

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. A function f is continuous on the closed interval $[2, 5]$ with $f(2) = 17$ and $f(5) = 17$. Which one of the following additional conditions guarantees that there is a number C in the open interval $(2, 5)$ such that $f'(C) = 0$?
 - A. f has relative extreme on the open interval $(2, 5)$
 - B. No additional conditions are necessary.
 - C. f is differentiable on the open interval $(2, 5)$
 - D. f is differentiable on the open interval $(5, 17)$
2. For the rational function $f(x) = \frac{x^3 + 2x^2 - 3x}{3x^2 + 3x - 6}$ which one of the following is NOT true?
 - A. Vertical asymptote are the lines $x = -2$ & $x = 1$
 - B. Zeros of $f(x)$ are $x = -3$, $x = 0$ and $x = 1$
 - C. Oblique asymptote is $y = \frac{1}{3}x + \frac{1}{3}$
 - D. $\lim_{x \rightarrow \infty} f(x) = \infty$
3. Two sides of a triangle have lengths of $10m$ and $13m$. The angle between them is increasing at a rate of $\frac{\pi}{60} \text{ rad/min}$. How fast is the length of the third side increasing when the angle between the sides of fixed length is $\frac{\pi}{3} \text{ rad}$?

A. $\frac{13\sqrt{3}}{12\sqrt{139}} \pi \text{ m/min}$.	C. $\frac{13\sqrt{139}}{12\sqrt{13}} \pi \text{ m/min}$.
B. $\frac{12\sqrt{3}}{13\sqrt{139}} \pi \text{ m/min}$.	D. $\frac{\sqrt{3}}{12\sqrt{139}} \pi \text{ m/min}$.

4. What is the equation of the tangent line to the graph of $f(x) = \ln(xe^x)$ at the point $(1, 1)$
- A. $2x - y - 1 = 0$ C. $2x - y + 1 = 0$
 B. $2x + y - 1 = 0$ D. $2x + y + 1 = 0$
5. For $f(x) = 2xe^{2x}$ which of the following is not true?
- A. The function $f(x)$ has local minimum at $x = -\frac{1}{2}$
 B. The function $f(x)$ is strictly increasing on $[-\frac{1}{2}, \infty)$
 C. The function $f(x)$ is strictly decreasing on $(-\infty, -\frac{1}{2}]$
 D. The function $f(x)$ is concave down on $[-1, \infty)$
6. If the sequence recursively defined by $a_1 = 1, a_2 = -2$ and for $n \geq 3$. $a_n = a_{n-1} + (a_{n-2})^2 + n$, then the a_6 term is:
- A. 125 B. 175 C. 41 D. 21
7. What is the value of K so that $f(x) = \begin{cases} \frac{3\sin(kx)}{x}, & \text{if } x > 0 \\ 6k^2 + 5x & \text{if } x \leq 0 \end{cases}$ is continuous at $x = 0$?
- A. $\frac{1}{2}$ B. 2 C. $-\frac{1}{2}$ D. -1
8. What is the value of $\lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin x}{h}$?
- A. $\sin x$ B. $\cos x$ C. $-\sin x$ D. $\cot x$
9. If $f(x) = e^{2x} \sin x$, then the second derivative $f''(x)$ is equal to ____
- A. $-\sin x e^{2x}$ C. $-e^{2x} \sin x - 2e^{2x} \cos 2x$
 B. $-4e^{2x} \sin x$ D. $3e^{2x} \sin x + 4e^{2x} \cos x$
10. Which one of the following is a divergent sequence?
- A. $\left\{1 + \frac{(-1)^7}{7^n}\right\}$ C. $\left\{\frac{2n}{n-1}\right\}$
 B. $\left\{\frac{2n+1}{n-1}\right\}$ D. $\left\{\left(\frac{7}{3}\right)^n\right\}$
11. Suppose $S(t) = 25t^2 + 30t + 14$ is the position of an object at time t which is moving along a straight line. Then which of the following is TRUE about $S(t)$?

- A. The average velocity over the time interval $[a, a + h]$ is $50a + 25h + 14$.
- B. The instantaneous velocity at $t = a$ is $50a + 30$
- C. The average velocity over the time interval $[a, a + h]$ is $25a + 25h$
- D. The instantaneous velocity at $t = a$ is $50a + 4$
12. If $y = (e + 1)^2$, then what is the value of $\frac{dy}{dx}$?
- A. $e + 1$ B. 0 C. $2(e + 1)$ D. 1
13. Which one of the following is equal to $\lim_{x \rightarrow 1} \frac{x^4 - \sqrt{x}}{\sqrt{x} - 1}$?
- A. 1 B. -2 C. 7 D. 6
14. If $f(x) = x^2 + 2x$ then $\frac{d}{dx} (f(\ln x))$ is equal to
- A. $\frac{2\ln x + 2}{x}$ C. $2\ln x + 2$
- B. $2x\ln x + 2$ D. $\frac{2x + 2}{x}$
15. Students created a trapezoid from the cans they had collected for the food bank. There were 10 rows in the trapezoid. The bottom row had 100 cans each consecutive row had five fewer cans than the previous row. How many cans were in the trapezoid?
- A. 995 B. 565 C. 125 D. 775
16. Which of the following relations holds for the sequence: $9, -6, 4, \frac{-8}{3}, \dots$
- A. $9\left[\frac{2}{3}\right]^{n-1}$ C. $9\left[-\frac{2}{3}\right]^{n-1}$
- B. $\frac{2}{3}[9]^{n-1}$ D. $-\frac{2}{3}[9]^{n-1}$
17. Which of the following arithmetic series the sum of 10 terms is 115?
- A. $39 + 34 + 29 + 24 + 19 + \dots$ C. $11 + 6 + 1 - 4 - 9 - \dots$
- B. $-11 - 6 - 1 + 4 + 9 + \dots$ D. $39 + 31 + 23 + 15 + 7 + \dots$
18. What is the simplified and lowest form of the following rational expression?

$$\frac{\frac{1}{x+3} - \frac{1}{x-3}}{1 + \frac{1}{x^2-9}} \text{ for } x \neq -3, 0, 3$$

A. $\frac{5}{2}$ B. $-\frac{x}{6}$ C. $\frac{x^2}{6}$ D. $-\frac{x^2}{6}$

19. If a point p does not lie on a line l in the coordinate plane, how far is the point $p(-5, 2)$ from the line $l: 3x + 8y - 5 = 0$?

A. $\frac{5}{\sqrt{31}}$ B. $\frac{4}{\sqrt{73}}$ C. $\frac{12}{\sqrt{7}}$ D. $\frac{\sqrt{5}}{2}$

20. The equation of the line tangent to the circle with equation

$$(x - 2)^2 + (y - 3)^2 = 10 \text{ at point } p(-1, 2) \text{ is:}$$

A. $y = -3x - 1$

B. $y = 3x + \frac{5}{18}$

C. $y = \frac{-2}{3}x + \frac{5}{3}$

D. $y = -3x - 2$

21. Which one of the following is one to one corresponding function?

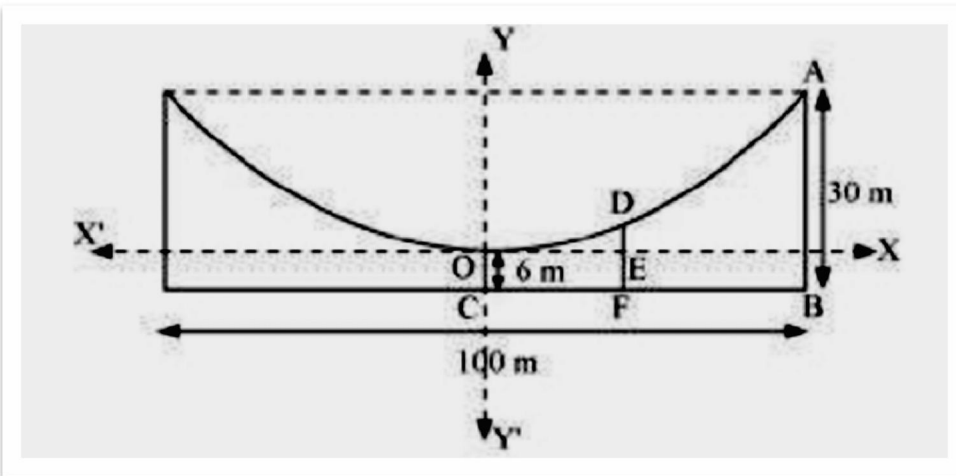
A. $f: [0, \infty) \rightarrow \mathbb{R} \text{ and } f(x) = |x - 5|$

B. $f: [0, \pi] \rightarrow (-1, 1) \text{ and } f(x) = \cos x$

C. $f: \mathbb{R}^+ \rightarrow \mathbb{R} \text{ and } f(x) = \log_3 x$

D. $f: \mathbb{R} \rightarrow [0, \infty) \text{ and } f(x) = \left(\frac{3}{2}\right)^x$

22. The cable of a uniformly loaded suspension bridge hangs in the form of a parabola as shown in the figure below. The road way which is horizontal and 100m long is supported by vertical wires attached to the cable the longest wire being 30m and the shortest being 6m. What is the length of a supporting wire (that means the length DF) attached to the road way 18m from the middle.



- A. $\frac{5694}{625}$ B. $\frac{569}{625}$ C. $\frac{694}{5625}$ D. $\frac{625}{5694}$

23. Let p, q and r are three propositions whose truth values are F, T and F respectively, then which one of the following has a truth value false?

- A. $(p \wedge q) \Rightarrow r \vee q$ C. $(\neg p \Rightarrow r) \vee (p \Leftrightarrow r)$
 B. $\neg(\neg r \vee p) \Rightarrow (\neg p \Rightarrow r)$ D. $(q \Leftrightarrow \neg p) \Leftrightarrow (p \wedge \neg r)$

24. Which one of the following combinations of questions matches with its truth value in the parenthesis. If $p(x, y) : x = y + 1$, where the universe is the set of real number.

- A. $(\exists x)(\exists y)p(x, y)$ is true. C. $(\forall x)(\forall y)p(x, y)$ is true
 B. $(\forall x)(\exists y)p(x, y)$ is false. D. $(\exists x)(\forall y)p(x, y)$ is false

25. The following table shows the mark of 20 students. What is the modal mark?

Mark	5-9	10-14	15-19	20-24
No.of students	3	7	4	6

- A. 13.1 B. 14.8 C. 12.4 D. 11.3

26. A basket contains 6 yellow, 3 green and 5 white balls. If one ball is drawn from the basket, what is the ball is not green?

- A. $\frac{3}{14}$ B. $\frac{11}{14}$ C. $\frac{9}{14}$ D. $\frac{13}{14}$

27. In the following matrices A , B and C , if $AB = C$ then what is the value of e and f respectively? $A = \begin{bmatrix} -3 & 0 & 3 \\ 2 & e & -1 \\ 1 & 4 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 5 & 2 & 6 \\ -1 & 1 & -3 \\ 0 & -3 & f \end{bmatrix}$
 $C = \begin{bmatrix} -15 & -15 & -6 \\ 11 & 6 & 11 \\ 1 & 12 & -14 \end{bmatrix}$
 A. 7 and -5 B. 3 and 5 C. -1 and -8 D. -1 and 4
28. In how many ways can the letters of the word GOSSAMERE be arranged such that all S 's and M 's appear in the middle?
 A. $\frac{9!}{2!2!}$ B. $\frac{7!}{2!}$ C. $\frac{7!3!}{2!2!}$ D. $\frac{6!3!}{2!2!}$
29. Suppose A is 3×3 matrix and $t(2A^{-1}) = -4 = \det(A^3(B^{-1}))^T$, then what is the value of $\det A$ and $\det B$ respectively?
 A. -2, 4 B. -2, 2 C. 2, -2 D. -4, -2
30. What is the solution set of the system $\begin{cases} 2x - 3y + z = 4 \\ x - 2y + 3z = -1 \\ 4x + y - z = 2 \end{cases}$
 A. $\left\{\left(\frac{1}{2}, \frac{-3}{2}, \frac{-3}{2}\right)\right\}$ C. $\left\{\left(\frac{2}{5}, \frac{-6}{5}, \frac{12}{5}\right)\right\}$
 B. $\left\{\left(\frac{-11}{6}, \frac{4}{5}, \frac{7}{4}\right)\right\}$ D. $\left\{\left(\frac{1}{6}, \frac{-7}{6}, \frac{5}{6}\right)\right\}$
31. In how many ways can a committee of 5 members be formed from 4 women and 6 men such that at least one woman is member of the committee?
 A. 112 B. 156 C. 208 D. 246
32. What is the exact value of the argument of w where $z = 1 + \sqrt{3}i$ and $\frac{w}{z} = 2 + 2i$
 A. $\frac{7\pi}{12}$ B. $\frac{7\pi}{5}$ C. $\frac{6\pi}{7}$ D. $\frac{3\pi}{4}$
33. If $x^2 + 2xy = y^2$, then what is the value of $\frac{dy}{dx}$?
 A. $\frac{x+y}{y-x}$ B. $2x + 2y$ C. $\frac{x+y}{y}$ D. $-x$
34. An ice cream cone has the shape of an inverted circular cone with a base of radius $2cm$ and height of $4cm$. If soft serve ice cream is being pumped in to the cone at a rate of $2cm^3/min$, what the rate at which the ice cream level is rising when the ice cream is $3cm$ in deep?
 A. $\frac{9}{8\pi}$ B. $\frac{9\pi}{8}$ C. $\frac{8}{9\pi}$ D. $\frac{8\pi}{9}$
35. What is the value of $\lim_{x \rightarrow \infty} \frac{\sqrt{9x^4 + 1}}{x^2 - 3x + 5}$?

- A. 1 B. 3 C. 9 D. ∞
36. What the area bounded by the coordinate axes the graph of $y = 4e^{-2x}$ and the line $x = 1$?
- A. $2(1 - e^{-2})$ square unit C. $-2(1 - e^{-2})$ square unit
 B. $2(1 + e^{-2})$ square unit D. $-2(1 + e^{-2})$ square unit
37. Let y be a differentiable function with $f(-3) = 12$, $f'(-3) = 9$, $h(-3) = -2$ and $h'(-3) = 5$. If $y = [x - f(x)] h(x)$, then what is the value of $\frac{dy}{dx}$ at $x = -3$?
- A. -2 B. 16 C. -15 D. -59
38. If i is an imaginary number what is the simplified form of $(i^{387} x i^{266}) \div (i^{69} x i^{152})$?
- A. 1 B. i C. -1 D. $-i$
39. What is the point on the curve $f(x) = 3x^2 - 4x + 5$ where the tangent line is parallel to the line $f(x) = -22x + 7$.
- A. (0, 5) B. (-1, 12) C. (-3, 44) D. (-2, 25)
40. Which of the following is Not true?
- A. If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ exist, then f is differentiable at a
 B. If f is differentiable at a , then $\lim_{x \rightarrow a} f(x) = f(a)$
 C. If $\lim_{x \rightarrow a} f(x)$ exists, then f is continuous at a
 D. If f is differentiable at a , then f is continuous at a .
41. Which one of the following is equal to $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{x - \frac{\pi}{4}}$?
- A. $\sqrt{2}$ B. 0 C. 2 D. $3\sqrt{2}$
42. Which of the following is the form of the partial fraction decomposition of $\frac{2x^3 + 2x^2 + x + 1}{x^2(x^2 + 1)}$?
- A. $\frac{A}{x} + \frac{B}{x^2} + \frac{Cx + D}{x^2 + 1}$ C. $\frac{A}{x} + \frac{Bx + C}{x^2} + \frac{D}{x^2 + 1}$

- B. $\frac{A}{x} + \frac{Bx}{x^2} + \frac{Cx+D}{x^2+1}$ D. $\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^2+1}$
43. Suppose $\lim_{x \rightarrow -3^-} f(x) = -1$ and $\lim_{x \rightarrow -3^+} f(x) = -1$; $f(-3)$ is not defined. Which one of the following is not true?
- A. $\lim_{x \rightarrow -3} f(x) = -1$
 B. f has discontinuity at $x = -3$
 C. If we redefine $f(-3)$ to be equal to -1 , then the new function will be continuous.
 D. f is continuous everywhere except at $x = -3$
44. The foci of the ellipse $25(x+1)^2 + 9(y+2)^2 = 225$ are equal to:
- A. $(-1, 2)$ & $(-1, -6)$ C. $(-1, -2)$ & $(-2, -1)$
 B. $(-2, 1)$ & $(-2, 6)$ D. $(-1, -2)$ & $(-1, -6)$
45. What is the center of the hyperbola $89 = 16y^2 - 9x^2 + 18x + 64y$ is?
- A. $(1, -2)$ B. $(-1, -2)$ C. $(1, 2)$ D. $(-1, 2)$
46. For $f(x) = e^{4-x^2}$ which of the following is not true?
- A. The function $f(x)$ has local minimum at $x = 0$
 B. The function $f(x)$ is strictly increasing on $(-\infty, 0]$
 C. The function $f(x)$ is concave down on $(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$
 D. The function $f(x)$ is concave up on $(-\infty, -\frac{1}{\sqrt{2}})$ & $(\frac{1}{\sqrt{2}}, \infty)$
47. What is the value of $\int_2^9 f(x)dx$ given that $\int_5^2 f(x)dx = 3$ and $\int_5^9 f(x)dx = 8$?
- A. 8 B. -3 C. 6 D. 5
48. If $\frac{d}{dx} f(x) = g(x)$ and $h(x) = \sin x$, then $\frac{d}{dx} f(h(x))$ is equal to _____
- A. $g(\sin x)$ B. $g(x) \cos x$ C. $\sin x g(\sin x)$ D. $\cos x g(\sin x)$
49. What is the value of $\int \frac{2x}{4x-3} dx$?
- A. $\frac{x}{2} + \frac{3}{8} \ln|4x-3| + c$ C. $\frac{4x-3}{8} + \frac{8}{3} \ln|4x-3| + c$
 B. $\frac{4x-3}{8} - \frac{3}{8} \ln|4x-3| + c$ D. $\frac{4x+3}{8} - \frac{3}{8} \ln|4x-3| + c$

50. Which of the following is equal to $\int \frac{4}{49-36x^2} dx$?

- A. $\frac{1}{21} \ln \left| \frac{7-6x}{7+6x} \right| + c$ C. $\frac{1}{21} \ln \left| \frac{-7+6x}{7-6x} \right| + c$
 B. $\frac{1}{21} \ln \left| \frac{7+6x}{7-6x} \right| + c$ D. $\frac{1}{21} \ln \left| \frac{7+6x}{-7-6x} \right| + c$

51. A shoe dealer made a discount of 20% on each item for a clearance sale. A shoe of the shop has a price tag of Birr 480. What is the amount of the discount?

- A. Birr 120 B. Birr 86 C. Birr 180 D. Birr 103

52. The mean and standard deviation of the mark scored by four students shown in the following table. Which one of the following data set is more consistent?

- A. F B. G C. H D. I

Students	Mean score	Standard deviation
F	68	1.36
G	68	1.20
H	72	1.6
I	72	1.8

53. Which of the following is false about frequency polygon?

- A. It is possible to draw frequency polygon from a histogram
 B. It will be more meaningfull if other similar data are on the same graph.
 C. The dotted lines at both ends of the graph are part of the data.
 D. Midpoint of each class limit is used to construct frequency polygon.

54. If the mean of six data a,b,c,d,e and f equals 8 , what will be the mean of $4a + 5, 4b + 5, 4c + 5, 4d + 5, 4e + 5$ and $4f + 5$

A. 28 B. 46 c. 48 D. 37

55. A computer whose cost price birr 6000 is sold for 15% of profit. What is its selling price?

A. Birr 7200 B. Birr 6500 C. Birr 9000 D. Birr 6900

56. Ato Tesfaye bought a house from a real state by paying 15% of the purchase price. If the price is birr 750,000, what is his mortgage amount?

A. Br. 583,620 B. Br. 637,500 C. Br. 700,000 D. Br. 592,800

57. W/o Lelise is an employee of administration office in her town, earns Birr 43200 a year. She works 40 hours in each week. What is her hourly rate of pay?

A. Br. 20.77 B. Br. 16.82 C. Br. 31.25 D. Br. 28.03

58. The equation of a line passing through the point (-2 , 4) and it is perpendicular to the line $2x - 3y = 9$ is ?

A. $y = \frac{-3}{2}x - 3$ B. $Y = \frac{-3}{2}x + 5$ C. $y = \frac{-3}{2}x + 1$ D. $y = \frac{-2}{3}x - 6$

59. Which of the following values of x and y that maximize the objective function

$$Z = 3x + 5y, \text{ subject to : } x + 3y \leq 12$$

$$0 \leq x \leq 7$$

$$0 \leq y \leq 7$$

A. $X = 8$ and $y = \frac{8}{5}$ B. $x = 7$ and $y = \frac{13}{2}$ C. $x = 7$ and $y = \frac{5}{3}$

D. $x = 7$ and $y = \frac{12}{5}$

60. From the total 1500 preparatory school students, 570 of them score above 400 out of 700. What percent of the students score below 400 out of 700?

- A. 38% B. 21% C. 28% D. 31%

61. A group of people those associated for business want to maximize their profit for two products. Product A gives a profit of Birr 1.20 per k.g and products B gives a profit of Birr.3.00per kg. Their market test and amount of resources have indicated the following constraints.

i. The level of combined product A and product B should not be exceed 900 k.g

ii. The demand for product A is not more than twice of the demand for product B. What is their maximum profit in a month?

- A. Br. 1890 B. Br. 2700 C. Br. 3120 D. Br. 4871

62. Among the total number 804 of a university students, 460 students enrolled in accounting department and the rests are in the Business department. What is the ratio of the number of student in Business department to that of accounting department?

- A. 117:402 B. 223:336 C. 38:27 D. 28: 39

63. Birr 1000 is invested at 10% interest rate compounded semi annually. What is the amount after 2 Year?

- A. Br.1300.08 B. Br. 1102.50 C. Br. 1110.45 D. Br. 1010.03

64. A refrigerator whose cost is Br.9000 is estimated to have a usefull life time of 5 years and a salvage value of Br. 500. What is the accumulated depression at the end of 3 Years?

- A. Br. 5100 B. Br. 5026 C. Br. 5339 D. Br.5270

65. Which one of the following is NOT true about Taxation?

- A. Ensures economic stability.
- B. Removes inequalities in income.
- C. Minimizes the income of a merchant.
- D. Promote economic growth.