ADDIS ABABA CITY GOVERNMENT OF EDUCATION BUREAU YEKA SUB–CITY EDUCATION OFFICE PREPARATORY SCHOOLS MATHEMATICS MODEL EXAMINATION FOR GRADE 12TH **SOCIAL** SCIENCE STREAM NEHASE 2012 E.C / AUGUST 2020 G.C

GENERAL INSTRUCTIONS:

THIS BOOKLET CONTAINS **MATHEMATICS** EXAMINATION. THE EXAMINATION CONTAINS **65** QUESTIONS **FOR SOCIAL SCIENCE STUDENTS**. ATTEMPT ALL THE QUESTIONS. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER EXACTLY. USE ONLY **PENCIL** TO MARK YOUR ANSWERS.

THERE IS ONLY **ONE BEST** ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND BLACKEN THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET. YOUR ANSWER MARK SHOULD BE HEAVY AND DARK, COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY PENCIL/PEN MARKS COMPLETELY FROM YOUR ANSWER SHEET.

YOU WILL BE LOWED TO WORK FOR **3:00** (OR 3 HOURS). IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY GO BACK AND REVISED. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, LAY YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION HALL WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE(S).

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

DIRECTIONS: For each of the following questions, choose the best answers from the given alternatives and carefully **blacken** the letter of your best choice on the separate answer sheet provided.

1. If $f(x) = 2x^2 - 4x - 8$. Then for $h \neq 0$, what is the expression $\frac{f(x+h)-f(x)}{h}$?

   A/ $4h - 4$ B/ $4x + 2h - 4$ C/ $2x - 3h$ D/ $x - h$

2. Let $f(x) = -x^2 - x - 2$, then what is $4f(2) + f(2)\,f(2)$?

   A. 32 B. -32 C. -96 D. 96

3. Let a function $f(x) = 4x^4 - 2x^2 + 8$, then which one of the following is **true** about f.
   A. f is odd C. f is even
   B. f is neither even nor odd D. f is both even and odd

4. If $g(x) = x - 1$ and $(fog)(x) = x^2 - x + 6$, then what is the equivalent expression for $f(x)$?
   A. $x^2 - x + 6$ B. $x^2 + x + 6$ C. $x^2 - x - 6$ D. $-x^2 - x + 6$

5. what is the value of x for the equation $-4 - \sqrt{4-x} = -\sqrt{-x-4}$ is
   A. -9 B. 9 C. 13 D. -13

6. Which one of the following is **not** one-to one correspondence?
   A. $f: (0, \infty) \to (0, \infty)$ given by $f(x) = x^4 \quad \forall x \in \mathbb{R}$
   B. $f: \mathbb{R} \to \mathbb{R}$ given by $f(x) = \frac{6x-10}{x^2+1}, \quad \forall x \in \mathbb{R}$
   C. $f: \mathbb{R} \to \mathbb{Q}$ given by $f(x) = 3^x, \quad \forall x \in \mathbb{R}$
   D. $f: [5, \infty) \to (-2, \infty)$ given by $f(x) = -2 + \sqrt{x-5}, \quad \forall x \in \mathbb{R}$

7. What is the distance d from the point $p\,(3, 2)$ to the line L: $3x + 4y + 13$?
   A.5 B.6 C.8 D.10

8. What is the equation of the tangent line at point $(3, -3)$ on the circle $x^2 + y^2 + 6x + 10y - 9 = 0$?
   A. $x - 3y - 4 = 0$ C. $x - y + 3 = 0$
   B. $-5x + y + 7 = 0$ D. $x + 3y - 4 = 0$

9. Which one of the following is **not** true about the parabola $x^2 + 12\,y - 2x - 11 = 0$?
   A. its directrix is $y = 4$ C. its focus is $(0, -2)$
   B. its vertex is $(1,1)$ D. its axis is y-axis

10. Which one of the following is **not true** about the relation $R=\left\{(x, y) : y = \frac{x-8}{9-x}\right\}$
    A. Domain of R is $(9, \infty) \cup (-\infty, 9)$
    B. The range of R is $(-1, \infty) \cup (-\infty, -1)$
    C. The inverse of R is $\left\{(y, x) : y = \frac{9x+8}{1-x}\right\}$
    D. R can be a function

11. Which one of the following sentences is a proposition?
    A. long live Ethiopia! C. Man is mortal?
    B. Please give me some money! D. America has good states

12. If $(\neg p \Leftrightarrow q) \Rightarrow (p \vee \neg r)$ is **False**, then which of the following has a truth value **True**?
A. ¬p ⇔r B. q⇒p C. q∧ ¬r D. ¬q⇔r

13. "If 3 is a factor of 12, then 12 is an even number" be a statement. Then what is the inverse of the statement?
A. If 3 is not a factor of 12, then 12 is an odd number
B. If 12 is an even number, and then 3 is a factor of 12.
C. If 12 is an odd number, then 3 is not a factor of 12
D. If 12 is an odd number, then 3 is a factor of 12.

14. Let U = Natural numbers, P(x) = x is divisible by 1, q(x) = x is prime, r(x) = x is divisible by 6. Then which one of the following quantifier has a truth value True.
A. $(\forall_x) r(x)$ B. $(\forall_x)[p(x) \Leftrightarrow q(x)]$ $C. (\exists_x)[r(x) \wedge q(x)]$ $D. (\forall_x) p(x)$

15. If A = $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ -1 & 0 & -2 \end{pmatrix}$, what is the matrix B such that, A+B is a unit matrix?
A. $\begin{pmatrix} 0 & -2 & -3 \\ -4 & -4 & -6 \\ 1 & 0 & 3 \end{pmatrix}$ B. $\begin{pmatrix} 2 & 3 & 0 \\ 1 & -1 & 2 \\ 0 & 0 & 3 \end{pmatrix}$ C. $\begin{pmatrix} -7 & 0 & -1 \\ 2 & 0 & 3 \\ 1 & -1 & -2 \end{pmatrix}$ D. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

16. If A = $\begin{pmatrix} 1 & -1 & 2 \\ 3 & -2 & 4 \\ 2 & 3 & -4 \end{pmatrix}$ then what is $|A|$? A. 2 B. 4 C. 3 D. 1

17. What is the value of x, if $\begin{vmatrix} 1-x & 0 & 0 \\ 0 & x-1 & 0 \\ 0 & 0 & -x+1 \end{vmatrix}$ = 64?
A. -3 B. 3 C.5 $D. -5$

18. Suppose A is a $3x3$ matrix. If $det(A) = 4$, then what is the value of $det(5A)$?
A. -500 B. 1000 C. -1000 D. 500

19. How many distinct permutations can be formed from all the letters of the word "SMART"?
A. 240 B. 120 C. 180 D. 200

20. Let = $\left(\frac{1+i}{1-i}\right)^{351}$, then what is the value of z? A. i B. 1 C. $-i$ D. -1

21. Let A and B be two events. Suppose that the probability that neither event occurs is $\frac{1}{8}$. What is the probability that at least one of the events occurs?
A. $\frac{3}{8}$ B. $\frac{7}{8}$ C. $\frac{5}{8}$ D. $\frac{1}{8}$

22. What is the solution set of the rational equation $\frac{6}{x} - \frac{3x-6}{x^2-2x} = 3 - \frac{6x-6}{3x-2}$?
A.$\{-1\}$ B.$\{1\}$ C.$\{2, -1\}$ D.$\{1,2\}$

23. Let $p(x) = x^2 - x$ is positive, then what is the equivalent expression of $\neg\big((\exists_x) p(x)\big)$?
A. $(\exists_x)(x^2 - x < 0)$ C. $(\forall_x)(x^2 - x \geq 0)$
B. $(\forall_x)(x^2 - x \leq 0)$ D. $(\exists_x)\neg(x^2 - x > 0)$

24. Let $2x^2 + 4x + 10 = 0$. Then what is the solution set of the equation in set of complex number?
A. $\{2 + i, 2 - i\}$ C. $\{2 + 4i, 2 - 4i\}$
B. $\{-1 + 2i, -1 - 2i\}$ D. $\{1 - 2i, -1 - 2i\}$

25. Let $Z = \left(\frac{1+i}{1+\sqrt{3}i}\right)^{19}$. Then which one of the following is **not** true about Z?

A. $Argz = \frac{5\pi}{12}$ C. The modulus of Z is $\sqrt{2^{19}}$

B. The polar form of Z is $\frac{\cos\frac{5\pi}{12} + i\, sin\frac{5\pi}{12}}{\sqrt{2^{19}}}$ D. $Argz = 19Arg\left(\frac{1+i}{1+\sqrt{3}i}\right)$

26. If $Z = cos(\frac{\pi}{60}) + i\ sin(\frac{\pi}{60})$, then what is the value of Z^{20}?

A. $\frac{1}{2} + \frac{\sqrt{3}}{2}i$ B. $\frac{\sqrt{3}}{2} + \frac{1}{2}i$ C. 1+i D. $\frac{\pi}{2} + \frac{\pi}{2}i$

27. Which one of the following is **not true** about the graph of $f(x) = \frac{x^3-6x^2+11x-6}{x^4-5x^2+4}$?

A The graph has vertical asymptotes at $x = -1$ & $x = -2$

B The graph of f crosses the $x - axis$ at $x = \pm 1, \pm 2$

C The graph has a hole at $x = 1$ & 2

D The graph of f has a horizontal asymptote at $y = 0$

28. If $\{A_n\}$ is an arithmetic sequence with $A_1 = 10$ & $A_5 = 18$, $then\ what\ is \sum_{n=1}^{10} A_n$?

A. 190 B.160 C.180 D.170

29. What is the sum of the series $\sum_{n=0}^{\infty} 4^n\ \ 5^{2-n}$?

A.∞ B. 101 C. 110 D. 100

30. What is the sum of the 1st 100th term of the sequence 5, 10, 15, 20, 25…?

A.2525 B. 22,750 C. 25,250 D. 2275

31. If 4-geometric means are inserted between 3 and 96, what are the inserted numbers?

A. {6,18,54,90} B. {9,18,36,72} C. {3,6,12,24} D. {6,12,24,48}

32. What is the value of the $6\lim_{x\to 0} \frac{cos^2x-1}{x^2cos2x}$?

A. -6 B. 6 C. $does$ not exist D. ∞

33. Let the function f be defined by $\begin{cases} \frac{tanmx}{x}, x > 0 \\ 3x - 2m^2, x \le 0 \end{cases}$, If $m \neq 0$, and then what is the value of m that make the function f is continuous at $x = 0$?

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

34. What is the value of $\lim_{x\to \bar{0}} \frac{-|x|+2xe^x}{x}$?

A. doesn't exist B. 0 C. -3 D. 3

35. Let $f(x) = x^3 - 3x$. Then what is value of the $\lim_{h\to 0} \frac{f(2+h)-f(2)}{h}$?

A. -9 B. 9 C. 3 D. -3

36. Let $f(x) = e^{3x+2}$ and $g(x) = tan\, x$. If $F(x) = xf(x) - f(g(x))$ .Then what is the value of $F'(0)$?

A/ $\frac{1}{e}\left(1 - \frac{1}{e}\right)$ B/ $-2e^2$ C/ $4e^2$ $D/\frac{1}{e}\left(1 - \frac{4}{e}\right)$

37. Let $h(x) = x\, g\,(3x + 2)$, $g\,(-4) = 12$ and $g'\,(-4) = 10$, then what is the value of $h'\,(-2)$?

A. -48 B. 48 C. 72 D. -72

38. Let $f(x) = x^5 - 15x^3 + 6$, in $[-1, 1]$. then which one of the following is **not** true about the function f ?

A. The minimum value of f is -156 & maximum value of f is 162.

B. the function is decreasing on $(-\infty, -3]$ & increasing on $[3, \infty)$

C. f has one of the inflection point is $(0, 6)$

D. The graph concave down on $\left(\frac{3\sqrt{2}}{2}, 0\right)$

39. What is the equation of the tangent line to the graph of $f(x) = \frac{8}{x^2} - 2x + 4$ at $(-2,\ f(-2))$

A. $6x + y + 22 = 0$ C. $6x - y - 22 = 0$

C. $6x - y + 22 = 0$ D. $6x + y - 22 = 0$

40. Let $f(x) = -3x^4 + 4x^3 + 12x^2 + 24$. Then what is the local minimum value of the graph of f ?

A. -56 B. 56 C. 24 D. -24

41. What is the second derivative of f if $f(x) = ln(x^2 + 2)$?

A. $\frac{4-2x^2}{(x^2+2)^2}$ B. $\frac{4+6x^2}{(x^2+2)^2}$ $C.\frac{2-2x^2}{(x^2+2)^2}$ $D.\frac{4-x^2}{(x^2+2)^2}$

42. Which one of the following expression is an anti- derivative of $f(x) = \frac{-12}{x\sqrt{x}}$?

A. $\frac{-12\sqrt{x}}{x} + c$ $B.\frac{24\sqrt{x}}{x} + c$ $C.\frac{-24\sqrt{x}}{x} + c$ $D.\frac{12\sqrt{x}}{x} + c$

43. If $h(x) = \frac{x-6}{\sqrt{x-6}}$ and $f(x) = \frac{9}{x} + 6$, $then\ what\ is\ h(f(x))$?

A. $\frac{\sqrt{x}}{9}$ $B.\frac{\sqrt{x}}{3}$ C. $\frac{3}{\sqrt{x}}$ D. $\frac{9}{\sqrt{x}}$

44. What is $\int_0^1 \frac{(x-1)^2}{x+1}$? A/ $\ln 2 + \frac{1}{2}$ $B.\ 4ln2 - \frac{5}{2}$ C/$\ln 3 + 5$ $D.\ln 3 + \frac{1}{5}$

45. What is the value of $\int_0^2 x^2 \ln(1 + x^3)\mathrm{d}\,x$?

A. $18\ln 3 - 10$ $B.\ 6\ln 3 - 10$ $C.\ 6\ln 3 - 8$ $D.\ 18\ln 3 - 8$

46. What is the area of the region bounded by the graph of $y = x^2 - 4$ and $y = 4 - x^2$?

A. $\frac{16}{3}$ B. $\frac{64}{3}$ $C.\frac{32}{3}$ $D.\ \frac{48}{3}$

47. Let a particle P is moving from point A towards point B with acceleration given by $a(t) = 2t^3 - 8t^2 + 10t + 6$ for time t≥ 0 and a velocity of 12m/s at $t = 2sec$. Then what is velocity of the particle just at $t = 3sec$ (in m/s)?

A. 14 B. 26 C. 16 D. 24

48. Which one of the following is **incorrect** about the application of **1st** and **2nd** derivative test on monotonicity, extreme values and concavity?

A. If $f``(c) > 0$, then the graph concave upward & $f``(c) < 0$, the graph concave downward on the interval I and $f``(c)$ exist

B. If $f``(c) > 0$ and $f`(c) = 0$, then $f$ has local minimum & If $f``(c) < 0$ and $f`(c) = 0$, then f has local maximum at $x = c$

C. If $f`(c)$ change its sign from" $-$ " $to$ " $+$ ". Then $f$ has local maximum & If $f`(c)$ change its sign from" $+$ " to " $-$ ". Then f has local minimum at $x = c$.

D. If $f`(x) \geq 0$ , $\forall x$, in the interior of I, then $f$ is decreasing on I & If $f`(x) \leq 0$, $\forall x$, in the interior of I, then f is increasing on I

49. Let $f(x) = \frac{1}{e^{-x+10}}$. Then what is the n^{th} derivative of f?

A. $f^{(n)}(x) = e^{x-10}$ C. $f^{(n)}(x) = -e^{-x-10}$

B. $f^{(n)}(x) = e^{-x+10}$ D. $f^{(n)}(x) = -e^{x-10}$

50. Which of the following is **not** a convergent sequence?

A.$\left\{7^{1/n}\right\}$ $B.\left\{\left(\frac{\pi}{3}\right)^n\right\}$ $C.\left\{1+\frac{(-1)}{9^n}\right\}$ $D.\left\{\left(\sqrt{3}\right)^{-n}\right\}$

51. What is the maximum possible interval for which the function f is continuous for $f(x) = \frac{x^2+9}{x^4-81}$?

A $(-\infty,-3] \cup [-3,3] \cup [3,\infty)$ C $(-\infty,-3] \cup [3,\infty)$

B $(-\infty,-3) \cup (3,\infty)$ D $(-\infty,-3) \cup (-3,3) \cup (3,\infty)$

52. Let $f(3) = ln\,7$. Then what is $\int \frac{5x^2-8x+5}{x^3-3x^2+3x-2}dx$?

A. $3ln|x-2| + ln|x^2-x+1| + ln\,7$ C. $3ln|x+2| + ln|x^2+x+1| + ln\,7$

B. $3ln|x-2| + ln|x^2+x+1| + ln\,7$ D. $3ln|x-2| + ln|x^2+x+1| + ln\,7$

53. If the region bounded by the curve $y = 5x^2$ and the line $y = 20$ rotates about the x-axis. Then what is the volume of the solid of revolution?

A. 120π $B.160\pi$ $C.1280\pi$ $D.1260\pi$

54. An object is moving along the parabola $y = 2\sqrt{x}$ in xy-plane. At what point on its path does the object become closest to the point $(5,0)$?

A. $(2, 2\sqrt{2})$ B. (2, 1) C. (2, 6) D. $(3, 2\sqrt{3})$

55. The radius of a right circular cylinder of height 5 cm increases at a rate of 4cm/min. what is the rate of change of the volume of the cylinder when the radius is 3cm?

A. $120\pi cm^3/min$ $B.180\pi cm^3/\min$ $C.60\pi cm^3/\min$ $D.40\pi cm^3/min$

56. The mark that students scored in an examination is grouped in class intervals shown in the following table.

Class interval	5-11	12-18	19-25	26-32	33-39
No of students	4	5	4	5	2

What is the median of the mark? A. 16.25 B. 17.25 C. 11.25 D. 14.25

57. What is the solution set of the system $\begin{cases} 3x+y-z=2 \\ 2x+3y+2z=7 \\ x-2y+z=7 \end{cases}$ is

A.$\{(1,-2,2)\}$ $B\{(2,-1,3)\}$ $C.\{(-2,1,3)\}$ $D.\{(1,2,3)\}$

58. Four kilos of tea and Five kilos of coffee cost 270 birr and three kilos of tea and three kilos of coffee cost 165 birr. What is the cost of one kilo of coffee?

A. 50 B. 5 C. 45 D. 6

59. Mr Mathios works in Awach-company earning a monthly salary of Birr 4,000. He is also a member of the credit association of his company and deposits 25% of his monthly salary at the end of each month at 6% compounded monthly. Then what is Mr Mathios's accumulated balance at the beginning of three years in birr?

A. 12,000 B. 50,000 C. 36,000 D. 24,000

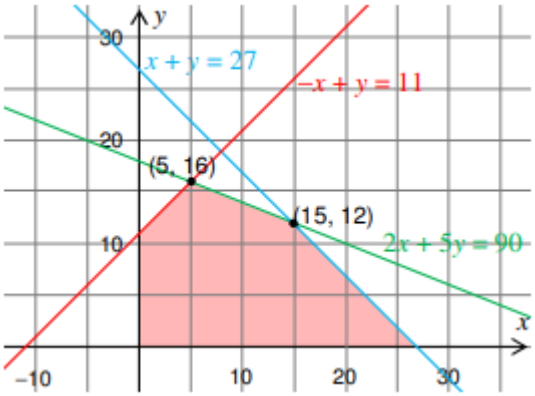
60. If the mean of x, y, z, w is 5.Then what is the mean of 3x + 3, 3y + 3, 3z + 3, 3w + 3?

A. 18 B. 5 C. 15 D. 12

61. Which of the following methods is **not** probabilistic sampling method/s?

A. quota and accident sampling
B. simple random and cluster sampling
C. systematic and stratified sampling
D. cluster & accident sampling

62. In the figure below, which one of the following is **not** true about the linear programing problem?



A. The maximum value of Z is 132 at $(15, 12)$

B. If $Z = 4x + 6y$ is the objective function, $z = 132$ is its maximum value

C. $In\ z = 4x + 6y$, $z = 0$ is its minimum value

D. The point $(15, 12)$ is the optimal value under $z = 4x + 6y$

63. The price of a quintal of cement in Addis Ababa in September 2011 was Birr 300, and ten months later, on July 2011, its price was Birr 480. What is the rate of increase in the price of one quintal of cement from September 2011 to July 2011?

A. 0.6 B. 0.8 C. 0.5 D. 0.4

64. A wool suit, discounted by 40% for a clearance sale, has a price tag of Birr 600. What was the suit's original price and the amount of discount in birr respectively?

A. 400 & 1000 B. 1000 & 400 C. 600 & 400 D. 400 & 600

65. Mr Amayehu bought a house from Sunshine Real estate by paying 20% of the purchase (cash) price, which is Birr 500,000.Then what are the down payment and the mortgage amount in birr respectively?

A. 400,000 & 100,000
B. 450,000 & 50,000
C. 100,000 & 400,000
D. 50,000 & 450,000