JKN_QA_03 – DETAILS

PAPER 1 **IDEAL SCORE** **65**

		EASY	MEDIUM	DIFFICULT	TOTAL	
A	**BUSINESS MATHEMATICS - 40Q**	**10**	**15**	**15**	**40**	
1.1	Surds Indices	1			1	
1.2	Logarithms	1			1	
1.3	Ratio and Proportion	1		1	2	
1.4	Mixtures			3	3	
2.1	Linear Equation		1	1	2	
2.2	Quadratic Equations	1			1	
2.3	Cubic Equations	1			1	
2.4	Matrix Algebra		2	1	3	
3.1	Linear Inequalities	1			1	
4.1	Simple Interest	1		1	2	
4.2	Compound Interest		1	1	2	
4.3	Annuties		1	1	2	
5.1	Linear Permutation		1	1	2	
5.2	Circular Permutation		1		1	
5.3	Combination		1	1	2	
6.1	Arithmetic Progression	1	1		2	
6.2	Geometric Progression		1	1	2	
7.1	Sets & Venn Diagrams		1		1	
7.2	Relations & Functions				0	
8.1	Derivatives	2			2	
8.2	Higher Order Derivatives		1	1	2	
8.3	Application of Derivatives			2	2	
8.4	Indefinite Integrals		2		2	
8.5	Definite Integrals		1		1	**40**
B	**LOGICAL REASONING - 20Q**	**4**	**9**	**7**	**20**	
9.1	Number Series	1	1		2	
9.2	Coding & Decoding	1	1	1	3	
9.3	Odd Man Out	1	1	1	3	
10.1	Direction Sense			1	1	
11.1	Linear Seating		3		3	
11.2	Circular Seating				0	
12.1	Blood Relations		2	2	4	
13.1	Deductive Logic	1	1	2	4	**20**
C	**STATISTICS - 40Q**	**11**	**16**	**13**	**40**	
14.1	Introduction to Statistics				0	
14.2	Data Collection & Presentation		1		1	
14.3	Frequency Distribution	1	1		2	
14.4	Graphs			1	1	
15.1	Arithmetic Mean				0	
15.2	Geometric & Harmonic Mean	1		1	2	
15.3	Median	1			1	
15.4	Mode		1		1	
15.5	Partition Values	1			1	
15.6	Range				0	
15.7	Quartile Deviation	1			1	
15.8	Mean Deviation		1		1	
15.9	Standard Deviation	1	1		2	
16.1	Probability Theory				0	
16.2	Probability - Simple cases		1	1	2	
16.3	Probability Theorems		1		1	
16.4	Independent Events		1		1	
16.5	Baye's Theorrem	1			1	
16.6	Theory of Expectation	1	1	1	3	
17.1	Theoretical Distribution Introduction		1	1	2	
17.2	Binomial Distribution		2	1	3	
17.3	Poisson Distribution		1	1	2	
17.4	Normal Distribution	1	1	1	3	
18.1	Bivariate Distribution				0	
18.2	Correlation (r)	1	1	2	4	
18.3	Rank Correlation (R)	1			1	
18.4	Regression Lines			2	2	
19.1	Index Numbers		1	1	2	
19.2	Time Series				0	**40**

TEST PAPER 1 – Explanatory Answers

Group A – Business Mathematics

1. $A^X = B$, $B^Y = A^{XY} = C$, $C^Z = A^{XYZ} = A^1$
   $XYZ = 1$
   $(XYZ)^{XYZ} = 1^1 = 1$
   Option B

2. $X = [\text{Log}_9 32 / \text{Log}_5 27] \div [\text{Log}_3 32 / \text{Log}_5 27]$
   $X = (\text{Log}32/\text{Log}9 \times \text{Log}5/\text{Log}27) \div (\text{Log}32/\text{Log}3 \times \text{Log}5/\text{Log}27)$
   $X = (\text{Log}32 \times \text{Log}5 \times \text{Log}3 \times \text{Log}27) / (2\ \text{Log}3 \times \text{Log}27 \times \text{Log}32 \times \text{Log}5)$
   $X = 1 / 2$
   $2X - 1 = 0$
   Option D

3. B : A = 4 : 3; A : C = 6 : 7
   B : A : C = 8 : 6 : 7
   B's share = 8/21 x 106501.50 = 40572
   Option D

4. A = 2
   B = 5
   A + B = 7
   $(x - 2)(x - 5)(x - 7) = x^3 - 14x^2 + 59x - 70 = 0$
   Option C

5. x/39 = 7/13
   x = 21
   Option A

6. $X^2 - 12X + 36 = 4X + 36$
   $X = 16 = 2^4$
   Number of factors = (4 + 1) = 5; Option A

7. For reciprocal roots: 4/A = 1, i.e. A = 4
   $A^2 + A + 1 = 16+4+1 = 21$; Option A

8. A + 17D + A + 8D = 14400
   2A + 25D = 14400
   S(26) = 26/2 [2A + 25D] = 13 * 14400 = 187200; Option B

9. $x^2 + 5x – 24 = (x + 8) (x – 3)$
   $2x^2 – 5x – 3 = (2x + 1) (x – 3)$
   $(x^2 + 5x – 24) / (2x^2 – 5x – 3) = (x + 8) / (2x + 1)$
   $(x + 8) / (2x + 1) < 0$
   $(x + 8) (2x + 1) / (2x + 1)^2 < 0$
   $(x + 8) (2x + 1) < 0$
   $(x + 8) (x + ½) < 0$
   Thus $– 8 < x < - ½$
   Option C

10. Difference in amount in 2 years = 13000 – 11800 = 1200
    Interest earned in 3 years = 1200/2 * 3 = 1800
    Thus principal invested at first bank = 11800 – 1800 = 10000
    Total amount invested with both the banks together = 10000 + 10000 = 20000
    Option B

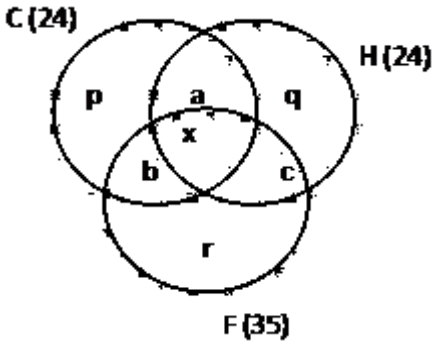
11. Let after n years value of both the assets be same.
    Value of Land after n years = $729000 (1 + 0.1)^n = 9^3 10^3 (1.1)^n$
    Value of building after n years = $1331000 (1 – 0.1)^n = 11^3 10^3 (0.9)^n$
    Now, $9^3 10^3 (1.1)^n = 11^3 10^3 (0.9)^n$
    $9^3 (11/10)^n = 11^3 (9/10)^n$
    $(11/9)^n = (11/9)^3$
    Hence; n = 3
    Option C

12. Difference between CI and SI for 3 years = $P i^2 (i + 3)$; where i = 5/100 = 1/20,
    $122 = P (1/400) (1/20 + 3) = P (1/400) (61/20)$
    P = (122 x 400 x 20) / 61 = 16000
    Thus Interest on Rs. 16,000 for 4 years @5% SI = 16000 x 0.05 x 4 = 3200
    Amount = 16000 + 3200 = Rs. 19,200
    Option D

13. X + Y = 95
    0.9X + 1.2Y = 180/2 = 90
    1.2X + 1.2Y = 114
    0.9X + 1.2Y = 90
    Solving we get, 0.3X = 24; X = 24/0.3 = 80; Y = 95-80 = 15
    Thus X – Y = 80 – 15 = 65
    Option C

14. $X(Y + 10) = XY – 19 + 59 = XY + 40$
    $XY + 10X = XY + 40$
    $10X = 40$
    $X = 4$
    Option D

15. $a + b + c + p + q + r + x = 52$
    $a + b + x + p = 24$
    $a + c + x + q = 24$
    $b + c + x + r = 35$
    Thus: $2(a + b + c) + (p + q + r) + 3x = 24 + 24 + 35 = 83$
    $(a + b + c) + 2x = 83 – 52 = 31$
    $2x = 31 – 13 = 18$
    $x = 9$



    Now, 9/3 = 3 (these three are students who now like only two sports)
    Thus, students liking exactly two sports = 13 + 3 = 16; Option B

16. $24/54 = (1 – x/54)^2$
    $(2/3)^2 = (1 – x/54)^2$
    $2/3 = 1 – x/54$
    $x/54 = 1/3$
    $x = 54/3 = 18$; Option A

17. Proportion of milk left = $(1 – 10/40)^3 = (3/4)^3 = 27/64$
    Milk : Mixture = 27 : 64
    Milk : Water = 27 : (64-27) = 27 : 37
    Water : Milk = 37 : 27; Option C

18. There are 12 letters except R, which can b arranged in 12! / (5! X 3! X 2!)
    There are 13 spaces between these 12 letters where 3 R can be placed in 13P3 / 3! Ways
    Total number of arrangements = [12! / (5! X 3! X 2!)] x [13P3 / 3!] = 9135040 ways
    Option B

19. 10C4 x 6C6 x (4-1)! (6-1)!
    = (10! /6!4!) x (1) x3! X 5!
    = 10!/24
    Option A

20. Let after x hours B's car overtakes A's car.
    Distance travelled by both cars in x hrs is same.
    10x = x/2 [16 + (x-1)1/2]
    20 = 16 + x/2 – ½
    x/2 = 9/2
    x = 9
    Option B

21. Every time an equilateral triangle would formed.
    Perimeter of 1st triangle is 3 x 36
    Perimeter of second triangle is 3 x 18
    Perimeter of third triangle is 3 x 9

    Total perimeter = 3 [36 + 18 + 9 +… till infinity]
    = 3 [36 + 36/2 + $36/2^2$ + ….]
    = 3 [36/(1 – ½)] = 3 [36 x 2] = 216 cms; Option C

22. 4P1 + 4P2 + 4P3 + 4P4 = 4 + 12 + 24 + 24 = 64
    Option D

23. $(2^5 – 1) (2^4 – 1) 2^3$ = 31 x 15 x 8 = 3720
    Option B

24. 3C2 x 5! X 5! = 3 * 120 * 120 = 43200
    Option A

25. 2Y = X + Z, thus X, Y, Z are in AP
    Y – d + Y + Y + d = 24
    Y = 24/3 = 8
    (Y – d) * Y * (Y + d) = 440
    $Y^2 – d^2$ = 55
    64 – 55 = d^2 = 9
    d = 3
    The three numbers are : 5, 8, 11 or 11 , 8 , 5
    X + Y = 5+8 = 13 or 11+8 = 19
    Option C

26. Amount

1^{st} year = 25000 * 1.12 = 28000

2^{nd} year = 28000 * 1.12 = 31360

3^{rd} year = 31360 * 1.12 = 35123.20

Interest in 3^{rd} year = 35123.20 – 31360 = 3763.20

Option B

27. AB exists; x = 11 – y

BA exists; y = x + 5

x = 11 – y = 11 – x – 5

2x = 6; x = 3, y = 8

Option A

28. $A = \begin{bmatrix} 5 & 3 & 1 \\ 2 & -1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$; $A^2 = \begin{bmatrix} 35 & 13 & 14 \\ 16 & 9 & 6 \\ 34 & 14 & 15 \end{bmatrix}$; $A^3 = \begin{bmatrix} 257 & 106 & 103 \\ 122 & 45 & 52 \\ 258 & 103 & 107 \end{bmatrix}$

$A^3 - 7A^2 - 5A = \begin{bmatrix} 257 & 106 & 103 \\ 122 & 45 & 52 \\ 258 & 103 & 107 \end{bmatrix} - \begin{bmatrix} 245 & 91 & 98 \\ 112 & 63 & 42 \\ 238 & 98 & 105 \end{bmatrix} - \begin{bmatrix} 25 & 15 & 5 \\ 10 & -5 & 10 \\ 20 & 5 & 15 \end{bmatrix} = \begin{bmatrix} -13 & 0 & 0 \\ 0 & -13 & 0 \\ 0 & 0 & -13 \end{bmatrix} = -13I$

Option C

29. $AB = \begin{bmatrix} 2 & -1 & 2 \\ 1 & 3 & -1 \end{bmatrix}$, $BC = \begin{bmatrix} 1 & -1 \\ -1 & 0 \\ 2 & 2 \end{bmatrix}$, $A(BC) = \begin{bmatrix} 4 & 1 \\ 0 & 2 \end{bmatrix}$, $(AB)C = \begin{bmatrix} 4 & 1 \\ 0 & 2 \end{bmatrix}$

(AB)C = A(BC)

Option C

30. $100000 = A/0.12\ [\ (1.12)^{10} - 1](1.12)$

$12000 = A[3.4785495 - 1.12]$

A = 12000 / 2.3585495

A = 5088

Option D

31. $20000 = A/0.04\ [1 - (1.04)^{-10}]$

$X = (1.04)^{-10}$

Log X = -10 Log(1.04) = - 10 * 0.0170 = - 0.17 = -1 + 0.83 = Log 0.6761

X = 0.6761

Now, 800 = A(1 – 0.6761)

A = 800/0.3239 = 2470

Option C

32. $e^{5\log_e x} = x^5$
$\int x^5\, dx = x^6/6 + C$
Option C

33. $dy/dx = 6x^2 + 6x - 36$
$dy^2/dx^2 = 12x + 6 = 0$
$x = -6/12 = -1/2$
Option B

34. $dY/dx = 3x^2 - 4kx - 4$
at $x = 2$
$dY/dx = 12 - 8k - 4 = 0$
$k = 8/8 = 1$; Option B

35. $dx/dt = 2b$
$dy/dt = 2bt$
$dy/dx = 2bt/2b = t$
Option A

36. $x = 20 - 2p$
$dx/dp = -2$
When $p = 2$, $x = 20 - 4 = 16$
Elasticity $= (dx/dp) \times (p/x) = (-2) \times (2/16) = -4/16 = -1/4 = -0.25$
Option B

37. $y = 4x^3 + 19x^2 - 14x + 3$
$y1 = 12x^2 + 38x - 14$
$y2 = 24x + 38$
Putting $y1=0$ we get;
$6x^2 + 19x - 7 = 0$
$6x^2 + 21x - 2x - 7 = 0$
$3x(2x + 7) - 1(2x + 7) = 0$
$(2x + 7)(3x - 1) = 0$
$x = 1/3, -7/2$

$y2$ at $x=1/3 > 0$. Thus at $x = 1/3$, y is minimum
$y2$ at $-7/2 < 0$. Thus at $x=-7/2$, y is maximum

y at $1/3 = 4/27 + 19/9 - 14/3 + 3 = (4 + 57 - 126 + 81)/27 = 16/27$ (Minimum value)
y at $-7/2 = -1372/8 + 931/4 + 98/2 + 3 = (-1372 + 1862 + 392 + 24)/8 = 906/8$ (Max value)
Max + Min $= 16/27 + 906/8 = (128 + 24462) / 216 = 24590/216 = 12295/108$
Option A

38. $I = \int_2^3 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}dx = \int_2^3 \frac{\sqrt{3+2-x}}{\sqrt{5-(3+2-x)}+\sqrt{(3+2-x)}}dx = \int_2^3 \frac{\sqrt{5-x}}{\sqrt{x}+\sqrt{5-x}}dx$

$2I = \int_2^3 dx = [x]_2^3 = (3-2) = 1$

I = ½ = 0.5

Option B

39. $I = \int \frac{x^3+4x^2-3x-2}{x+2}dx$

$I = \int (x^2+2x-7+\frac{12}{x+2})dx = \frac{1}{3}x^3+\frac{2}{2}x^2-7x+12\log(x+2)+C$

Option A

40. dx/dt = c; dy/dt = $-c/t^2$

dy/dx = $-1/t^2 = -t^{-2}$

$d^2y/dx^2 = 2t^{-3}$. dt/dx = $2/t^3$ * 1/c = $2/ct^3$

at t = ½ = 16/c

Option C

Group B – Logical Reasoning

41. S/T * U + Z

= S is daughter of T, T is brother of U, U is father of Z

= S is the cousin of Z

Option C

42. From the situations given in the problem, the standing pattern is follows:

D – B – F OR F – B – D

C – E – A OR A – E – C

Combining we get:

D – B – F – C – E – A

It is clear that A and D occupy the extreme ends of the row.

Option D

43. It is given that R = 1.

T is neither 2, 3 nor 4. Thus T is neither 1, 2, 3 nor 4. T = 5

S is either 4 or 5. But T = 5. Thus S = 4

As P is an odd number and the only odd number left is 3. Hence P = 3 and thus Q = 2.

Hence the ordered sequence is 3-2-1-4-5.

Option C

44. Comparing 2 words, shall give 4 for “me” (me and 4 are common to both the words/numbers)
    Option B

45. Grandfather’s only son = Vineet’s father
    Vineet’s father’s daughter is Vineet’s sister
    Vineet is brother of that lady in the park
    Option B

46. I LIKE YOU
    9 0 12 9 11 5 0 25 15 21
    Option B

47. $BC^2 = AB^2 + AC^2 = 1^2 + 1^2 = 2$
    $BC = \sqrt{2}$
    Option B

48.

2	5	14	41	122	**365**
	3	9	27	81	**243**
	3^1	3^2	3^3	3^4	$\mathbf{3^5}$

    Difference is in powers of 3
    Option B

49. T1 = 15
    T2 = 15*1 + 1 = 16
    T3 = 16*2 + 2 = 34
    T4 = 34*3 + 3 = 105
    T5 = 105*4 + 4 = 424
    T6 = 424*5 + 5 = 2125
    Option C

50. From the situations given in the problem, the standing pattern is follows:
    D – B – P OR P – B – D
    C – E – A OR A – E – C
    Combining and following other conditions given in the problem we get:
    D – B – P – C – E – A
    From the pattern it is clear that D and A occupy the extreme ends of the row.
    Option D

51. A – AA – S or AA – A – S can be the probable sequence of ages of the three person given in the question. (Read L – R as Elder – Younger). Thus no valid conclusion can be drawn.
    Option D

52. Screen is not a component of typewriter; the other three are.
    Option D

53. Mania is the odd-man out, as all the other choices are the name of diseases, caused by the external agent like virus or bacteria. Mania is a psychological disease.
    Option C

54. Subtracting 8 from all the four options gives: 13, 23, 33, 43.
    33 is not a prime number, other three are prime numbers.
    Option C

55. F is maternal uncle of E means F is the brother of E's mother, i.e. F is brother of C. C is the sister of B. So, F is the brother of B who is A's father. Thus F is the maternal uncle of A. So, A and D are the nephews of F, i.e. F has two nephews.
    Option C

56. From information is evident that A is male and C is also male. Gender of B is required.
    Option B

57. Either I or II follows as conclusion.

    Option C

58. Statement says – all actors are male, means some male are not actors. All male are handsome, means all actors are handsome. Thus both I and II follows.
    Option C

59. Standing arrangement is:
    F – B – M – A – G – C – E
    G and E are on both sides of C.
    Option A

60. Here P is the proper subset of S and S is the proper subset of C. Thus All the P are C and Some C are P.
    Option C

Group C – Statistics

61. Then the values are averaged. Option D

62. The given distribution is continuous. 25 shall appear in class 25 – 35. Option C

63. A discrete series is given. Option C
64. Histogram – Class Interval, Frequency Polygon – Mid Value, Less than Ogive – Upper limit. Option C

65. The data collected by a firm in a market survey conducted by it, is the primary source of data collection. Option C

66. HM(y) = 14, AM(y) = 1/14
    AM(y) = 2 AM(x) = 1/14
    AM(x) = 1/28
    HM(x) = 28; Option C

67. To calculate the median, first step to array the data in ascending or descending order. Option C

68. The mode is not affected by the presence of extreme data. Option B

69. Average Speed = (2*60*30)/(60+30) = 3600/90 = 40. Option C

70. P90 – P20 = 90% - 20% = 70% data. Option D

71. Arrange: 1, 3, 4, 5, 6, 6, 10
    Q1 = (7+1)/4 = 2^{nd} element = 3
    Q3 = 3*2 = 6^{th} element = 6
    QD = (6 – 3)/2 = 1.5; Option A

72. Sum of squares of the data = $(5^2 + 60^2)*100 = 3625*100 = 362500$. Option B

73. Mean Deviation

X	F	FX	$\|X - \mu\| * F$
14	3	42	6
13	12	156	12
11	12	132	12
10	3	30	6
12	18	216	0
	48	**576**	**36**

Mean μ = 576/48 = 12
Mean Deviation = 36/48 = 0.75
Option A

74. Mean = 160/10 = 16
COV = SD/Mean = 4/16 = 0.25 = 25%
Option B

75. The correlation between two variables having no casual relation is known as spurious correlation. Option C

76. P = 0.6*0.8 + 0.4*0.3 = 0.48 + 0.12 = 0.60. Option B

77. E(2X + 5) = 2E(X) + 5 = 2+5 = 7
E(X) = 1/6 -2/3 + 3/2 = (1 – 4 + 9)/6 = 1
Option C

78. P(Contradict) = 3/5*1/4 + 2/5*3/4 = 9/20
Odds in favour = 9:(20-9) = 9 : 11
Option B

79. In case of attributes or qualitative data, Spearman's Rank Correlation Coefficient is used.
Option C

80. Expected value = 300*0.15 + 100*0.25 – 100*0.60 = 45 + 25 – 60 = 10
Expected value = 10,00,000. Option B

81. P = 1 / 2 [6/36 + 5/36] + 1 / 2 [4/36 + 4/36] = 19/72
Pack of number cards contains 4 * 9 = 36 cards
Option A

82. It represents a straight line with positive slope. Thus Y = A + BX, B>0 is the correct linear relationship. Option B

83. Total cases = 11C7 = 330
Favourable cases = 5C5 * 1C1 * 5C1 = 1 * 5 = 5
[We need to select 5 numbers from 9,12,14,15,17; and one number from 1, 2,3,4,5 along with compulsory selection of the number 8]
Probability = 5/330 = 1/66
Option B

84. Probability of getting blue ball = ½ [2/5 + 4/5] = 6/10
Probability of getting blue from Bag2 = ½ [4/5] = 4/10
Required probability = 4/10 / 6/10 = 4/6 = 2/3
Option B

85. $1 - r^2 = 0.25$
$r^2 = 1 - 0.25 = 0.75$
Option B

86. BYX = ¾; BXY = 1/3
$r^2 = 3/4 * 1/3 = ¼$
r= 0.5
now, $1/3 = 0.5(2/\sigma y)$
$\sigma y = 3$
Option B

87. Coded SD x = σx/5
Coded SD y = σy/10
Coded bYX = r (σy/10 / σx/5) = ½ r(σy/σx) = Half of bYX
Option C

88. Correlation coefficient is unit free. Thus with changes in units of measurement, there shall be no change in the value of correlation coefficient. Option B

89. Q = Variance/Mean = 1/3
P = 1 – 1/3 = 2/3
Mean = nP = 4; n = 6
$P(x > 5) = P(x = 6) = 6C6 (2/3)^6 = 0.0877$
Option A

90. $P(X=0) = e^{-3} = 0.0498$
Number of drivers = 0.0498 * 10000 = 500
Option C

91. E(X) = 0 + 0.10 + 0.42 + 0.96 + 0.80 + 0.45 + 0.36 = 3.09
$E(X^2) = 0 + 0.10 + 0.84 + 2.88 + 3.20 + 2.25 + 2.16 = 11.43$
Variance = $11.43 - (3.09)^2 = 1.8819$
SD = 1.36
Option B

92. For standard normal distribution: Mean = 0 and SD = 1. Option B

93. There are two methods to fit the normal curve. Option B

94. $I = \int_{-1}^{1} K dx = K[x]_{-1}^{1} = 2K = 1$

    K = ½ = 0.5

    Option B

95. Mean = E(x) = 1/n [1 + 2 + 3+ ...+ n] = 1/n * n(n + 1)/2 = (n + 1)/2

    Option C

96. In case of binomial distribution Mean is always greater than the variance. Option C

97. P(x = 2) = 3 P(x = 3)

    $4C2\ p^2q^2 = 3 * 4C3p^3q^1$

    $6p^2q^2 = 12p^3q$

    q = 2p = 1 – p

    p = 1/3

    Option C

98. The statement was given by Prof. Kelly. Option C

99. SD should be same for the look alike normal distribution's curve. Option C

100. All the 3 conditions in a) b) and c) are necessary for use of Poisson distribution. Option D