

**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. Given  $f(x) = 4x + 3$  and  $(gof)(x) = 12x + 7$ . Then which of the following is equal to  $g(x)$ ?

A.  $g(x) = -2x + 3$       B.  $g(x) = 2x - 3$       C.  $g(x) = 3x + 2$       D.  $g(x) = 3x - 2$

2. Given that  $f(x) = \frac{x-1}{x+1}$ , the what is the simplest form of  $\frac{f(a)-f(b)}{1+f(a)f(b)}$ ?

A.  $\frac{ab+1}{a-b}; a \neq b$

C.  $\frac{a+b}{ab+1}; a, b \neq -1$

B.  $\frac{a-b}{ab+1}; a, b \neq -1$

D.  $\frac{a-b}{ab-1}; a, b \neq -1$

3. If  $\frac{5x+1}{x^2(x^2+4)} = \frac{A}{x} + \frac{B}{x^2} + \frac{Cx+D}{x^2+4}$ , where A, B, C and D are constants, then what are the values of A, B, C and D respectively?

A.  $\frac{5}{4}, \frac{1}{4}, \frac{-5}{4}$  and  $\frac{-1}{4}$

C.  $\frac{-5}{4}, \frac{-1}{4}, \frac{1}{4}$  and  $\frac{5}{4}$

B.  $\frac{-1}{4}, \frac{-5}{4}, \frac{1}{4}$  and  $\frac{5}{4}$

D.  $\frac{1}{4}, \frac{-5}{4}, \frac{5}{4}$  and  $\frac{-1}{4}$

4. Consider a circle whose equation is given by  $(x-3)^2 + (y-4)^2 = 20$ . Then what is the equation of the tangent line to the circle at the point  $P(1, 0)$ ?

A.  $x - 2y - 1 = 0$

C.  $x + 2y - 1 = 0$

B.  $2x - y - 1 = 0$

D.  $2x + 2y - 1 = 0$

5. Let L be a line with angle of inclination  $\frac{3}{4}\pi$  and passes through (3,4). Which of the following is the equation of the line L?

A.  $y = -x + 7$

B.  $y = -x - 7$

C.  $y = x + 7$

D.  $y = x - 7$

6. Let  $f(x) = \log_3 2x$  and  $g(x) = \frac{1}{2}(3^x)$ . Then which of the following is **NOT** true about these functions?

A.  $f(x)$  and  $g(x)$  are inverses of each other.

B. Domain of  $f(x)$  is equal to Range of  $g(x)$

C.  $(f \circ g)(x) = x ; x \in \text{Domain of } g(x)$

D.  $(g \circ f)(x) = 2x ; x \in \text{Domain of } f(x)$

7. Suppose p, q, and r are propositions such that  $p \Rightarrow (r \vee \neg q)$  has truth value **False**. Then which one of the following propositions has truth value **True**?

A.  $q \Leftrightarrow r$

B.  $\neg p \wedge q$

C.  $\neg r \Rightarrow q$

D.  $\neg p \vee r$

8. For real numbers x and y which one of the following statements is **True**?

A.  $(\exists x)(\forall y)(x^2 + y = 0)$

C.  $(\exists y)(\forall x)(x^2 + y = 0)$

B.  $(\forall x)(\exists y)(x^2 + y = 0)$

D.  $(\forall y)(\exists x)(x^2 + y = 0)$

9. Let  $a_1 = 0$ ,  $a_2 = 1$ ,  $a_n = a_{n-1} + a_{n-2}$  for  $n \geq 3$  be the  $n^{th}$  terms of the sequence. Then which of the following is **not** true?
- A. The third term is 1.                      C.  $a_3 + a_4 = a_5$   
 B. The fifth term is 3                      D.  $a_5 + a_6 = 7$
10. What is the sum of the series  $\sum_{k=1}^{k=\infty} \frac{6^k + 4^k}{12^k}$  ?
- A. 1.5              B. 3              C. 1.25              D.  $\infty$
11. Which of the following is equal to  $\lim_{x \rightarrow 0^-} \frac{|x| - 2xe^{3x}}{3x}$  ?
- A.  $-\frac{1}{3}$               B. 0              C. -1              D. Doesn't exist
12. When n arithmetic means are inserted between 8 and 44 the sum of the resulting terms is 338. What is the value of n?
- A. 10              B. 11              C. 13              D. 14
13. Which of the following is equal to  $\lim_{x \rightarrow \infty} \frac{(4n+3)^2}{2n^2+3n+5}$  ?
- A. 8              B. 16              C. 4              D. 2
14. If  $f(x) = \frac{2x+1}{(x-2)^2(x+1)^2}$ , Which of the following is **true** about  $f$ ?
- A. As  $x \rightarrow 2^-$ ,  $f(x) \rightarrow -\infty$   
 B. As  $x \rightarrow -1^+$ ,  $f(x) \rightarrow -\infty$   
 C. The graph of  $f(x)$  doesn't meet any of its asymptote.  
 D. The graph of  $f(x)$  has oblique asymptote.

15. What is the equation of an ellipse which has center at (1, 4) and two of its vertices are at (10, 4) and (1, 2)?

A.  $(x - 1)^2 + 9(y - 4)^2 = 4$

C.  $4(x - 1)^2 + 81(y - 4)^2 = 324$

B.  $2(x - 1)^2 + 9(y - 4)^2 = 4$

D.  $81(x - 1)^2 + 4(y - 4)^2 = 324$

16. Given a hyperbola whose transverse axis has length 8 units and the end points of the conjugate axis are A (5,-5) and B(5,1). Then which of the following is **not** true about the hyperbola?

A. (1,-2) and (9,-2) are the vertices.

B. The eccentricity of the hyperbola is 1.25.

C. The hyperbola has horizontal transverse axis.

D. The hyperbola has foci at (2,-2) and (11,-2).

17. Which one of the following logical deductions is valid?

A.  $p \vee q, p \vdash q$

C.  $\neg p \Rightarrow q, q \vdash p$

B.  $p \Rightarrow q, q \vdash p$

D.  $p \Rightarrow \neg q, p, r \Rightarrow q \vdash \neg r$

18. A theater hall has 38 rows of seats. The first row has 10 seats, the second row has 12 seats, the third row has 14 seats and so on. What is the seating capacity of the theatre hall?

A. 1786

B. 1676

C. 2755

D. 2052

MATHS E.P MODEL EXAMINATION, GRADE 12

19. Let  $G_3 = \frac{2}{9}$  and  $G_6 = \frac{2}{243}$  be a geometric sequence. Then which of the following is the general term of the sequence?

A.  $G_n = 2(3)^{n-1}$

C.  $G_n = 2(3)^n$

B.  $G_n = 2(3)^{-n}$

D.  $G_n = 2(3)^{1-n}$

20. Which the following is equal to  $\lim_{x \rightarrow \frac{\pi}{2}} \left( \frac{2x-\pi}{\cos x} \right)$ ?

A. 0

B. -1

C. -2

D. doesn't exist

21.  $\lim_{x \rightarrow \infty} \left( \frac{x+4}{x-1} \right)^{x+4}$  is equal to:

A.  $e^6$

B.  $e^3$

C.  $e$

D.  $e^5$

22. Let  $f(x) = \begin{cases} \frac{k}{x+3}, & \text{if } x \leq 4 \\ \frac{x-4}{\sqrt{x}-2}, & \text{if } x > 4 \end{cases}$

What is the value of k if f is continuous at  $x = 4$ ?

A. 7

B. 14

C. 28

D. 34

23. Given two matrices  $A = (a_{ij})_{m \times n}$  and  $B = (b_{ij})_{m \times n}$ , then which of the following is **not** true about the given matrices?

A.  $(A^T)^T = A$

B.  $(AB)^T = A^T B^T$ , provided that AB is defined.

C.  $(rB)^T = rB^T$ , if r is any scalar.

D.  $(A+B)^T = A^T + B^T$

24. Let  $A = \begin{pmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{pmatrix}$ . Which one of the following is equal to the determinant of A?

- A.  $\cos^2 x - \sin^2 x$       B. 1      C.  $\sin^2 x - \cos^2 x$       D.  $\frac{1}{2}$

25. What is the simplest form of  $\left(\frac{2-3i}{1-i}\right)\left(\frac{1+i}{2+3i}\right)$ ?

- A.  $\frac{12}{13} - \frac{5}{13}i$       C.  $\frac{13}{5} + \frac{13}{12}i$   
 B.  $\frac{5}{13} - \frac{12}{13}i$       D.  $\frac{13}{12} + \frac{13}{5}i$

26. If  $f(x) = \ln x + e^x$ , then what is  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ ?

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

27. Let  $f(x) = \frac{e^{3x+2}}{1-2x}$ . What is the equation of the line tangent to the graph of  $f$  at  $(0, e^2)$ ?

- A.  $y = e^2(5x + 1)$       C.  $y = e^2(x + 1)$   
 B.  $y = e^5(3x - 2)$       D.  $y = e^{-2}(5x + 1)$

28. If  $y = x^3 e^{-x}$ , then  $\frac{d^2 y}{dx^2} \Big|_{x=1}$  is equal to

- A.  $11e^{-1}$       B.  $6e^{-1}$       C.  $-6e^{-1}$       D.  $e^{-1}$

29. For what value of  $x$ ,  $\left| \frac{2}{x-3} - \frac{5}{x} \right| = x + 3$ ?

- A.  $\frac{9}{4}$       B. 3      C.  $\frac{3}{2}$       D. 4

30. Let  $\begin{pmatrix} 0 & -3 & -4 \\ k & 0 & 8 \\ 4 & -8 & 0 \end{pmatrix}$  be a skew-symmetric matrix. Then what is the value of  $k$ ?

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

31. Given a data on the age of students in a primary school.

|                |    |    |    |    |    |
|----------------|----|----|----|----|----|
| Age            | 10 | 12 | 13 | 14 | 15 |
| No of students | 5  | 15 | 8  | 10 | 2  |

Which one of the following is **not** true about the data?

- A. The mode is 12                      C. The median is 12.5  
B. The range is 5                      D. The mean is 12

32. How many four digit numbers can be formed from the digits 2, 3, 5, 7, 8 and 9 if a digit is used at most once?

- A. 360                      B. 320                      C. 296                      D. 480

33. If  $f(x) = \ln g(x) + \sqrt{g(x)}$  and  $g(3) = 4, g'(3) = 9$ , then which of the following is equal to  $f'(3)$ ?

- A. 4.5                      B. 3                      C. 4                      D. 3.5

34. Let  $f(x) = x|x|$ . Which of the following is **true**?

- A.  $f$  is not differentiable at  $x = 0$                       C.  $f'(x) = 2|x|$  for all  $x \in (-\infty, \infty)$   
B.  $f''(x) = 2$  for all  $x \in (-\infty, \infty)$                       D.  $\lim_{x \rightarrow 0} f(x)$  doesn't exist.

35. In throwing a die, consider the following events.

$E_1$  = the number that show up is even.

$E_2$  = the number that show up is prime.

$E_3$  = the number that show up is more than 3

Which one of the following is **true**?  
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A. The number of elements in  $E_1 \cap E_2$  is zero.

B.  $P(E_1 \cap E_3) = \frac{1}{2}$

C.  $P(E_1 \cap E_2 \cap E_3) = \frac{1}{6}$

D.  $P(E_1 \cup E_2 \cup E_3) = \frac{5}{6}$

36. Two lamps are to be chosen from pack of 12 lamps where four are defective and the rest are non defective. What is the probability that both lamps are defective?

A.  $\frac{14}{33}$

B.  $\frac{1}{11}$

C.  $\frac{13}{33}$

D.  $\frac{2}{33}$

37. On which of the following intervals is the graph of  $f(x) = -x^3 + 3x^2 + 5$  increasing?

A.  $(-\infty, 0]$

B.  $[2, \infty)$

C.  $[0, \infty)$

D.  $[0, 2]$

38. On which of the following intervals is the graph of  $f(x) = \frac{1}{4}x^4 - 2x^2$  concave down ward?

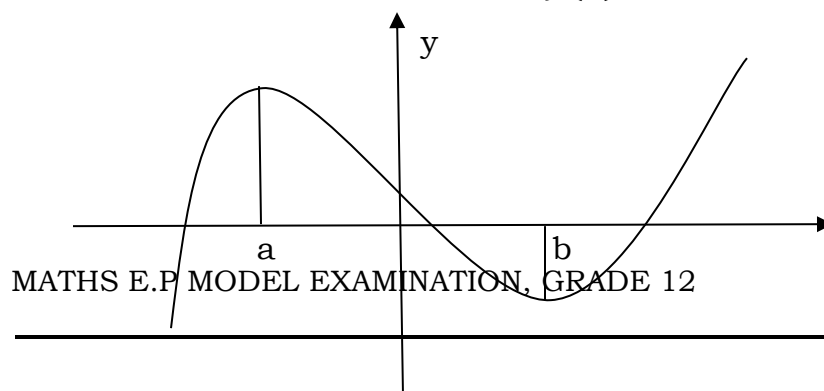
A.  $(\frac{-2}{\sqrt{3}}, \frac{2}{\sqrt{3}})$

B.  $(-\infty, \frac{-2}{\sqrt{3}})$

C.  $(2, \infty)$

D.  $(-2, 2)$

39. Look at the following graph of  $f(x)$



Which of the following is **true** about  $f$ ?

A.  $f'(x) > 0$  on  $[a, b]$

C.  $f'(x)=0$  at  $x=a$  or  $x=b$

B.  $f'(x) < 0$  on  $(-\infty, a]$

D.  $f''(a) > 0$

40. A runner and a bicycle rider leave their home to their school. The runner runs at a constant speed  $8 \frac{km}{hr}$ . At the end of half an hour, the bicycle rider is 2km a head of the runner. How fast is the bicycle rider?

A.  $12 \frac{km}{hr}$

B.  $10 \frac{km}{hr}$

C.  $8 \frac{km}{hr}$

D.  $15 \frac{km}{hr}$

41. Which of the following is an antiderivative of  $f(x) = \log_5 x$ ?

A.  $\ln 5(\ln x - x)$

C.  $\ln x(x \ln 5 - x)$

B.  $\frac{1}{\ln x}(x \ln 5 - x)$

D.  $\frac{1}{\ln 5}(x \ln x - x)$

42. Which of the following is equal to  $\int (x-1) \sqrt[3]{(x^2-2x+3)^2} dx$ ?

A.  $\frac{3}{10} \sqrt[3]{(x^2-2x+3)^5} + C$

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

B.  $\frac{2}{5} \sqrt[3]{(x^2-2x+3)^4} + C$

D.  $\frac{2}{5} \sqrt{(x^2-2x+3)} + C$

43. What is the solution set of the equation  $3z^2 - 2z + 1 = 0$  in the set of complex numbers?

A.  $\left\{ \frac{2+\sqrt{2}i}{3}, \frac{2-\sqrt{2}i}{3} \right\}$

C.  $\left\{ \frac{1+\sqrt{2}i}{3}, \frac{1-\sqrt{2}i}{3} \right\}$

B.  $\left\{ \frac{4-\sqrt{2}i}{3}, \frac{4+\sqrt{2}i}{3} \right\}$

D.  $\left\{ \frac{3+\sqrt{3}i}{3}, \frac{3-\sqrt{3}i}{3} \right\}$

44. For any two complex numbers  $z_1$  and  $z_2$ , which of the following is **not** necessarily true?

A.  $|z_1 + z_2| \leq |z_1| + |z_2|$

C.  $|z_1||z_2| = |z_1 z_2|$

B.  $|z_1| - |z_2| = ||z_1| - |z_2||$

D.  $|z_1 - z_2| \geq |z_1| - |z_2|$

45. Which of the following is equal to  $\int \frac{x-1}{(x+1)^2(x+2)} dx$ ?

A.  $3 \ln \left| \frac{x+1}{x+2} \right| - 2 \ln(x+1)^2 + c$

C.  $3 \ln \left| \frac{x+1}{x+2} \right| - 2 \left( \frac{1}{x+1} \right)^2 + c$

B.  $3 \ln \left| \frac{x+1}{x+2} \right| + 2 \left( \frac{1}{x+1} \right) + c$

D.  $3 \ln \left| \frac{(x+1)^3}{x+2} \right| + 2 \left( \frac{1}{x+2} \right) + c$

46. A man wants to enclose a rectangular field on three sides. The fourth side is not to have a fence which is protected by a cliff. If he uses 200m long fence, what should be the maximum area he can enclose?

A.  $5000m^2$

B.  $10,000m^2$

C.  $2500m^2$

D.  $7500m^2$

47. Water is being poured into a conical vase at rate of  $6\pi \frac{cm^3}{sec}$ . The diameter of the cone is 10cm and its height is 15 cm. At what rate is the water level rising when its depth is 6cm?

A.  $6 \frac{cm}{sec}$

C.  $1.5 \frac{cm}{sec}$

B.  $0.5 \frac{cm}{sec}$

D.  $4 \frac{cm}{sec}$

48. Which of the following is equal to  $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \sin x \cos^2 x dx$ ?

A.  $\frac{1}{8}$

B.  $\frac{1}{32}$

C.  $\frac{1}{6}$

D.  $\frac{1}{24}$

49. What is the area of the region bounded by the graph of

$$f(x) = |x^2 - 1|, \text{ the x-axis and the lines } x = -3 \text{ and } x = 2$$

A. 8 sq. units.

C. 9 sq. units

B.  $\frac{32}{3}$  sq. units

D.  $\frac{28}{3}$  sq. units

50. What is the volume of the solid generated if the region bounded by  $y = 3x$  and  $y = x^2 + 2$  rotates about the x-axis?

A.  $\frac{7}{3}\pi$

C.  $\frac{32}{15}\pi$

B.  $\frac{22}{15}\pi$

D.  $\frac{9}{5}\pi$

51. Consider the following linear programming problem with the objective function  $Z = 4x + 2y$  subjected to the constraints:

$$x \geq 0$$

$$y \geq 0$$

$$3x + y \geq 7$$

$$-x + 2y \leq 7$$

Then which one of the following is correct?

A. (1, 4) is an optimal solution of the problem.

B. The maximum value is  $Z = 16$ .

C. The minimum value is  $Z = 10$ .

D. The solution region of the system is bounded.

52. An item is sold for Birr 300 after 20% discount from its regular price. How much was its regular price?

- A. Birr 375                      B. Birr 400                      C. Birr 350                      D. Birr 385

53. A sum of money was divided among Aster, Ali and Masfin in the ratio  $\frac{2}{3} : \frac{1}{4} : \frac{1}{2}$  respectively. Aster has received Birr 3504. How much money was there?

- A. Birr 7464                      B. Birr 7446                      C. Birr 8446                      D. Birr 8644

54. A steel company has imported 45 tons of raw materials from South Africa in 2003. In 2012 the company imported 60 tons of raw materials from the same country. What is the rate of change of amount imported?

- A.  $\frac{1}{4}$                                   B.  $\frac{7}{20}$                                   C.  $\frac{3}{4}$                                   D.  $\frac{1}{3}$

55. At what point the maximum value of the objective function  $Z = x + 3y$  is attained if it is subject to the constraints:

$$2x + 3y \leq 24$$

$$x - y \leq 7$$

$$y \leq 6$$

$$x, y \geq 0$$

- A. (0, 6)                      B. (9, 2)                      C. (7, 3)                      D. (3, 6)

56. In a preparatory school there are 240 students whose list numbers written from 1 – 240. suppose you need to select a sample of size 30 using the technique of systematic sampling. If the first individual selected randomly is number 6, what are the second and the third numbers respectively that should be included in the sample?

- A. 14 and 22                      B. 12 and 20                      C. 7 and 15                      D. 8 and 16

57. The following table shows the simple frequency distribution of a data  
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|           |   |   |   |   |   |
|-----------|---|---|---|---|---|
| x         | 1 | 2 | 3 | 4 | 5 |
| Frequency | 3 | 1 | 4 | 2 | 1 |

Which one of the following is the mean deviation about the mode of the data?

- A. 0.5                      B. 2                      C. 1                      D. 1.5

58. If Birr 1000 is deposited in Commercial Bank of Ethiopia with interest rate of 10% per annum, then what will be the amount at the end of one year, if it is compounded semi-annually?

- A. Birr 1210              B. birr 1102.5              C. Birr 1050              D. Birr 1103.5

59. Ato Chala sold a quintal of Teff at Birr 1,068 with 45% markup on selling price. Then What is the cost?

- A. Birr 587.4                                      C. Birr 578.4  
B. Birr 560                                      D. Birr 576

60. Which one of the following is **not** true?

- A. If mean = median = mode, then the distribution is symmetrical.  
B. If mean > median > mode, then the distribution is positively skewed.  
C. If median < mean < mode, then the distribution is positively skewed.  
D. If mean < median < mode, then the distribution is negatively skewed.

61. Chaltu owned 150,000 shares of Common Stock Nile Company. The company declared and paid a dividend of birr 3 per share. Then which of the following is **not** true?

- A. Chaltu will get the dividend income Birr 450,000.  
B. Chaltu will pay tax on dividend income Birr 45,000  
C. Chaltu is not expected to pay tax on dividend income.  
D. The tax paid by chaltu is direct tax.

62. If store A sells 6 cans of honey for Birr 183 and store B sells 20 cans of the same honey for Birr 615, then which one of the following is true?

- A. The unit cost of a can of honey in store A is Birr 30.75.
- B. Buying honey from store B is better than from store A.
- C. The unit cost of a can of honey in store B is Birr 30.5.
- D. Buying honey from store A is better than from store B.

63. A machine costing Birr 50,000 is estimated to have a useful life time of 8 years and a salvage value of Birr 4000. What is the accumulated depreciation at the end of 7 years? (Using the fixed installment method)

- A. Birr 40,250      B. Birr 34,500      C. Birr 41,250      D. Birr 35,250

64. Consider the following two set of data below.

Data A: 2, 3, 5, 6, 9

Data B: 3, 4, 5, 5, 8

Which one of the following is **not** true about these data?

- A. Both data have the same mean.
- B. The two data have different variance.
- C. Data A is more consistent than data B.
- D. The standard deviation of data A is  $\sqrt{6}$

65. Megersa buys 300 apples for Birr 600. He sells them for Birr 2.35 each.

What will be the percentage profit?

- A. 17.5%      B. 12.5%      C. 16.6%      D. 18.7%

### ENTRANCE PREPARATION

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