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Ph.D ENTRANCE EXAM SAMPLE QUESTIONS

BASIC MATHEMATICS

This document consists of two sets of Sample Questions (SET I and SET II) of the Ph.D Entrance Exam, which is in addition to the sample questions given in the Information Handout . Please note that the sample questions are provided for Basic Mathematics (Test II). The questions are illustrative and not exhaustive. In the actual examination you may find questions of a higher difficulty level on some or all of these types and also questions on the types not mentioned here.

SET I

Test II: TEST OF BASIC MATHEMATICS

This test is designed to examine the candidate's mathematical abilities.

Q.1. The limit of the sequence f(n) = 50 + $(-1)^n \left(\frac{n^2}{2n}\right)$; $n = 1,2,3, \ldots$, equals:

(1) 0

(2) 50

(3) Positive infinity

(4) Negative infinity

(5) None of the above

Q.2. Let $f(x) = x \log(1 + x^{\ 1})$, $0 < x < \infty$. Then, $lim_{n\to\infty} f(x)$ is:

(1) 1

(2) 0

(3) e (i.e., exponent)

(4) Undefined

(5) None of the above.

Q.3. The function $f(x) = -e^{-x}$ is

(1) Convex

(2) Concave

(3) Linear

(4) Quasi-linear

(5) None of the above.

Q.4. Given $f(x) = \sqrt{x}$, then $f^{-1}(f(x))$ is:

(1) x

(2) x^2

(3) $\sqrt{x}$

(4) $\sqrt{x^2}$

(5) None of the above.

Q.5. Seven basketball teams play in a league against each other. At the end of the season, how many different permutations are there for the top three teams in the rankings?

(1) 6

(2) 42

(3) 210

(4) 5040

(5) 50450

Q.6. Six horses are running a race. How many different groups of horses could make up the first three finishers?

(1) 6

(2) 18

(3) 20

(4) 120

(5) 720

Q.7. What are the values of x that satisfy the equation $x^2+4x+3=0$

(1) -3

(2) -1

(3) -3 and -1

(4) 3 and 4

(5) 4

Q.8. A company's profits have doubled for each of the 4 years it has been in existence. If the total profits for the last four years were Rs. 30 million, what were the profits in the first year of operation?

(1) Rs.1 million

(2) Rs. 2 million

(3) Rs. 4 million

(4) Rs.4.5 million

(5) Rs. 6 million.

Q.9. Let A and B be two 3X3 matrices with Det A = 4 and Det B = 3. If Det (2AB) = X and Det ($3AB^{-1}$) = Y. Then the values of X and Y are

(1) 24, 36

(2) 24,4

(3) 96,36

(4) 96,4

(5) None of the above

Q.10. Find the area of the triangle ABC whose vertices are A(1,-1,2) , B(2,1, -1) and C (3,-1,2)

(1) $2\sqrt{13}$

(2) $\sqrt{13}$

(3) $\sqrt{15}$

(4) $\sqrt{26}$

(5) 13

Q.11. The number of solutions of $|x+1|=|x-1|$ is

(1) 0

(2) 1

(3) 2

(4) 3

(5) None of the above

Q.12. Find the sum of the infinite series whose n^{th} term is $\frac{n}{(n-1)!}$

(1) 2e-1

(2) 2e+1

(3) e-1

(4) e+1

(5) 2e

Q.13. The ratio of sum of first 3 terms of a Geometric Progression to the sum of first 6 terms is 64:91. The common ratio of GP is

(1) $\frac{3}{4}$

(2) $\frac{1}{2}$

(3) $\frac{1}{4}$

(4) $\frac{2}{3}$

(5) None of the above

Q.14. Y varies with respect to the sum of 2 components; of which one varies directly with X and the other inversely with X. If $Y = 6$, $X = 4$ and if $Y = \frac{10}{3}$, $X = 3$; the relation between X and Y is,

(1) $Y = 2X - \frac{8}{X}$

(2) $Y = X + \frac{4}{X}$

(3) $Y = -2X + \frac{4}{X}$

(4) $Y = 2X + \frac{4}{X}$

(5) None of the above

Q.15. If the lines x+y+1=0, 4x+3y+4=0 and x+αy+β=0, where $\alpha^2 + \beta^2 = 2$, are concurrent , then

(1) α=1 and β=1

(2) α=1 and $\beta = \pm 1$

(3) α=-1 and β=1

(4) $\alpha = \pm 1$ and β=1

(5) None of the above

Q.16. The sum of the series $1 + \frac{1}{3}.\frac{1}{4} + \frac{1}{5}.\frac{1}{4^2} + \frac{1}{7}.\frac{1}{4^3} + \ldots\ldots\ldots\infty = ?$

(1) ln 3

(2) ln 4

(3) ln 2

(4) ln 5

(5) None of the above

Q.17. If the line *y= mx+5* be a tangent to the ellipse $7x^2 + 9y^2 = 63$, then m = ?

(1) ± 1

(2) ± 2

(3) -1

(4) $\pm \sqrt{2}$

(5) None of the above

Q.18. The common region represented by the inequalities $3x+5y \leq 15$, $5x+2y \leq 10$, $x \geq 0$ and $y \geq 0$ is

(1) a triangle

(2) a quadrilateral

(3) a rectangle

(4) a pentagon

(5) None of the above

Q.19. $\underset{x\to a}{Lt}\ \frac{x\sin a - a\sin x}{x-a}$ is equal to

(1) $\sin a$

(2) $-a\cos a$

(3) $\sin a - a\cos a$

(4) $a\sin a$

(5) None of the above

Q.20. X= 6-8i, where i is imaginary. Then |X| is

(1) 1

(2) 10

(3) 9

(4) 16

(5) 5

Q.21. $x^2 + px + q = 0$ has 2 roots r_1 and r_2. Then $r_1^2 + r_2^2$ is equal to

(1) $p^2 + 2q$

(2) $p^2 - 2q$

(3) p^2

(4) $p^2 - q$

(5) q^2

Q.22. Radius of the circle $x^2 + y^2 - 6x + 4y - 3 = 0$ is

(1) 4

(2) 3

(3) 2

(4) 6

(5) 10

Q.23. $x = (1+y)^{-4}$ and $y = -2\log t$. The derivative of x with respect to t is

(1) $\frac{8}{t}$

(2) $\frac{8}{t.(1+y)^3}$

(3) $\frac{8}{t.(1+y)^5}$

(4) $\frac{4}{t.(1+y)^3}$

(5) $\frac{8logt}{(1+y)^3}$

Q.24. The limit of $\frac{c^{1-\theta}-1}{1-\theta}$ as $\theta \to 1$ is equal to

(1) (1) 0

(2) (2) π

(3) (3) ∞

(4) (4) 1

(5) (5) $\log(c)$

Q.25. Find $\log_{10}(\frac{4}{17}) + \log_{10}(68)$

(1) $\log_{10}(8)$

(2) $\log_{10}(16)$

(3) $\log_{10}(68\frac{4}{17})$

(4) $\log_{10}(\frac{72}{17})$

(5) None of the above

Q.26. The derivative of the inverse of the function $y = f(x) = (x^5 + 3)$ is given by

(1) $\frac{1}{5}(y-3)^{-\frac{1}{5}}$

(2) $\frac{4}{5}(y-3)^{-\frac{4}{5}}$

(3) $\frac{4}{5}(y-3)^{-\frac{1}{5}}$

(4) $\frac{1}{5}(y)^{-\frac{4}{5}}$

(5) None of the above

Q.27. If P(AUB) = 0.6 and P (A∩B) =0.2, then $P(A^c) + P(B^c)$ =

(1) 0.8

(2) 0.4

(3) 0.6

(4) 1

(5) 1.2

Q.28. The equation of the tangent to the circle $x^2 + y^2 - 6x - 2y + 2 = 0$ at the point (1,-1) is:

(1) $x + y = 2$

(2) $3x - y = 0$

(3) $x - y = 0$

(4) $x + y = 0$

(5) None of the above

Q.29. Solve $\frac{dy}{dt} = 2$, given initial value $y(0) = 5$

(1) 2+5t

(2) 5+2t

(3) 2t

(4) 2y+5t

(5) 5y+2t

Q.30. A card is selected at random from a deck of 52 cards. What is the probability that the card selected is a Queen or a Spade?

(1) $\frac{1}{13}$

(2) $\frac{1}{4}$

(3) $\frac{4}{13}$

(4) $\frac{1}{26}$

(5) $\frac{1}{2}$

Q.31. Out of 50 consecutive natural numbers, two are chosen at random. What is the probability that the sum of the numbers is odd ?

(1) $\frac{1}{2}$

(2) $\frac{1}{4}$

(3) $\frac{12}{25}$

(4) $\frac{25}{49}$

(5) None of the above

Q.32. If sum of the roots of $ax^2 + bx + c = 0$ is equal to the sum of their squares then,

(1) $2ab = ac + c^2$

(2) $2ab = bc + c^2$

(3) $2bc = ac + c^2$

(4) $2bc = ab + b^2$

(5) $2ac = ab + b^2$

Q.33. Two variables x and y are connected by the relation $ax + by + c = 0$. If the signs of a and b are different then the correlation coefficient between x and y is

(1) -1

(2) 1

(3) 0

(4) $-\frac{a}{b}$

(5) None of the above

Q.34. The distance between foci of the hyperbola $x^2 - y^2 = 16$ is

(1) 8

(2) $8\sqrt{2}$

(3) $2\sqrt{8}$

(4) 4

(5) None of the above

Q.35. If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to

(1) $\frac{\log x}{(1+\log x)^2}$

(2) $\frac{x-y}{(1+\log x}$

(3) $\frac{x-y}{(1+\log x)^2}$

(4) $\frac{1}{(1+\log x)}$

(5) None of the above

Q.36. If the function $f(x) = \frac{ax+b}{(x-1)(x-4)}$ has a local maxima at (2, -1), then

(1) b =1, a =0

(2) a=1, b = 0

(3) b = -1, a =0

(4) a = -1, b =0

(5) None of the above

Q.37. $x = \frac{1-\sqrt{y}}{1+\sqrt{y}}$ implies $\frac{dy}{dx}$ is equal to

(1) $\frac{4}{(x+1)^2}$

(2) $\frac{4(x-1)}{(1+x)^3}$

(3) $\frac{x-1}{(1+x)^3}$

(4) $\frac{4}{(x+1)^3}$

(5) None of the above

Q.38. If $F(x) = f\big(g(x)\big), where\ f(-2) = 8, f'(-2) = 4, f'(5) = 3,$

$g(5) = -2,\ g'(5) = 6, find\ F'(5).$

(1) 24 (2) 8 (3) 12 (4) 20 (5) None of the above

Q.39. If $\int_{-1}^{4} f(x)dx = 4\ and\ \int_{2}^{4}[3 - f(x)]dx = 7$, then the value of $\int_{-1}^{2} f(x)dx$ is

(1) -2 (2) 3 (3) 5 (4) 8 (5) None of the above

Q.40. $\int_{-2}^{2}|1 - x^2|dx\ is\ equal\ to$

(1) 4 (2) 2 (3) -2 (4) 0 (5) None of the above

Q.41. Function $f(x) = 2 + 4x^2 + 6x^4 + 8x^6$ has

(1) Many maxima and many minima

(2) No maxima and no minima

(3) Only one minima

(4) Only one maxima

(5) None of the above

Q.42. If $f'(x) = \sqrt{x}$ and $f(1) = 2, then\ f(x)\ is\ equal\ to$

(1) $\frac{3}{2}\, x^{\frac{3}{2}}$

(2) $\frac{3}{2}\, x^{\frac{3}{2}} + \frac{4}{3}$

(3) $\frac{2}{3}\, x^{\frac{3}{2}}$

(4) $\frac{2}{3}\, x^{\frac{3}{2}} + \frac{4}{3}$

(5) None of the above

Q.43. Find the coordinates of the vertex of the parabola $y = x^2 - 4x + 1$

(1) (2, -3)

(2) (0,0)

(3) (2, -2)

(4) (-2, 3)

(5) (2, -1)

Q.44. Suppose that there is a 6-sided die that is weighted in such a way that each time the die is rolled, the probabilities of rolling any of the numbers 1 to 5 are all equal but the probability of rolling a 6 is twice the probability of rolling a 1. When you roll the dies once, the 6 outcomes are not equally likely. What is the probability of the most likely event?

(1) 1/7

(2) 2/7

(3) 1/3

(4) 1/6

(5) 1/2

Q.45. Find the mean of the following probability distribution

X	8	12	16	20	24
P(X)	1/8	1/6	3/8	1/4	1/12

(1) 20

(2) 12

(3) 16

(4) 18

(5) 24

Q.46. Let $y = \sqrt{(3 + 4x - x^2)}$. What is $\frac{dy}{dx}$?

(1) $-2x + 4$

(2) $\frac{1}{2\sqrt{(3+4x-x^2)}}$

(3) $\frac{2-x}{-2x+4}$

(4) $\frac{2-x}{y}$

(5) None of the above

Q.47. Find $\frac{dy}{dx}$ for $y = \frac{5x+1}{x^2+2}$.

(1) $\frac{-5x^2+2x+10}{(x^2+2)^2}$

(2) $\frac{-5x^2-2x+1}{(x^2+2)^2}$

(3) $\frac{-5x^2-2x+10}{x^2+2}$

(4) $\frac{-5x^2-2x+10}{(x^2+2)^2}$

(5) None of the above

Q.48. Find $\frac{dy}{dx}$ for $y = e^{2x}\, sin^2 3x$.

(1) $2e^{2x}\, sin3x\, (sin3x + cos3x)$

(2) $2e^{2x}\, cos3x\, (sin3x + cos3x)$

(3) $2e^{2x}\, sin3x\, (sin3x + 3cos3x)$

(4) $2e^{2x}\, sin3x\, (sin3x - 3cos3x)$

(5) None of the above

Q.49. The equation $x^4 + y^4 + 9x - 6y = 14$ defines a curve passing through the point A(1,2). What is the equation of the tangent to the curve at A.

(1) $y = -\frac{1}{2}x + \frac{5}{2}$

(2) $y = \frac{1}{2}x - \frac{3}{2}$

(3) $y = \frac{1}{2}x - \frac{5}{2}$

(4) $y = -\frac{1}{2}x + \frac{4}{2}$

(5) None of the above

Q.50. What is the solution set for the equation $x - 12 = \sqrt{x + 44}$.

(1) {5}

(2) {20}

(3) {-5,20}

(4) {5,20}

(5) None of the above

Ph.D SAMPLE QUESTIONS

SET I

ANSWER KEY

TEST OF BASIC MATHEMATICS

Q.No.	Choice	Q.No.	Choice
Q.1	5	Q.26	5
Q.2	2	Q.27	5
Q.3	2	Q.28	4
Q.4	1	Q.29	2
Q.5	4	Q.30	3
Q.6	3	Q.31	4
Q.7	3	Q.32	5
Q.8	2	Q.33	2
Q.9	3	Q.34	2
Q.10	2	Q.35	1
Q.11	1	Q.36	2
Q.12	5	Q.37	2
Q.13	1	Q.38	1
Q.14	1	Q.39	3
Q.15	4	Q.40	1
Q.16	1	Q.41	3
Q.17	4	Q.42	4
Q.18	2	Q.43	1
Q.19	3	Q.44	2
Q.20	2	Q.45	3
Q.21	2	Q.46	4
Q.22	1	Q.47	4
Q.23	3	Q.48	3
Q.24	5	Q.49	1
Q.25	2	Q.50	4

SET II

Test II: TEST OF BASIC MATHEMATICS

This test is designed to examine the candidate's mathematical abilities.

Q.1. For what value of λ, the following system of equations inconsistent?

$$2x_1 - x_2 + x_3 = 6$$
$$-3x_1 + x_2 + x_3 = 4$$
$$x_1 + 2x_2 + \lambda x_3 = -2$$

(1) 6

(2) -6

(3) -12

(4) 12

(5) 0

Q.2. If A is a square matrix of order n, then Det(kA) = ?

(1) k. Det(A)

(2) n.k.Det(A)

(3) n^k Det(A)

(4) k^2 Det(A)

(5) k^n Det(A)

Q.3. Solve the equation $|4x + 23| = |4x - 9|$?

(1) $x = 0$

(2) $x = 8$

(3) $x = \frac{7}{4}$

(4) $x = -\frac{7}{4}$

(5) indeterminate

Q.4. Polynomial equation f(x) of degree 2 when f(0)=3, f(1) = 8, F(2) = 21 is

(1) $4x^2 + x + 3$

(2) $x^2 + 4x + 3$

(3) $3x^2 + 2x + 3$

(4) $2x^2 + 3x + 3$

(5) $21x^2 + 8x + 3$

Q.5. The common region represented by the following inequalities is _____?

$3x+5y \leq 15$

$5x+2y \leq 10$

$x \geq 0 \quad y \geq 0$

(1) a triangle

(2) a quadrilateral

(3) a pentagon

(4) a rectangle

(5) a square

Q.6. The matrix A= $\begin{bmatrix} -2 & 2 \\ 2 & -2 \end{bmatrix}$ is

(1) positive definite

(2) negative definite

(3) positive semi definite

(4) negative semi definite

(5) indefinite

Q.7. A = $\begin{bmatrix} k & 0 & 0 \\ 0 & k & 0 \\ 0 & 0 & k \end{bmatrix}$ Then the determinant of (adj A) is

(1) k^6

(2) $3k$

(3) k^3

(4) $27k^3$

(5) $3k^3$

Q.8. The particular solution of the differential equation $\frac{dy}{dt} - y - t^2 = 0$ is

(1) $-t^2$

(2) $t^2 - 2t$

(3) $t^2 + 2t + 2$

(4) $t^2 + 2t$

(5) Other than the given options

Q.9. The general solution of $\frac{dx}{dt} + 2x = c$ is

(1) 2

(2) e^{-t}

(3) $2t$

(4) 2^t

(5) Ae^{-2t}

Q.10. Let f(x) = e^x, g(x) = $\sin^{-1}$x and h(x) = f(g(x)), then h'(x)/h(x) is equal to

(1) $e^{\sin^{-1} x}$

(2) $\frac{1}{\sqrt{1-x^2}}$

(3) $\sin^{-1} x$

(4) $\frac{1}{(1-x^2)}$

(5) None of the above

Q.11. The maximum value of $f(x) = \frac{x}{4+x+x^2}$ on $[-1,1]$ is:

(1) $\frac{-1}{4}$

(2) $\frac{-1}{3}$

(3) $\frac{1}{6}$

(4) $\frac{1}{7}$

(5) None of the above

Q.12. If *x log x* + *y log y* = 1, then $\frac{dy}{dx}$ is equal to

(1) $-\frac{\log x}{\log y}$

(2) $-\frac{\log ex}{\log ey}$

(3) $\frac{\log x}{\log y}$

(4) $\frac{\log y}{\log x}$

(5) None of the above

Q.13. If f(x) = ax^4 + bx^2 and ab>0, then

(1) The curve has no horizontal tangents

(2) The curve is concave up for all *x*

(3) The curve is concave down for all *x*

(4) The curve has no inflection point

(5) None of the preceding is necessarily true

Q.14. The value of $\frac{d}{dx}(|x-1|+|x-5|)\ at\ x=3$ is

(1) -2
(2) 0
(3) 2
(4) 4
(5) 5

Q.15. $\int 2^x 3^{x+1} 4^{x+2} dx =$

(1) $\frac{(48)^x}{log\,48}$
(2) $\int \frac{2^x 3^{x+1} 4^{x+2}}{log2+log4+log3}$
(3) $\frac{(24)^{x+2}}{log\,24}$
(4) $\int \frac{2^{x+1} 3^{x+2} 4^{x+3}}{log2+log4+log3}$
(5) None of the above

Q.16. If $\int(3x^2+bx+5)dx = 93, then\ value\ of\ b\ equals$

(1) 1
(2) 3
(3) 2
(4) 5
(5) None of the above

Q.17. If $\int \frac{1}{f(x)} dx = \log\{f(x)\}^2 + c, then\ f(x) =$

(1) x + a
(2) 2x + a
(3) x/2 + a
(4) x^2 + a
(5) x/4 + a

Q.18. $\int_0^1 x(1-x)^n\, dx =$

(1) $\frac{n(n+1)}{2}$
(2) $\frac{1}{(n+1)(n+2)}$
(3) $\frac{(n+1)(n+2)}{3}$
(4) $n^2(n+1)$
(5) None of the above

Q.19. There are 35 students in art class and 57 students in dance class. Find the number of students who are either in art class or in dance class.

(a) When two classes meet at different hours and 12 students are enrolled in both activities.

(b) When two classes meet at the same hour.

(1) 47; 69

(2) 12; 47

(3) 69; 23

(4) 80; 92

(5) 45; 22

Q.20. Each student in a class of 40 plays at least one indoor game: chess, carrom and scrabble. 18 play chess, 20 play scrabble and 27 play carrom. 7 play chess and scrabble, 12 play scrabble and carrom and 4 play chess, carrom and scrabble. Find the number of students who play chess and carrom.

(1) 10

(2) 69

(3) 19

(4) 50

(5) 40

Q.21. You drop a ball from a meters above a flat surface. Each time the ball hits the surface after falling a distance h, it rebounds to a distance rh, where r is positive but less than 1. Find the total distance the ball travels up and down, given that $a = 6$ m and $r = 2/3$.

(1) 30 m

(2) 20 m

(3) 10 m

(4) 40 m

(5) 50 m

Q.22. The partial sums of the first n and n + 1 numbers of the Fibonacci sequence are both divisible by 11. What is the smallest value of n for which this is true?

(1) 11

(2) 9

(3) 8

(4) 12

(5) 10

Q.23. An arithmetic sequence has its 5th term equal to 22 and its 15th term equal to 62. Find its 100-th term.

(1) 210

(2) 402

(3) 305

(4) 510

(5) 406

Q.24. Find the sum of the first 50 even positive integers.

(1) 2550

(2) 4210

(3) 3270

(4) 5320

(5) 3080

Q.25. In a class 40% of the students enrolled for Math and 70% enrolled for Economics. If 15% of the students enrolled for both Math and Economics, what % of the students of the class did not enroll for either of the two subjects?

(1) 5%

(2) 15%

(3) 0%

(4) 25%

(5) 10%

Q.26. Find the value of n for which the following equation is true: $\sum_{i=1}^{n}(0.25i+2)=21.$

(1) 7

(2) 24

(3) 10

(4) 32

(5) 12

Q.27. The sum to infinity of a Geometric Progression (GP) is twice the sum of the first two terms. Find possible values of the common ratio.

(1) $\pm 1/3$

(2) $\pm 1/2$

(3) $\pm 1/\sqrt{2}$

(4) $\pm 1/\sqrt{3}$

(5) $\pm 1/\sqrt{4}$

Q.28. Find an equation of the parabola with focus at (0 , 4) and vertex at (0 , 0)

(1) $x^2 = 16\,y$

(2) $y = 16\,x^2$

(3) $y = 4ax$

(4) $y^2 = 4ax$

(5) Not listed in the answers

Q.29. Let X be a variable with a binomial distribution, n=25 and p=0.3. Which of the following statements is true?

(1) The mean of X is 7.5 and variance is 5.25

(2) The mean of X is 7.5 and variance is 0.21

(3) The mean of X is 5 and variance is 0.09

(4) The mean of X is 0.75 and variance is 1

(5) Not listed in the answers.

Q.30. Let B= $\begin{pmatrix} 3 & -2 \\ 5 & 7 \end{pmatrix}$ and C= $\begin{pmatrix} 1 & 2 \\ 6 & -3 \end{pmatrix}$. Find A= $\begin{pmatrix} x & y \\ z & w \end{pmatrix}$ such that 2A=3B-2C

(1) $\begin{pmatrix} 7 & -10 \\ 3 & 27 \end{pmatrix}$

(2) $\begin{pmatrix} 26 & -20 \\ 0 & 54 \end{pmatrix}$

(3) $\begin{pmatrix} 3.5 & -10 \\ 1.5 & 13.5 \end{pmatrix}$

(4) $\begin{pmatrix} 2.5 & -5 \\ 1.5 & 14.5 \end{pmatrix}$

(5) $\begin{pmatrix} 1 & -2 \\ 2 & 4 \end{pmatrix}$

Q.31. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?

(1) ½

(2) ¾

(3) 3/8

(4) 5/16

(5) Not listed here

Q.32. Find $\frac{dy}{dx}$ for $y = 2^{cotx}$.

(1) $-2^{cotx}\ ln2$

(2) $-2^{cotx}\ ln2\ (sec^2x)$

(3) $-2^{cotx}\ ln2\ (cosec^2x)$

(4) $2^{cotx}\ ln2\ (cosec^2x)$

(5) None of the above

Q.33. Find $\frac{dy}{dx}$ for $y = cos^2(x^3)$.

(1) $-6x^2cos(x^3)sin(x^3)$

(2) $-6x^2cos(x^3)sin^2(x^3)$

(3) $6x^2cos(x^3)sin(x^3)$

(4) $-6x^2cos(x^3)sinx$

(5) None of the above

Q.34. Find $\frac{dy}{dx}$ for $y = e^{5x^2+7x-13}$.

(1) $(5x^2 + 7x)\ e^{5x^2+7x-13}$

(2) $e^{5x^2+7x-13}$

(3) $(10x + 7)e^{5x^2+7x-13}$

(4) $10x + 7$

(5) None of the above

Q.35. Evaluate $\int x^2e^{3x}dx$

(1) $\frac{x^2e^{3x}}{3} - \frac{2xe^{3x}}{9} + \frac{e^{3x}}{27} + c$

(2) $\frac{x^2e^{3x}}{3} - \frac{2xe^{3x}}{9} + \frac{2e^{3x}}{27} + c$

(3) $\frac{x^2e^{3x}}{3} - \frac{2xe^{3x}}{9} + \frac{2e^{3x}}{9} + c$

(4) $\frac{x^2e^{3x}}{3} - \frac{2xe^{3x}}{9} + \frac{2e^{x}}{27} + c$

(5) None of the above

Q.36. Determine which of the following is true.

$$f(x) = \begin{cases} 3x - 5 \; if \; x \neq 1 \\ 2 \; if \; x = 1 \end{cases}$$

(1) f is continuous at $x = 1$.
(2) f is not continuous at $x = 1$
(3) f is not continuous at $x = 2$
(4) f is not continuous at $x = 0$
(5) None of the above

Q.37. Evaluate $\lim_{x \to 4} \frac{x-4}{\sqrt{x}-2}$.

(1) 2
(2) 10
(3) 4
(4) 5
(5) 6

Q.38. Evaluate $\lim_{x \to 0} \frac{3^x - 2^x}{x^2 - x}$.

(1) $\ln 3 - \ln 2$
(2) $\ln 2 - \ln 3$
(3) $\ln 2$
(4) 5
(5) $\ln 3$

Q.39. Find the odd man out. 1, 5, 11, 17, 23, 29.

(1) 29
(2) 11
(3) 17
(4) 1
(5) 23

Q.40. Which equation has infinitely many solutions?

(1) $x = \frac{1}{4}x + \frac{3}{4}$
(2) $\frac{1}{3}x - 5 = \frac{2}{3}x - 5$
(3) $\frac{1}{2}(1 + 4x) = 2x - 3$
(4) $3 - 4x = -6(\frac{2}{3}x - \frac{1}{2})$
(5) None of the above

Q.41. Which equation is not a linear function?

(1) $y = xy + 2$

(2) $y = x + 2y$

(3) $y = -x - \frac{y}{2}$

(4) $y = x - y + 2$

(5) None of the above

Q.42. If a∗b=2a−4b+2ab, then 2∗3+3∗2=?

(1) 6

(2) 8

(3) 12

(4) 14

(5) 10

Q.43. b−[b−(a+b)−{b−(b−a+b)}+2a]=?

(1) 0

(2) $4a$

(3) a

(4) $-2a$

(5) None of the above

Q.44. Glen spends a total of 9 hours writing a paper and finishing a project. He spends x hours on the paper and y hours finishing the project. Glen spends $1\frac{1}{2}$ more hours on the paper than he spends on the project. How many hours does Glen spends writing the paper?

(1) $3\frac{1}{4}$ hours

(2) $3\frac{3}{4}$ hours

(3) $5\frac{1}{4}$ hours

(4) $5\frac{3}{4}$ hours

(5) None of the above

Q.45. Assume $h(x) = f(g(x))$, where both f and g are differentiable functions.. If $g(-1) = 2$, $f(2) = -4$, $g'(-1) = 3$. What is $h'(-1)$?

(1) 6

(2) 8

(3) -12

(4) 12

(5) -10

Q.46. Differentiate $(x) = \frac{2^x}{2^x - 3^x}$.

(1) $\frac{6^x \, ln\frac{3}{2}}{(2^x - 3^x)^2}$

(2) $\frac{ln\frac{3}{2}}{(2^x - 3^x)^2}$

(3) $\frac{6^x ln\frac{2}{3}}{(2^x - 3^x)^2}$

(4) $\frac{2^x \, ln\frac{3}{2}}{(2^x - 3^x)^2}$

(5) None of the above

Q.47. In a group of 40 people, 10 are healthy and every person of the remaining 30 has either high blood pressure, a high level of cholesterol or both.15 have high blood pressure and 25 have high level of cholesterol. If a person is selected randomly from this group, what is the probability that he/she has high blood pressure and high level of cholesterol? (Answers have been rounded off to two decimal points)

(1) 0.38

(2) 0.63

(3) 0.75

(4) 0.45

(5) 0.25

Q.48. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

(1) 0.55

(2) 0.35

(3) 0.53

(4) 0.45

(5) 0.25

Q.49. The exam grades of 7 students are: 70, 66, 72, 96, 46, 90, 50. What is the sample standard deviation?

(1) 18.6

(2) 20.1

(3) 17.5

(4) 19.2

(5) 21.4

Q.50. In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green? (Answers have been rounded off to two decimal points)

(1) 0.33

(2) 0.75

(3) 0.37

(4) 0.38

(5) 0.43

Ph.D SAMPLE QUESTIONS

SET II

ANSWER KEY

TEST OF BASIC MATHEMATICS	Choice	Q.No.	Choice
Q.1	3	Q.26	1
Q.2	5	Q.27	3
Q.3	4	Q.28	1
Q.4	1	Q.29	1
Q.5	2	Q.30	3
Q.6	4	Q.31	2
Q.7	1	Q.32	3
Q.8	3	Q.33	1
Q.9	5	Q.34	3
Q.10	2	Q.35	2
Q.11	3	Q.36	2
Q.12	1	Q.37	3
Q.13	4	Q.38	2
Q.14	2	Q.39	4
Q.15	2	Q.40	4
Q.16	3	Q.41	1
Q.17	3	Q.42	4
Q.18	2	Q.43	1
Q.19	4	Q.44	3
Q.20	1	Q.45	3
Q.21	1	Q.46	1
Q.22	5	Q.47	5
Q.23	2	Q.48	4
Q.24	1	Q.49	1
Q.25	1	Q.50	1