✦ ADVANCED MATHEMATICS ✦

50 Toughest Solved MCQs for Competitive Exam Preparation

PPSC	FPSC	NTS	CSS	PMS

★ Fully Solved | Step-by-Step Explanation | Highlighted Correct Answers ★

Total Questions	**50 MCQs**
Subject	**Mathematics**
Level	**PPSC / FPSC / NTS / CSS / PMS**
Format	**MCQ + Correct Answer + Line-by-Line Explanation**
Difficulty	**Advanced / Competitive Examination Level**

Mathematics MCQs — Solved and Explained

1 **If $\log_{10}(x) = 2.5$, then the value of x is:**

A) 150

B) 250

CORRECT ANSWER C) 316.23

D) 500

EXPLANATION:

$\log_{10}(x) = 2.5$ means $x = 10^{2.5} = 10^2 \times 10^{0.5} = 100 \times \text{sqrt}(10) = 100 \times 3.1623 = 316.23$. This uses the definition of logarithm: log_b(x) = y iff $x = b^y$.

2 **Sum of the infinite geometric series 1 + 1/3 + 1/9 + 1/27 + ... is:**

CORRECT ANSWER A) 3/2

B) 2

C) 4/3

D) 3

EXPLANATION:

For an infinite geometric series, first term a = 1, common ratio r = 1/3 (|r| < 1). Sum = a/(1-r) = 1/(1-1/3) = 1/(2/3) = 3/2.

3 **A train 150 m long passes a telegraph post in 10 s. Time to pass a 300 m bridge is:**

A) 20 s

B) 25 s

CORRECT ANSWER C) 30 s

D) 35 s

EXPLANATION:

Speed = 150/10 = 15 m/s. Distance to cross bridge = 150 + 300 = 450 m. Time = 450/15 = 30 seconds.

4 **If $2^x = 8^{(x-1)}$, then x equals:**

A) 2

B) 3

CORRECT ANSWER C) 3/2

D) 4

EXPLANATION:

Since $8 = 2^3$, we get $2^x = 2^{3(x-1)}$. Setting exponents equal: $x = 3x - 3$, so $2x = 3$, giving $x = 3/2$.

5 **The area of a rhombus with diagonals 12 cm and 16 cm is:**

CORRECT ANSWER A) 96 cm2

B) 192 cm2

C) 48 cm2

D) 112 cm2

EXPLANATION:

Area of rhombus = (d1 x d2)/2 = (12 x 16)/2 = 192/2 = 96 cm2.

6 **A man rows 6 km/h in still water; river flows at 2 km/h. Time to row 16 km upstream:**

A) 2 h

B) 3 h

CORRECT ANSWER C) 4 h

D) 5 h

EXPLANATION:

Upstream speed = 6 - 2 = 4 km/h. Time = Distance/Speed = 16/4 = 4 hours.

7 **The number of diagonals in a polygon with n = 10 sides is:**

A) 25

CORRECT ANSWER B) 35

C) 40

D) 45

EXPLANATION:

Number of diagonals = n(n-3)/2 = 10 x 7/2 = 35.

8 **If $x + 1/x = 5$, then $x^2 + 1/x^2$ equals:**

CORRECT ANSWER A) 23

B) 25

C) 27

D) 21

EXPLANATION:

Square both sides: $(x + 1/x)^2 = x^2 + 2 + 1/x^2 = 25$. Therefore $x^2 + 1/x^2 = 25 - 2 = 23$.

9 **The LCM of 12, 15, 20, and 35 is:**

A) 210

CORRECT ANSWER B) 420

C) 840

D) 1260

EXPLANATION:

Prime factorizations: $12 = 2^2x3$, $15 = 3x5$, $20 = 2^2x5$, $35 = 5x7$. LCM = $2^2 \times 3 \times 5 \times 7 = 420$.

10 **Simple interest on a sum for 5 years at 8% p.a. is Rs.1,200. The principal is:**

A) Rs.2,000

B) Rs.2,500

CORRECT ANSWER C) Rs.3,000

D) Rs.3,600

EXPLANATION:

SI = PRT/100 => 1200 = P x 8 x 5/100 => P = 1200 x 100/40 = Rs.3,000.

11 **The value of $\sin^2 30 + \cos^2 60 + \tan^2 45$ is:**

A) 1

CORRECT ANSWER B) 1.5

C) 2

D) 2.5

EXPLANATION:

sin30 = 1/2 => $\sin^2 30$ = 1/4. cos60 = 1/2 => $\cos^2 60$ = 1/4. tan45 = 1 => $\tan^2 45$ = 1. Sum = 1/4 + 1/4 + 1 = 3/2 = 1.5.

12 **A boat goes 24 km downstream in 2 h and 18 km upstream in 3 h. Speed of current:**

A) 1 km/h

B) 2 km/h

CORRECT ANSWER C) 3 km/h

D) 4 km/h

EXPLANATION:

Downstream speed = 24/2 = 12 km/h. Upstream speed = 18/3 = 6 km/h. Speed of current = (12 - 6)/2 = 3 km/h.

13 **Product of two numbers is 1575 and their ratio is 7:9. The smaller number is:**

CORRECT ANSWER A) 35

B) 42

C) 45

D) 63

EXPLANATION:

Let numbers = 7k and 9k. Then $63k^2 = 1575 \Rightarrow k^2 = 25 \Rightarrow k = 5$. Smaller number = 7k = 35.

14 **How many 3-digit numbers are divisible by 7?**

A) 126

B) 127

CORRECT ANSWER C) 128

D) 129

EXPLANATION:

First 3-digit number divisible by 7: 105. Last: 994. Count = (994-105)/7 + 1 = 889/7 + 1 = 127 + 1 = 128.

15 **If angles of a triangle are in ratio 2:3:5, the largest angle is:**

A) 54

B) 72

CORRECT ANSWER C) 90

D) 108

EXPLANATION:

Sum = 180. 2x + 3x + 5x = 180 => 10x = 180 => x = 18. Largest angle = 5x = 90 degrees.

16 **Compound interest on Rs.8,000 at 10% p.a. for 2 years compounded annually:**

A) Rs.1,600

CORRECT ANSWER B) Rs.1,680

C) Rs.1,764

D) Rs.1,800

EXPLANATION:

CI = $P[(1 + R/100)^T - 1] = 8000[(1.1)^2 - 1] = 8000 \times 0.21 = Rs.1,680$.

17 **Derivative of $f(x) = x^3 - 3x^2 + 2x - 1$ at $x = 2$ is:**

A) 1

CORRECT ANSWER B) 2

C) 3

D) 4

EXPLANATION:

$f'(x) = 3x^2 - 6x + 2$. At $x = 2$: $f'(2) = 3(4) - 6(2) + 2 = 12 - 12 + 2 = 2$.

18 **A 30% discount followed by 20% discount gives an overall discount of:**

CORRECT ANSWER A) 44%

B) 50%

C) 46%

D) 48%

EXPLANATION:

Overall multiplier = $(1 - 0.30)(1 - 0.20) = 0.70 \times 0.80 = 0.56$. Overall discount = $1 - 0.56 = 44\%$.

19 **The value of the integral of $(3x^2 - 2x + 1)\,dx$ from 0 to 2 is:**

CORRECT ANSWER A) 6

B) 7

C) 8

D) 9

EXPLANATION:

Integral = $[x^3 - x^2 + x]$ from 0 to 2 = (8 - 4 + 2) - 0 = 6.

20 **Mean of 10 numbers is 15. If 20 is replaced by 30, the new mean is:**

A) 15.5

CORRECT ANSWER B) 16

C) 16.5

D) 17

EXPLANATION:

Original sum = 10 x 15 = 150. New sum = 150 - 20 + 30 = 160. New mean = 160/10 = 16.

21 **Pipes A and B fill a tank in 12 and 16 hours. Both together fill it in:**

CORRECT ANSWER A) 6 h 51 min

B) 7 h 12 min

C) 6 h

D) 8 h

EXPLANATION:

Combined rate = 1/12 + 1/16 = 7/48 per hour. Time = 48/7 = 6 hours 51.4 minutes.

22 **If A:B = 3:4 and B:C = 5:6, then A:B:C is:**

CORRECT ANSWER A) 15:20:24

B) 3:4:6

C) 9:12:16

D) 5:6:8

EXPLANATION:

A:B = 3:4, B:C = 5:6. Make B common: multiply first ratio by 5 and second by 4. A:B = 15:20, B:C = 20:24. So A:B:C = 15:20:24.

23 **Sum of interior angles of a hexagon is:**

A) 540

CORRECT ANSWER B) 720

C) 900

D) 1080

EXPLANATION:

Sum of interior angles = (n - 2) x 180. For hexagon n=6: (6-2) x 180 = 4 x 180 = 720 degrees.

24 **A number gives remainder 1 with 3, remainder 2 with 4, remainder 3 with 5. The number is:**

CORRECT ANSWER A) 58

B) 62

C) 48

D) 67

EXPLANATION:

In each case divisor - remainder = 2. So n + 2 is divisible by LCM(3,4,5) = 60. Hence n = 60 - 2 = 58.

25 **Circumference of a circle is 44 cm. Its area is: (pi = 22/7)**

CORRECT ANSWER A) 154 cm2

B) 176 cm2

C) 132 cm2

D) 196 cm2

EXPLANATION:

2pi x r = 44 => r = 7 cm. Area = pi x r^2 = (22/7) x 49 = 154 cm^2.

26 **Price rises by 25%. By what % must consumption fall to keep expenditure unchanged?**

CORRECT ANSWER A) 20%

B) 25%

C) 16.67%

D) 15%

EXPLANATION:

Reduction % = [Increase% / (100 + Increase%)] x 100 = [25/125] x 100 = 20%.

27 **Value of $0.1^2 + 0.2^2 + 0.3^2 + 0.4^2 + 0.5^2$ is:**

CORRECT ANSWER A) 0.55

B) 0.45

C) 0.65

D) 0.35

EXPLANATION:

= 0.01 + 0.04 + 0.09 + 0.16 + 0.25 = 0.55.

28 **Merchant marks 40% above cost and gives 15% discount. Profit % is:**

CORRECT ANSWER A) 19%

B) 20%

C) 25%

D) 22%

EXPLANATION:

Let CP = 100. MP = 140. SP = 140 x 0.85 = 119. Profit = 119 - 100 = 19. Profit % = 19%.

29 **If median of 5, 7, x, 11, 13 (in order) is 9, then x =**

A) 8

CORRECT ANSWER B) 9

C) 10

D) 11

EXPLANATION:

With 5 values arranged in ascending order, the median is the 3rd value. The 3rd value is x. Therefore x = 9.

30 **HCF of two numbers is 12, LCM is 360. If one number is 60, the other is:**

A) 60

CORRECT ANSWER B) 72

C) 80

D) 90

EXPLANATION:

Product of two numbers = HCF x LCM = 12 x 360 = 4320. Other number = 4320/60 = 72.

31 **Roots of $x^2 - 5x + 6 = 0$ are:**

CORRECT ANSWER A) 2 and 3

B) 1 and 6

C) -2 and -3

D) 3 and 4

EXPLANATION:

$x^2 - 5x + 6 = (x - 2)(x - 3) = 0$. So x = 2 or x = 3. Verification: 2 + 3 = 5, 2 x 3 = 6. Both correct.

32 **Perimeter of rectangle is 80 m. Length is 5 m more than breadth. Area is:**

CORRECT ANSWER A) 393.75 m2

B) 350 m2

C) 387.5 m2

D) 400 m2

EXPLANATION:

2(l + b) = 80 => l + b = 40. l = b + 5 => 2b + 5 = 40 => b = 17.5, l = 22.5. Area = 22.5 x 17.5 = 393.75 m^2.

33 **Value of $(1 + \tan^2\text{theta}) / (1 + \cot^2\text{theta})$ is:**

A) sin2(theta)

B) cos2(theta)

CORRECT ANSWER C) tan2(theta)

D) cot2(theta)

EXPLANATION:

$(1 + \tan^2\text{theta}) = \sec^2\text{theta}$ and $(1 + \cot^2\text{theta}) = \text{cosec}^2\text{theta}$. Ratio = $\sec^2\text{theta} / \text{cosec}^2\text{theta} = \sin^2\text{theta}/\cos^2\text{theta} = \tan^2\text{theta}$.

34 **Sum becomes Rs.6050 in 2 years and Rs.6655 in 3 years at CI. Rate is:**

A) 8%

B) 9%

CORRECT ANSWER C) 10%

D) 11%

EXPLANATION:

Interest in 3rd year = 6655 - 6050 = Rs.605. Rate = (605/6050) x 100 = 10%.

35 **Solve: $\log_2(x) + \log_2(x-6) = 4$**

A) 7

CORRECT ANSWER B) 8

C) 10

D) 12

EXPLANATION:

$\log_2[x(x-6)] = 4 \Rightarrow x(x-6) = 16 \Rightarrow x^2 - 6x - 16 = 0 \Rightarrow (x-8)(x+2) = 0$. Since $x > 0$, $x = 8$.

36 **In a class of 40, 60% play cricket and 50% play football. 20% play neither. How many play both?**

CORRECT ANSWER A) 12

B) 14

C) 16

D) 18

EXPLANATION:

Players = 80% of 40 = 32. n(C) = 24, n(F) = 20. n(C and F) = n(C) + n(F) - n(C or F) = 24 + 20 - 32 = 12.

37 **Number of ways to arrange letters of MATHEMATICS is:**

CORRECT ANSWER A) 4,989,600

B) 6,652,800

C) 3,326,400

D) 2,494,800

EXPLANATION:

MATHEMATICS has 11 letters: M=2, A=2, T=2, others=1 each. Arrangements = 11! / (2! x 2! x 2!) = 39916800/8 = 4,989,600.

38 **5 men or 9 women can finish work in 19 days. 3 men and 6 women take:**

A) 12 days

CORRECT ANSWER B) 15 days

C) 16 days

D) 18 days

EXPLANATION:

1 man = 9/5 women. 3 men + 6 women = 27/5 + 30/5 = 57/5 women. Time = (9 x 19) / (57/5) = 171 x 5/57 = 15 days.

39 **Probability of getting exactly two heads in 3 coin tosses is:**

A) 1/4

CORRECT ANSWER B) 3/8

C) 1/2

D) 2/3

EXPLANATION:

Total outcomes = 2^3 = 8. Favorable (HHT, HTH, THH) = 3. P = 3/8. Or: C(3,2) x $(1/2)^3$ = 3 x 1/8 = 3/8.

40 **Circle inscribed in a square of side 14 cm. Area between square and circle (pi=22/7):**

CORRECT ANSWER A) 42 cm2

B) 44 cm2

C) 36 cm2

D) 56 cm2

EXPLANATION:

Square area = 14^2 = 196 cm^2. Circle radius = 7 cm. Circle area = 22/7 x 49 = 154 cm^2. Remaining = 196 - 154 = 42 cm^2.

41 **Find the sum: $1^2 + 2^2 + 3^2 + ... + 10^2$**

A) 345

B) 355

C) 365

CORRECT ANSWER D) 385

EXPLANATION:

Formula: n(n+1)(2n+1)/6 = 10 x 11 x 21/6 = 2310/6 = 385.

42 **Distance between A(3, 4) and B(-2, -8) is:**

A) 11

B) 12

CORRECT ANSWER C) 13

D) 14

EXPLANATION:

Distance = sqrt[$(-2-3)^2$ + $(-8-4)^2$] = sqrt[25 + 144] = sqrt(169) = 13.

43 **Article bought for Rs.450 and sold at 20% loss. Selling price is:**

A) Rs.340

B) Rs.350

CORRECT ANSWER C) Rs.360

D) Rs.380

EXPLANATION:

SP = CP x (1 - loss%) = 450 x 0.80 = Rs.360.

44 **Value of tan(45) + cot(45) is:**

A) 1

B) sqrt(2)

CORRECT ANSWER C) 2

D) 2sqrt(2)

EXPLANATION:

tan45 = 1 and cot45 = 1. Sum = 1 + 1 = 2.

45 **Bag has 5 red, 3 blue, 2 green balls. Probability of drawing a non-red ball:**

CORRECT ANSWER A) 1/2

B) 3/10

C) 2/5

D) 1/5

EXPLANATION:

Total = 10. Non-red = 5. P(non-red) = 5/10 = 1/2.

46 **Volume of cone with radius 7 cm and height 24 cm (pi = 22/7):**

A) 1024 cm3

CORRECT ANSWER B) 1232 cm3

C) 1540 cm3

D) 1848 cm3

EXPLANATION:

Volume = (1/3) x pi x r^2 x h = (1/3) x (22/7) x 49 x 24 = (1/3) x 3696 = 1232 cm^3.

47 **The 8th term of the arithmetic sequence 3, 7, 11, 15, ... is:**

A) 30

CORRECT ANSWER B) 31

C) 32

D) 33

EXPLANATION:

First term a = 3, common difference d = 4. T_n = a + (n-1)d = 3 + 7 x 4 = 3 + 28 = 31.

48 **If sin(theta) = 3/5, then cos(theta) + tan(theta) equals:**

A) 19/20

CORRECT ANSWER B) 31/20

C) 4/5

D) 7/4

EXPLANATION:

sin theta = 3/5. Using 3-4-5 right triangle: cos theta = 4/5, tan theta = 3/4. Sum = 4/5 + 3/4 = 16/20 + 15/20 = 31/20.

49 **If A can do work in 10 days and B in 15 days, they work together 3 days then B finishes alone in:**

A) 6 days

CORRECT ANSWER B) 7.5 days

C) 9 days

D) 10 days

EXPLANATION:

Combined rate = 1/10 + 1/15 = 1/6 per day. Work in 3 days = 3/6 = 1/2. Remaining = 1/2. B alone: (1/2) / (1/15) = 7.5 days.

50 **Square root of 0.00059049 is:**

CORRECT ANSWER A) 0.0243

B) 0.00243

C) 0.243

D) 0.000243

EXPLANATION:

0.00059049 = 59049 x 10^{-8}. sqrt(59049) = 243 (since 243^2 = 59049). sqrt(10^{-8}) = 10^{-4}. Answer = 243 x 10^{-4} = 0.0243.

Quick Answer Key

1	C	11	B	21	A	31	A	41	D
2	A	12	C	22	A	32	A	42	C
3	C	13	A	23	B	33	C	43	C
4	C	14	C	24	A	34	C	44	C
5	A	15	C	25	A	35	B	45	A
6	C	16	B	26	A	36	A	46	B
7	B	17	B	27	A	37	A	47	B
8	A	18	A	28	A	38	B	48	B
9	B	19	A	29	B	39	B	49	B
10	C	20	B	30	B	40	A	50	A

This booklet contains 50 advanced-level Mathematics MCQs prepared for PPSC, FPSC, NTS, CSS, and PMS competitive examinations. Every question includes the correct answer highlighted in green along with a complete step-by-step explanation. Topics covered include: Arithmetic, Algebra, Geometry, Trigonometry, Calculus, Probability, Statistics, and Number Theory. Best of luck with your exam preparation!