, \dots, 37\}$ have?

- (A) 26
- (B) 62
- (C) 38
- (D) 14
- (E) 50

Questions 37–39

37. Solve $y' + 20y = x^2e^{-20x}$, $y(0) = 0$, and find $y(1)$.

- (A) $\frac{1}{3e^{20}}$
- (B) e^{-20}
- (C) $\frac{20}{3e^{20}}$
- (D) $\frac{1}{2e^{20}}$
- (E) $\frac{e^{20}}{3}$

38. Let V consist of real polynomials of degree at most 5 that vanish at 96, 97, and 99. Find $\dim V$.

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

39. Let $f(x, y) = e^{20x+2y}$. Find $\partial^2 f / \partial x^1 \partial y$ at $(0, 0)$.

- (A) $10(2 \cdot 20^1)$
- (B) $\frac{1}{2}(2 \cdot 20^1)$
- (C) $2 \cdot 20^1$
- (D) $\frac{1}{10}(2 \cdot 20^1)$
- (E) $2(2 \cdot 20^1)$

Questions 40–42

40. Let $\zeta = e^{2\pi i/29}$. Find $\sum_{k=0}^{28} \zeta^k$.

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

41. Near $(0, 0)$, $z = z(x, y)$ satisfies $z + 20z^2 = x + 2y$ and $z(0, 0) = 0$. Find $z_{xy}(0, 0)$.

- (A) -160
- (B) -40
- (C) -80
- (D) 80
- (E) -2

42. The roots r, s of $x^2 - 107x + 1056 = 0$ are counted with multiplicity. Find $r^2 + s^2$.

- (A) 9336
- (B) 9339
- (C) 9337
- (D) 9338
- (E) 9335

Questions 43–45

43. Find the coefficient of x^2 in the Taylor series of $(1 - 20x)^{-2}$ at zero.

- (A) $\frac{1}{20} (3 \cdot 20^2)$
- (B) $\frac{1}{3} (3 \cdot 20^2)$
- (C) $3 \cdot 20^2$
- (D) $\frac{2}{3} (3 \cdot 20^2)$
- (E) $2 (3 \cdot 20^2)$

44. An analytic function has real part $u(x, y) = x^2 - y^2 + 27x$ and satisfies $f(0) = 0$. Find $\text{Im } f(1 + i)$.

- (A) 29
- (B) 47
- (C) 11
- (D) 38
- (E) 20

45. Let $F(x) = \int_0^x (x - t)^1 e^{20t} dt$. Find $F^{(2)}(0)$.

- (A) 2
- (B) $\frac{1}{2}$
- (C) 0
- (D) 20
- (E) 1

Questions 46–48

46. For real t , let $M(t) = \begin{pmatrix} t-96 & 11 & 0 \\ 0 & t-96 & 1 \\ 0 & 0 & t-96 \end{pmatrix}$. At $t = 96$, what is $\text{rank } M(t)$?

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

47. Evaluate $\int_0^1 x^{19}(\log x)^1 dx$.

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

48. Apply one Newton iteration to solve $x^2 - 42 = 0$, starting at $x_0 = 1$. What is x_1 ?

- (A) $\frac{43}{4}$
- (B) 43
- (C) $\frac{47}{2}$
- (D) $\frac{45}{2}$
- (E) $\frac{43}{2}$

Questions 49–51

49. Evaluate $\int_0^1 \frac{x^1}{1 + 20x^2} dx$.

- (A) $\frac{\log(21)}{20}$
- (B) $\frac{\log(21)}{2}$
- (C) $\log(21)$
- (D) $\frac{\log(21)}{40}$
- (E) $-\frac{\log(21)}{40}$

50. How many permutations in S_{102} consist of one 3-cycle and 99 fixed points?

- (A) 343401
- (B) 343399
- (C) 343402
- (D) 343400
- (E) 343398

51. Find the curvature at $t = 0$ of $r(t) = (2t, 20t^2)$.

- (A) -10
- (B) 10
- (C) 11
- (D) 5
- (E) 20

Questions 52–54

52. Bisection starts with an interval of length 2^{42} . After 44 interval halvings, what is the maximum distance from the final midpoint to a root remaining in the interval?

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

53. Evaluate $\lim_{x \rightarrow 0} \frac{e^{20x} - \sum_{j=0}^1 (20x)^j / j!}{x^2}$.

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

54. How many subgroups does the cyclic group of order 1200 have?

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

Questions 55–57

55. Evaluate $\int_0^1 x^{20}(1-x)^1 dx$.

- (A) $\frac{1}{2} \left(\frac{20! 1!}{22!} \right)$
- (B) $22 \left(\frac{20! 1!}{22!} \right)$
- (C) $21 \left(\frac{20! 1!}{22!} \right)$
- (D) $11 \left(\frac{20! 1!}{22!} \right)$
- (E) $\frac{20! 1!}{22!}$

56. What is the least positive multiplicative inverse of 2 modulo 85?

- (A) 57
- (B) 71
- (C) 15
- (D) 29
- (E) 43

57. If $y'' + 4y = 0$, $y(0) = 20$, and $y'(0) = 6$, find $y(\pi/4)$.

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

Questions 58–60

58. How many residues x modulo 120 satisfy $8x \equiv 56 \pmod{120}$?

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

59. If $y' + 20y = 2e^{-20x}$ and $y(0) = 6$, find $y(1)$.

- (A) $\frac{4}{e^{20}}$
- (B) $\frac{16}{e^{20}}$
- (C) $\frac{8}{e^{20}} + 1$
- (D) $-\frac{8}{e^{20}}$
- (E) $\frac{8}{e^{20}}$

60. How many truth assignments to $p, q, r_1, \dots, r_{40}$ make $p \Rightarrow q$ false?

- (A) 2^{39}
- (B) 2^{40}
- (C) 2^{42}
- (D) 2^{41}
- (E) 2^{43}

Questions 61–63

61. Let $\mathbf{F} = (20y^2, z^2, x^2)$. Find $(\nabla \times \mathbf{F})(1, 1, 1) \cdot (0, 0, 1)$.

- (A) -39
- (B) -20
- (C) -80
- (D) -40
- (E) 40

62. The field K has 2^{20} elements. Find $[K : \mathbb{F}_2]$.

- (A) 22
- (B) 18
- (C) 20
- (D) 19
- (E) 21

63. For $T = \{x, y, z \geq 0 : x + y + z \leq 1\}$, evaluate $\iiint_T x^{20}y^1 dV$.

- (A) $\frac{20! 1!}{24!}$
- (B) $6 \left(\frac{20! 1!}{24!} \right)$
- (C) $24 \left(\frac{20! 1!}{24!} \right)$
- (D) $\frac{1}{42}$
- (E) $\frac{1}{6} \left(\frac{20! 1!}{24!} \right)$

Questions 64–66

64. What is the coefficient of x^2 in $(1 + 2x)^{42}$?

- (A) 4592
- (B) 2296
- (C) 1148
- (D) 3444
- (E) 5740

65. Evaluate $\int_0^{\log 2} e^x(e^x + 20)^2 dx$.

- (A) $-\frac{22^3 - 21^3}{3}$
- (B) $3\left(\frac{22^3 - 21^3}{3}\right)$
- (C) $22^2 - 21^2$
- (D) $\frac{22^3}{3}$
- (E) $\frac{22^3 - 21^3}{3}$

66. Let $G = \mathbb{Z}/606\mathbb{Z} \times \mathbb{Z}/408\mathbb{Z}$. Find the order of $(1, 1)$.

- (A) 41210
- (B) 41208
- (C) 41209
- (D) 41206
- (E) 41207

Answer Key

Practice Test 100 / Questions 1–66

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

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