MATHEMATICS MODEL EXAM FOR GRADE 12

DIRECTION: THE PAPER CONTAINS MATHEMATICS EXAMINATION FOR GRADE **12** FOR **SOCIAL SCIENCE STREAM ONLY**. THE EXAMINATION CONTAINS **65** ITEMS. THERE IS ONLY ONE BEST ANSWER FOR EACH ITEM. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **3 HOURS**.

1. If $a_1, a_2, a_3 \ldots$ in arithmetic sequence such that $a_1+a_5+a_{10}+a_{15}+a_{20}+a_{24}=225$, *then* $a_1+a_2+a_3+a_4+\ldots+a_{23}+a_{24}$ *is* equal to

   A.909 B. 75 C. 750 D. 900

2. The sum of integers from 1 to 100 which are not divisible by 3 or 5 is

   A. 2489 B. 4735 C. 2317 D. 2632

3. What is the sum of the series $\sum_{n=1}^{\infty}\left(\frac{4}{2^n}-\frac{2}{n(n+1)}\right)$?

   A. 2 B. 4 C. 0 D. -2

4. If $f(x)=x^2-x^{-2}$, $x \in \text{-}(0)$, then $f\left(\frac{1}{x}\right)$ is equal to

   A. $f(x)$ B. $-f(x)$ C. $f\left(\frac{1}{x}\right)$ D. $(f(x))^2$

5. If $f(x)=x^3+3x^2+4x+5$ and $g(x)=5$, *then* g¿ is equal to

   A. $5x^2+15x+25$ C.1125

   B. $5x^3+15x^2+20x+25$ D.5

6. If $a, b, c, d, e \wedge f$ are in arithmetic sequence, then $e-c$ is equal to:

   A. $2(c-a)$ B. $2(d-c)$ C. $2(f-a)$ D. $(d-c)$

7. Let $(x)=\begin{cases} x^2-a^2x, if\ x<2 \\ 4-2x^2, if\ x\geq 2 \end{cases}$. What is the value of **a** if f is continuous at $x=2$?

   A.-2 B. 2 C. 2 & -2 D. 4

8. If $f(x)=\lfloor x \rfloor, x \in IR$, which of the following is **true** about f?

   A. $f(x)=2f(x)$ B. $f(x)=(fxf)(x)$ C. $f(x)=(fof)$¿ D. $f(x)=x$

9. Let $\{a_n\}_{n=1}^{\infty}$ be defied recursively by $a_1=1 \wedge a_{n+1}=\left(\frac{n+2}{n}\right)a_n, n\geq 1$.

Then $\sum_{n=1}^{5} a_i$ is equal to

A. 55 B. 45 C. 35 D. 20

10. If $f(x)=-\sqrt{25-x^2}$, then $\lim_{x\to 1}\frac{f(x)-f(1)}{x-1}$ is

A. $\frac{1}{24}$ B. $\frac{1}{5}$ C. $-\sqrt{24}$ D. $\frac{1}{\sqrt{24}}$

11. For the equation $4x^2+7y^2+32x-56y+148=0$. Which one of the following is true?

A. ellipse with center $(4,-4)$ and foci at $(4\pm\sqrt{3},-4)$

B. hyperbola with center $(-4,4)$ and foci at $(4,-4\pm\sqrt{3})$

C. ellipse with center $(-4,4)$ and foci at $(-4\pm\sqrt{3},4)$

D. hyperbola with center $(4,-4)$ and foci at $(-4,4\pm\sqrt{3})$

12. Which of the following is equal to $\sum_{n=1}^{\infty}\frac{(2)^{n-1}+3}{3^{n+2}}$

A. $\frac{1}{3}$ B. $\frac{1}{9}$ C. $\frac{1}{4}$ D. $\frac{1}{5}$

13. If a,b,c,d are positive integers, then $\lim_{x\to\infty}\left(1+\frac{1}{a+bx}\right)^{c+dx}$ is equal to

A. $e^{\frac{d}{b}}$ B. $e^{\frac{c+d}{a+b}}$ C. e D. $e^{\frac{c}{a}}$

14. A fair die is tossed once. The probability that either an even number or 3 will be appear is

A. $\frac{3}{4}$ B. $\frac{4}{5}$ C. $\frac{2}{3}$ D. $\frac{1}{6}$

15. The following is the frequency of a grouped data. The mean of the following frequency table is 50. Then what is the value of $f_1 \wedge f_2$ respectively.

Class interval	Frequency
0-20	17
20-40	f_1
40-60	32
60-80	f_2
80-100	19
Total	120

A. 27 & 25 B. 22 & 30 C. 28 & 24 D. 36 & 24

16. If $f(2)=4$ and $f'(2)=5$, then $\lim_{x\to 2}\frac{xf(x)-2f(x)}{x-2}$ is

A. – 6 B. – 4 C. 2 D. 3

17. $\int \frac{x-1}{(x-3)(x-2)}dx$ is equal to

A. $2\ln|x-3|-\ln|x-2|+c$ C. $\ln|x-3|-2\ln|x-2|+c$

B. $\ln\left|\frac{x-3}{x-2}\right|+c$ D. $2\ln|x+3|-\ln|x-2|+c$

18. If f is a continuous function such that $f(0)=f(1)=0, f'(1)=2$ and $g(x)=f(e^x)e^{f(x)}$, then $g'(0)$ is :

A. 0 B. 1 C. 2 D. 3

19. The value of the derivative of $|x-2|+|x-5|$ at $x=4$ is

A. 0 B. -1 C. $2x-3$ D. 2

20. If $A=\begin{bmatrix}1 & 0 & 0\\ 12 & sinx & cosx\\ 13 & cosx & sinx\end{bmatrix}$, then $|A|$ is

A. $\cos 2x$ B. $-\cos 2x$ C. $\sin 2x$ D. $cosx$

21. If A and B are square matrices of the same order and A is non- singular, then for a positive integer **n**, $(A^{-1}BA)^n$ is equal to

A. $(A^{-n})^n B^n A^n$ B. $A^n B^n$¿ C. $A^{-1}B^n A$ D. $n(A^{-1}BA)$

22. Which of the following is **Not** rational expression?

A. $\frac{\log_2 16+3x^2}{2^3}$ C. $3x^{-2}+15x^{-1}+8$

B. $\frac{3^5+3x^2}{9x}$ D. $\frac{\sqrt{x^2}}{x+1}$

23. If $f(x)=\begin{cases} ax^2-b, if\ |x|<1 \\ \frac{1}{|x|}, if\ |x|\geq 1 \end{cases}$ is differentiable at $x=1$, then the value of a and b is :

A. $a=\frac{1}{2}, b=\frac{-1}{2}$ B. $a=\frac{-1}{2}, b=\frac{-3}{2}$ C. $a=b=\frac{1}{2}$ D. $a=b=\frac{-1}{2}$

24. A person walks at the rate of $6\frac{m}{s}$ towards a street light pole whose lamp is 5m above the base of the light pole. If the person is 1.5m tall, determine the rate of change of the length of his shadow at the rate of change of the length of his shadow at the moment he is 10m from the base of light pole.

A. $\frac{18}{7}\frac{m}{s}$ B. $\frac{30}{7}\frac{m}{s}$

C. $\frac{7}{30}\frac{m}{s}$ D. $\frac{7}{18}\frac{m}{s}$

25. The latus rectum of the ellipse $5x^2+9y^2=45$ is

A. $\frac{6}{5}$ B. $\frac{3}{5}$ C. $\frac{5}{3}$ D. $\frac{10}{3}$

26. $\int_0^1 (x+1)e^{x^2+2x}dx$ equal to :

A. $\frac{e^3}{2}$ B. $\frac{e^3-1}{2}$ C. $\frac{e^3}{2}+\frac{1}{2}$ D. $\frac{-1}{2}-\frac{e^3}{2}$

27. $\int x\sqrt{x-2}dx$ is equal to :

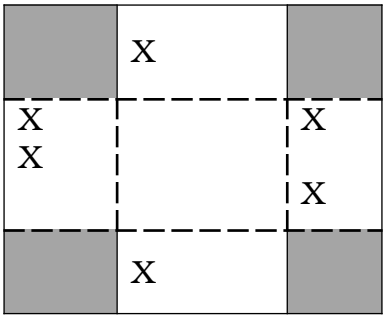
A. $\frac{2}{5}(x-2)^{\frac{5}{2}}+\frac{4}{3}(x-2)^{\frac{3}{2}}$ + c C. $\frac{5}{2}(x-2)^{\frac{5}{2}}+\frac{4}{3}(x-2)^{\frac{3}{2}}$ + c

B. $\frac{2}{5}(x-2)^{\frac{5}{2}}+\frac{2}{3}(x-2)^{\frac{3}{2}}$ + c D. $\frac{2}{5}(x-2)^{\frac{5}{2}}+\frac{4}{3}(x+2)^{\frac{3}{2}}$ + c

28. If the function $f(x)=ax^3+bx^2+11x-6$ satisfies conditions of Rolle's Theorem in $[1,3]$ and $f'\left(2+\frac{1}{\sqrt{3}}\right)=0$, then values of **a** and **b** respectively.

A.1 & -6 B. -2 & 1 C. -1 & 6 D. -1 & $\frac{1}{2}$

29. A metal box (without top) is to be constructed from a square sheet of metal that is 10cm on the side by first cutting the square pieces of the same size from the corners of the sheet and folding up sides a shown in the figure below. What size squares should be cut in order to maximize he volume of the box.



A. $\frac{5}{3}cm$ B. 5cm C. $\frac{3}{5}cm$ D. $\frac{1}{5}cm$

30. Which one of the following is a valid logical argument?

A. $p \Rightarrow q, \neg q \vdash p$
B. $p \wedge q$, p $\vdash \neg$ q
C. p$\Rightarrow$ q, $\neg$ r$\Rightarrow$ $\neg q \vdash \neg$r$\Rightarrow \neg$p
D. $p \Leftrightarrow q$, p $\vdash \neg$q

31. Let z be complex number. Then the solution set of $z^2 - z + 1 = 0$.

A. $\{\frac{-1 \pm i\sqrt{3}}{2}\}$ B. $\{\frac{1 \pm i\sqrt{3}}{2}\}$ C. $\{\frac{1 \pm i\sqrt{3}}{3}\}$ D. $\{1 \pm \sqrt{3}\}$

32. On which of the following intervals is the graph of $f(x) = 3x^4 - 4x^3$ concave down ward?

A. (0, $\frac{2}{3}$¿ B. $\left(\frac{2}{3}, \infty\right) \wedge (-\infty, 0)$ C. $[0,2]$ D. $[0,4]$

33. On which of the following intervals is the graph of $f(x) = x^3 - 3x^2 - 24x + 1$ decreasing?

A. $(-\infty, -2]$ B. $[-2, 4]$ C. $(4, \infty) \wedge (-\infty, -2]$ D. $(-2, 3)$

34. What is an anti derivative of $f(x) = \frac{\cos(2x)}{(sinx + cosx)^2}$

A. $\ln(sinx - cosx)$ C. $\ln(sinx - cosx)^2$
B. $\ln(sinx + cosx)^2$ D. $\ln|sinx + cosx|$

35. The area of the region bounded between the graph of $y = |x - 1|$ and $y = 3 - |x|$ is

A.2squ. Unit B. 3squ.unit C. 4squ. Unit D. 6squ. Unit

36. If A and B are two matrices such that $AB=B$ and $BA=A$, then A^2+B^2 is equal to

A. $2AB$ B. $2BA$ C. $A+B$ D. AB

37. Let f be twice differentiable function such that $f''(x)=-f(x)$ and $g(x)=f'(x), h(x)=[f(x)]^2+[g(x)]^2$. If $h(7)=12$ then $h(5)$ is equal to

A.12 B. 2x + 4 C. 12x + 1 D. 5

38. Let $f(x)=\ln(x^2)$.What is the equation of the line tangent to the graph of f at $x=e^2$.

A. $y=\frac{2}{e^2}(x-2)$ B. $y-2=\frac{2}{e^2}x+2$ C. $y=\frac{-2}{e^2}(x+2)$ D. $y=e^2$

39. Equation of a circle through $(-1,-2)$ and concentric with the circle $x^2+y^2-3x+4y-c=0$ is

A. $x^2+y^2-3x+4y-1=0$ C. $x^2+y^2-3x+4y+2=0$

B. $x^2+y^2-3x+4y+1=0$ D. $x^2+y^2-3x+4y=0$

40. If the diameter of a parabolic mirror is 10m and if the mirror is 5m deep at the center, how far is the focus from the center of the mirror?

A. $\frac{5}{4}$ B. $\frac{5}{2}$ C. $\frac{4}{5}$ D. $\frac{2}{5}$

41. The radius of a circle with center $(7,12)$ and tangent to the line $2x-y+3=0$ is

A. 5 B. 25 C. $\sqrt{5}$ D. $\frac{\sqrt{5}}{5}$

42. $\lim_{x\to\frac{\pi}{2}} \frac{cosxsin(cosx)}{sinx-cscx}$ is equal to :

A. -1 B. 1 C. ∞ D. 4

43. Let $X=\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}, A=\begin{bmatrix}1&-1&2\\2&0&1\\3&2&1\end{bmatrix}$ and $B=\begin{bmatrix}3\\1\\4\end{bmatrix}$and if$Ax=B$, then X equal to:

A. $\begin{bmatrix}1\\2\\3\end{bmatrix}$ B. $\begin{bmatrix}-1\\-2\\3\end{bmatrix}$ C. $\begin{bmatrix}-1\\-2\\-3\end{bmatrix}$ D. $\begin{bmatrix}-1\\2\\3\end{bmatrix}$

44. If all the letters of the word **MISSISSIPPI**, are written down at random, the probability that all the four **S**'s appear consecutively is

A. $\frac{3}{165}$ B. $\frac{7}{165}$ C. $\frac{4}{165}$ D. $\frac{1}{6}$

45. What is the volume of the solid generated if the region bounded by $f(x)=3-x^2$ and $g(x)=3x-1$ on $[0,1]$ by revolving about the $y-axis$

A. $\frac{\pi}{2}$ B. $\frac{3\pi}{2}$ C. $\frac{\pi}{4}$ D. $\frac{5\pi}{4}$

46. The solution set of $\frac{3}{x+1¿}=\frac{-3x}{x+1}+\frac{6}{x}$ is

A. $\{-1,2\}$ B. $\{-1\}$ C. $\{2\}$ D. $\left\{\frac{1}{2},-1\right\}$

47. $p(x,y):x+y=7$ Where x and y are natural numbers, then which one of the following is true?

A. $(\exists x)(\exists y)P(X,Y)$ C. $(\forall x)(\forall y)P¿$**)**
B. $(\exists x)(\forall y)P(X,Y)$ D. $(\forall x)(\exists y)P(X,Y)$

48. Polar form of $z=1-\sqrt{3}i$ is

A. $2\left[\cos\left(\frac{\pi}{3}\right)+iSin\left(\frac{\pi}{3}\right)\right]$ C. $\sqrt{2}\left[\cos(300^\circ)+iSin(300^\circ)\right]$

B. $2\left[\cos\left(\frac{-\pi}{3}\right)+iSin\left(\frac{-\pi}{3}\right)\right]$ D. $2\left[\cos(120^\circ)+iSin(120^\circ)\right]$

49. Three letters are written to different persons and corresponding addresses are written on three envelopes. However; letter are placed in envelopes without looking at the addresses. The probability that the letters go in to right envelopes is A. $\frac{1}{6}$ B. $\frac{1}{27}$ C. $\frac{1}{9}$ D. $\frac{1}{3}$

50. $f(x)=\frac{x^2-3x}{x^2-2x-8}$, Which of the following is **true** about f?

A. The line $y=3$ is a Horizontal asymptote.

B. The line $x=4$ and $x=-2$ are a vertical Asymptote.

C. If $x \to \infty$, then $f(x) \to 4$

D. If $\to 4^{+¿¿}$, then $f(x) \to -\infty$

You are given a data as follows

V	F
140-159	7
160-179	20
180-199	33
200-219	25
220-239	11
240-259	4

Then from the above frequency table

51.The mode of the frequency table is

A.161.88 B.191.88 C.181.88 D.171.88

52. If Selling Price of an item is Birr 720 and the rate of markup is 25%Then value of the cost is A.576 Birr B.420 Birr C.376 Birr D.300 Birr

53.The value of the markup on Q.52 is

A.144 Birr B.178 Birr C.188 Birr D.168 Birr

54. For a unimodal distribution which of the following is not true?

A. If the distribution is symmetrical, then mean=median=mode

B. If the distribution is positively skewed, then mean<median<mode

C. If the distribution is negatively skewed, then mean>median>mode

D. mean is greater than the median and mode in both distributions, that is

in positively & negatively skewed.

Use the values if necessary [$(1.01)^4=1.041$, $(1.04)^4=1.17$, $(1.01)^6=1.062$, $(1.04)^6=1.265$, $(1.015)^3=1.05$, $(1.015)^{12}=1.1956$, $(1.015)^3=1.045$, $(1.06)^4=1.26$]

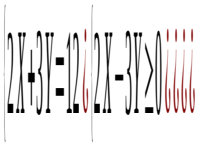
55. The amount obtained by investing birr 3000.00 at 4% rate of interest per year

compounded quarterly in a year and a half is equal to

A.3123 C.3184.56
B.3795 D.3510.00

56.Suppose a person deposited birr 2000 with 6% rate of interest per year compounded quarterly a year .Then what is the profit gaind after 3 years?

A.100.00 B.520.00 C.90.00 D.39.00

57.The Value of X and Y that minimizes Z=2X-Y, satisfying 

A.X=3,Y=2 B.X=2 ,Y=3 C.X=0 ,Y=0 D.X=6 ,Y=0

58.A person buys a gold ring for birr 498 and sold it for birr 759 ,then the markup percent with respect to the selling price is equal to

A. 33.6% B. 50.6% C.17.0% D83.6%

59.Suppose birr 2000 is invested at 6%interest rate per year which is compounded monthly ,then the amount of money after 5 years is equal to

A.6597.5 B.2696 C.2860.00 D3102.35

60.A person deposited birr 1000 in a bank that pays 4% interest per annum compounded semi annually .After a year ,he withdrew birr 200 then what approximate amount of money will there be in the bank just after the next year?

A.1913.33 B. 1932.60 C1964.86 D2139.71

Suppose a town has 16 applicants for admission in which the scores of the applicants are given below
27,27,27,28,27,25,28,25,26,28,26,28,31,30,26,26 be.Then,

61.From the given data, if we have four classes then , the largest concentration of score class is in the

A. 2nd class B. first class C.3rd class D.4th class

62. For a symmetrical frequency distribution which is not true?

A.Skewness is zero C.Mean=Median=Mode
B.Normal distribution D.Has no asymptote on x-axis

63. The following is a frequency distribution based on 4 observations. Then the standard deviation is equal to

V	10-20	20-30	30-40	40-50
F	1	1	1	1

A.125 B.5 $\sqrt{3}$ C.5 $\sqrt{5}$ D.5

64. Which One of the following the best measure

A. Mean and Variance C. Standard deviation and mode
B. Mean and Standard deviation D. Mode and Meadian

65.Let the following Frequency distribution table be given

Then the

X	f
2	2
3	3
4	6

mean deviation about the mode is

A. 1.14 B. 2.83 C. 0.5 D. 0.75