UNIVERSITY OF BUEA

FACULTY OF ENGINEERING AND TECHNOLOGY

ENTRANCE EXAMINATION **September 2017**

MATHEMATICS

Time: 3 Hours

Answer all Questions

1. Given that $f(x)=\dfrac{x-1}{x-2}, x \neq 2$, the range of f(x) is

   A $(x \in R, x \neq 2)$
   B $(x \in R, x \neq -1)$
   C $(x \in R, x \neq 1)$
   D $(x \in R, x \neq -2)$

2. The functions f and g are real valued functions. Given that $g(x)=\dfrac{x-1}{x+2}$ and $g \circ f(x)=\dfrac{7}{3x-5}$ then f(x)=

   A $\dfrac{x+3}{x+4}$
   B $\dfrac{x-3}{x-4}$
   C $\dfrac{x+3}{x-4}$
   D $\dfrac{x-3}{x+4}$

3. The values of x that satisfy the equation $3^{2x}-10(3^{x+1})+3^{4}=0$ is

   A $x=2$ or $x=$ [illegible]
   B $x=3$ or $x=-1$
   C $x=1$ or $x=-3$
   D $x=1$ or $x=3$

4. The solution of the differential equation $y\dfrac{dy}{dx}=2x$, given that y=1 and x=1 is

   A $x^2=y^2-2$
   B $2x^2=y^2-1$
   C $x=2y^2-1$
   D $y^2=2x^2-1$

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5. The line segment PQ, where P is the point(7,7) and Q the point(-1,3), is the diameter of a circle. The equation of the circle is

A $(x-7)(x+1)+(y-7)(y-3)=0$

B $(x-7)(x-1)+(y-7)(y-3)=0$

C $(x+7)(x-1)+(y+7)(y+3)=0$

D $(x+7)(x+1)+(y-7)(y+3)=0$

6. When $f(x)=2x^3+x^2-13x+6$ is divided by $2x-1$, the remainder is

A 13

B 52

C $\frac{1}{2}$

D 0

7. The range of values of x for which $|x-4|\le 2$ is

A $x\le 6$

B $x\le 2$ *or* $x\ge 6$

C $2\le x\le 6$

D $x\ge 2$

8. Which of the following statements is TRUE?

A If $x^2=y^2$, *then* $x=y$

B If f(a)=0 then x+a is a factor of f(x)

C If f(x) has a maximum value at x=a then $f''(a)>0$

D Let $m,n\in Z$, the set of integers. If m and n are both odd, then m+n is even

9. Given that $f(x)=\begin{vmatrix} x & x^2 & x^3 \\ 1 & 2x & 3x^2 \\ 0 & 2 & 6x \end{vmatrix}$, $f'(x)=$

A 12

B $6x^2$

C 6x

D $42x^2$

10. Given that f is a periodic function of period 4 and that
$f(x)=\{x^2,\ 0\le x<2\ ;\ x+2,\ 2\le x<4$ *then* $f(9)=$

A 1

B 81

C 11

D 7

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11. The volume generated when the area of the finite region enclosed by the x-axis and the curve $y = x - x^2$ is rotated completely about the x-axis is

A $\pi\int_0^1 (x - x^2)^2\,dx$

B $\pi\int_0^2 (x - x^2)^2\,dx$

C $2\pi\int_{-1}^1 (x - x^2)^2\,dx$

D $2\pi\int_{-1}^0 (x - x^2)^2\,dx$

12. Two consecutive integers between which a root of the equation $x^3 + x - 16 = 10$ lies are

A 1 and 2
B 2 and 3
C 3 and 4
D 4 and 5

13. The vectors a and b are such that $|a| = 3, |b| = 5,$ *and* $a.b = -14$ *then* $|a - b| =$

A 62
B $\sqrt{62}$
C 44
D $\sqrt{44}$

14. The sum of the first n terms of a series is given by $S = 5n^2 + 2n$. The n^{th} term of the series is

A 10n + 7
B 10n − 3
C 10n + 3
D 10n − 7

15. The expansion of $(2 + 3x)^{-1}$ is valid when

A $-\frac{2}{3} < x < \frac{2}{3}$

B $-\frac{1}{3} \le x \le \frac{1}{3}$

C $-\frac{1}{3} < x < \frac{1}{3}$

D $-\frac{3}{2} < x < \frac{3}{2}$

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16 The Cartesian equation of the curve with parametric equation $x = 1 + t^2$, $y = 2t$, where t is a parameter, is

A $y^2 = 4(x-4)$

B $y^2 = 4(x-1)$

C $y^2 = 4(x+4)$

D $y^2 = 4(1-x)$

17. $\lim_{x\to\pi} \frac{\sin 2x}{\sin x} =$

A -1

B 2

C 0

D -2

18. $1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + =$

A $\frac{31}{16}$

B $\frac{1}{2}$

C 7

D 2

19. The asymptotes of the curve $y = \frac{(x-5)^2}{(x+5)(x-3)}$ are

A x=3, x=-5, y=5

B x=-3, x=-5, y=-5

C x=3, x=-5, y=1

D x=3, x=-5, y=-1

20. The values of y corresponding to the values of x are given in the table below.

X	6	9	12	15	18	21
Y	0.3	0.8	1.4	2.1	3.0	4.3

Using the trapezoid rule, the approximate value for $\int_6^{21} y\,dx$ is

A 9.6

B 35.7

C 28.9

D 28.8

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21. The gradient of the implicit function to the curve $x^2 + y^2 = 13$ at the point(2,-3) is

A $-\frac{2}{3}$

B $\frac{3}{2}$

C $\frac{2}{3}$

D $-\frac{3}{2}$

22. $\sin 50^{o} + \sin 40^{o} =$

A $\sqrt{2}\cos 5^{o}$

B $2\cos 10^{o}$

C $2\cos 5^{o}$

D $\sqrt{2}\cos 10^{o}$

23. The value of the constant λ, for which the plane

$\lambda x - 3y + 4z = 5$ *and the line* $r = i - 2j - 3k + t(2i + 6j + 3k)$ *are parallel is*

A 6

B 3

C 4

D 5

24. $\int \frac{x}{1+x^2}\,dx =$

A $\ln(1+x^2)+c$

B $\frac{1}{2}\ln(1+x^2)+c$

C $\frac{1}{2}\tan^{-1}x+c$

D $\tan^{-1}x+c$

25. The general solution of the equation $\tan(2x+\frac{\pi}{3}) = \frac{1}{\sqrt{3}}$ is

A $2x = n\pi - \frac{\pi}{6}$

B $2x = n\pi + \frac{\pi}{3}$

C $2x = n\pi + \frac{\pi}{6}$

D $2x = n\pi - \frac{\pi}{3}$

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26. Given the vectors **a** and **b**, where **a=2i-2j+2k** and **b= 3i-j+2k** are coplanar vectors, **a x b=**

A **-2i-2j+4k**

B **-2i+2j-4k**

C **-2i+2j+4k**

D **2i-2j-4k**

27. Given $n \in N^*$ *such that* $u_n = 1 - \frac{1}{n}$, *the sequence* (u_n) *is*

A Strictly monotonic increasing

B not bounded below

C Strictly monotonic decreasing

D tends to infinity as $n \to \infty$

28. The function $f : R \to R$, *where* $f : x \to x - \frac{1}{3}x^3$ accepts the following ranges of values of x

A decreases for $x \le -1$, increases for $-1 < x < 1$, decreases for $x \ge 1$

B increases for $x \le 1$, decreases for $-1 < x < 1$, increases for $x \ge 1$

C increases for $x \le 1$, decreases for $x > 1$

D decreases for $x \le 1$, increases for $x > 1$

29. The complex number $1 + \sqrt{3}\,i$ can be expressed in exponential form

A $2e^{\frac{\pi}{6}i}$

B $2e^{-\frac{\pi}{6}i}$

C $2e^{-\frac{\pi}{3}i}$

D $2e^{\frac{\pi}{3}i}$

30. $(\cos 4\theta + i\sin 4\theta)^3 (\cos 3\theta + i\sin 3\theta) =$

A $\cos 5\theta + i\sin 5\theta$

B $\cos 11\theta + i\sin 11\theta$

C $\cos 3\theta + i\sin 3\theta$

D $\cos 19\theta + i\sin 19\theta$

31. An iterative formula is given by $X_{n+1} = \frac{X_n^3 + 1}{5}$. Given that $X_1 = 0$, $X_3 =$

A 0.2

B 0.2016

C 0.208

D 2.016

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32. Given the matrix A, where $A = \begin{pmatrix} 2 & 8 & 9 \\ 0 & -1 & -3 \\ 0 & 2 & 1 \end{pmatrix}$. The Determinant of A^T, the transpose of A , is

A -14

B 14

C -10

D 10

33. The image of the line y=2x under the transformation matrix $\begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$ is the line

A $7x - 4y = 0$

B $7x + 4y = 0$

C $4x - 7y = 0$

D $4x + 7y = 0$

34. The equations

$$\begin{aligned} 2x - 3y + 4z &= 1 \\ 3x - y \quad\quad &= 2 \\ x + 2y - 4z &= 1 \end{aligned}$$

A are linearly independent

B are straight lines

C are linearly dependent

D have a unique solution

35. $\lim_{x \to 3} \left(\frac{x^2 - 9}{x - 3} \right)$

A 0

B -3

C ∞

D 6

36. Given that $y^3 + x^2 y - x^3 = 3$, $\frac{dy}{dx} =$

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

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

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

D $\frac{3x - 2y}{x + 3y^2}$

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37. $\int \frac{x+2}{x+3}\,dx =$

A $2x - \ln(x+3) + K$

B $x - \ln(x+3) + K$

C $\ln(x+3) - x + K$

D $x + \ln(x+3) + K$

38. Given that $(1+i)z - 3 + i = 0$, the value of z in the form $a + bi$, where a and b $\in \mathbb{R}$, is

A $-1-2i$

B $-1+2i$

C $1+2i$

D $1-2i$

39. If a complex number z has modulus 2 and argument $\frac{\pi}{6}$, then

A $z = 1 + \sqrt{3}\,i$

B $z = \sqrt{3} - i$

C $z = \sqrt{3} + i$

D $z = 1 - \sqrt{3}\,i$

40. $e^{-\frac{\pi}{2}i} =$

A $\cos\frac{\pi}{2} - i\sin\frac{\pi}{2}$

B $-\cos\frac{\pi}{2} - i\sin\frac{\pi}{2}$

C $\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}$

D $\frac{1}{2}[\cos(-\pi) + i\sin(-\pi)]$

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41. The solution of the differential equation $(1+x^2)\frac{dy}{dx} = 1$ is

A $\tan^{-1}(\frac{x}{2}) + k$

B $\tan^{-1}(x) + k$

C $\cot^{-1}(\frac{x}{2}) + k$

D $\cot^{-1}(x) + k$

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42. Given that $r_1 = i + 2j + 3k + \lambda(4i - j + mk)$ and $r_2 = 3i + 2j - k + \mu(i + j - k)$ are two perpendicular lines, the value of m is

A 3
B -3
C 1
D -1

43. Given that $\sqrt{3}\cos x + \sin x \equiv R\cos(x - \theta)$, where R>0 and $0 < \theta < \frac{\pi}{2}$, the values of R and $\tan\theta$ *respectively are* :

A $\sqrt{3}$, $\sqrt{3}$
B $4, -\frac{1}{\sqrt{3}}$
C $2, , \frac{1}{\sqrt{3}}$
D $3, -\sqrt{3}$

44. $\cos 7\theta + i\sin 7\theta =$

A $7(\cos\theta + i\sin\theta)$
B $7(\cos\theta - i\sin\theta)$
C $(\cos\theta + i\sin\theta)^7$
D $\cos 2\theta \cos 5\theta + i\sin 2\theta \sin 5\theta$

45. The sum of the roots of the equation $3x^2 + kx - 15 = 0$ *is* 2. The value of the constant K is

A 6
B -6
C 30
D -30

46. Which of the following binary relations defined on Z, the set of integers, is not transitive?

A $aRb \Leftrightarrow a$ *is a factor of* b
B $aRb \Leftrightarrow a$ *is a greater than* b
C $aRb \Leftrightarrow a + b$ *is odd*
D $aRb \Leftrightarrow a + b$ *is even*

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47. The functions f and g are defined on R by $f : x \to 2x - 1$ *and* $fg : x \to x - 2$

A $\quad g : x \to \frac{x-2}{2}$

B $\quad g : x \to \frac{x-1}{2}$

C $\quad g : x \to \frac{2x-1}{2}$

D $\quad g : x \to \frac{x+1}{2}$

48. A linear relationship involving the variables x and y is $\ln y = nx + \ln a$, where a and n are constants. The relationship between x and y is also

A $\quad y = an^x$

B $\quad y = ae^{nx}$

C $\quad y = ax^n$

D $\quad y = ne^{ax}$

49. The gradient of the tangent to the curve $y = 2e^{2x} - 3e^{-x}$ at the point where x=0 is

A 5

B 7

C -1

D -5

50. The function f is defined on the set of real numbers R by $f(x) = \frac{k + 3x}{2 + x}$, $x \neq -2,\ 0$. The value of the constant K for which f is an even function is

A 6

B 3

C 2

D 5

51. A point P divides the line segment joining the points M(4, 1) and N(7, 7) internally in the ratio 2:1. The coordinates of P are

A (5, 6)

B (5, 5)

C (6, 3)

D (6, 5)

52. If $4\log_{10} x - \log_{10} y = \log_{10} 13$ *then*

A $\quad x^4 y = 13$

B $\quad 4x = 13y$

C $\quad x^4 = 13y$

D $\quad 4^x = 13y$

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53. A first approximation to the real root of the equation $x^3 + x^2 - 5x - 1 = 0$ *is* 2. A second Approximation to the root of the equation, using the Newton-Raphson's method, is

A $\frac{21}{11}$

B $\frac{23}{11}$

C $\frac{19}{11}$

D $\frac{18}{11}$

54. Given the complex number z, where $z = -\sqrt{3} - i$, the modulus-argument form for z is

A $2(\cos\frac{\pi}{6} - i\sin\frac{\pi}{6})$

B $2(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6})$

C $2(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6})$

D $2(\cos\frac{5\pi}{6} - i\sin\frac{5\pi}{6})$

55. Given that $\sqrt{3}\cos x = \cos(\frac{\pi}{6} - x)$, $\tan x =$

A $\sqrt{3}$

B $\frac{1}{\sqrt{3}}$

C 1

D $\frac{\sqrt{3}}{2}$

56. $\int e^{3x}dx =$

A $\frac{1}{3x+1}e^{3x+1} + k$

B $3e^{3x} + k$

C $e^{3x} + k$

D $\frac{1}{3}e^{3x} + k$

57. Given the parametric equations

$x = 2t + \sin 2t$ *and* $y = 1 - \cos 2t$, *where* t *is a parameter*, $\frac{dy}{dx} =$

A $-\tan t$

B $\cot t$

C $\frac{-\sin 2t}{1+\cos 2t}$

D $\frac{\sin 2t}{1+\cos 2t}$

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58. The curve $y = (x+2)^2$ has a minimum point at
    A (0, 4)
    B (4, 0)
    C (0, -2)
    D (-2, 0)

59. The number of selections of 3 students from a class of 7 students for a party in which the class prefect must attend is
    A $1x\,{}^6C_3$
    B $1+{}^6C_3$
    C $1x\,{}^6C_2$
    D $1+{}^6C_2$

60. Given that x-c is a factor of f(x), where $f(x) = 2x^3 - cx^2 + +c(1-c)x - (6+c)$, the value of the constant c is
    A 2 or -3
    B -2 or 3
    C -2 or -3
    D 2 or 3

61. Given the differential equation $\cos x \dfrac{dy}{dx} = y \sin x$, then
    A $y = \ln(\sec x) + K$
    B $\ln y = \ln(\sec x) + K$
    C $y = \sec x + K$
    D $\ln y = \sec x + K$

62. $\sum_{r=1}^{n+1}(r-1) =$
    A $\frac{1}{2}n(n+1)-(n+1)$
    B $\frac{1}{2}n(n+1)(n+2)-1$
    C $\frac{1}{2}n(n+1)$
    D $\frac{1}{2}n(n+2)-(n+1)$

63. $\lim_{x\to 0}\left(\dfrac{\sin 2x - \sin x}{\sin x}\right) =$
    A 0
    B -3
    C 2
    D 1

64. Given that $\dfrac{d}{dx}(3x^3e^{2x}) = 3x^2(a+bx)e^{2x}$
    A a=9, b=6
    B a=6, b=9
    C a=2, b=3
    D a=3, b=2

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65. The number of arrangements of the letters of the word MINIMUM is

A $\frac{7!}{2!3!}$

B $7!x3!x2!$

C $7!$

D $\frac{5!}{2!3!}$

66. If $\frac{2}{x-2}+\frac{3}{x+1}=\frac{ax+b}{(x-2)(x+1)}$ then the values of the real constants a and b are respectively

A 5, 4
B 5, -4
C -5, 4
D -5, -4

67. The roots of the quadratic equation $cx^2-3x-c=0$ are

A $\frac{3\pm\sqrt{9-4c^2}}{2c}$

B $\frac{3\pm\sqrt{9+4c}}{2c}$

C $\frac{3\pm\sqrt{9+4c^2}}{2c}$

D $\frac{3\pm\sqrt{9-4c}}{2c}$

68. Given that $x\in R$ and that $x>0$, the root of the equation $\log 2+\log(2x^2+2x-1)=0$ is

A $\frac{3}{2}$

B $\frac{2}{3}$

C $\frac{1}{4}$

D $\frac{1}{2}$

69. The diameters of two concentric circles are 10m and 6m. The area of the region between the two circles is

A 16π
B 64π
C 4π
D 9π

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70. The parametric equations of a curve are $1-x=\tan\theta$, $y=\sec\theta$.

The Cartesian equation of this curve is

A $x^2-y^2+2x+2=0$

B $x^2-y^2+2x-2=0$

C $x^2-y^2-2x+2=0$

D $x+y^2-2x+2=0$

71. $n!+(n-1)!+(n-2)!=$

A $n^2(n-1)!$

B $n^2(n-2)!$

C $n(n-2)!$

D $n(n-1)!$

72. The center of the circle $x^2+y^2-x+\frac{1}{2}y-\frac{1}{4}=0$ is

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

B (2, -1)

C $(-\frac{1}{2},-\frac{1}{4})$

D $(\frac{1}{2},-\frac{1}{4})$

73. The general solution of the equation $\sin 2x=\frac{\sqrt{3}}{2}$ is

A $\frac{\pi}{6}[3n+(-1)^n]$

B $\frac{\pi}{2}[6n+(-1)^n]$

C $\frac{\pi}{6}[2n+(-1)^n]$

D $\frac{\pi}{3}[3n+(-1)^n]$

74. If $y=\ln(\frac{x+1}{2x})$, then $\frac{dy}{dx}$ is

A $\frac{2x}{1+x}$

B $\frac{1}{x+1}-\frac{1}{x}$

C $\frac{1}{x+1}+\frac{1}{2x}$

D $\frac{1}{x+1}-\frac{1}{2x}$

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75. $\int_1^2 3e^{\ln x^2}\,dx =$

A $6 \ln 2$

B $\frac{3}{\ln 4}$

C 8

D 7

76. The general solution of the differential equation $(x-3)\frac{dy}{dx} = y$ is

A $y = \frac{x^2}{2} - 3x + K$

B $y = K e^{x-3}$

C y=K(x-3)

D y=(x-3)+K

77. The statement $x - 3 > \frac{x-4}{x}$, $x \in R$ is equivalent to

A $\frac{x^2 - 4x + 4}{x} > 0$

B $x^2 - 4x + 4 > 0$

C $\frac{x^2 - 4x - 4}{x} > 0$

D $x^2 - 2x - 4 > 0$

78. Given that -2, K, 5 are three consecutive terms of an arithmetic progression, then the common difference is

A $\frac{3}{2}$

B $\frac{7}{2}$

C 7

D 3

79. The set of values of x for which the geometric series $\sum_{r=0}^{\infty} (x-1)^r$ is convergent is

A $0 < x < 2$

B $-1 < x < 1$

C $-2 < x < 1$

D $0 \le x \le 2$

80. The partial fractions corresponding to $\frac{2x+7}{x^2+5x+6}$ are

A $\frac{3}{x+2} - \frac{1}{x+3}$

B $-\frac{3}{x+2} + \frac{1}{x+3}$

C $-\frac{3}{x+2} - \frac{1}{x+3}$

D $\frac{3}{x+2} + \frac{1}{x+3}$

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