

MILLENNIUM SECONDARY AND PREPARATORY SCHOOL 2012 E.C GRADE 12
MATHS SOCIAL OPEN BOOK MODEL EXAM -ONE

CHOOSE THE BEST ANSWER

1. If $p \Leftrightarrow q$ is false, then which one of the following is always true?
- A. $p \vee q$ B. $p \wedge q$ C. $p \Rightarrow q$ D. $p \wedge \neg q$
2. The simplified form of $(\neg q \Rightarrow p) \wedge (\neg p \vee q)$ is
- A. p B. q C. $q \Rightarrow p$ D. $p \vee q$
3. Which of the following is true about the function $f(x) = x^2 + 1$?
- A. It is an odd function B. It is an even function
C. It is neither odd nor even function. D. Its range is \mathbb{R} .
4. Which one of the following is a proposition?
- A. The most quality coffee in the world is from Ethiopia. B. $3x + 4 = 8$
C. Tell me the truth. D. Ethiopians are intelligent.
5. Given that p : Every triangle is isosceles.
 q : Every square is a rectangle, then the symbolic representation of the compound statement "Every triangle is isosceles while every square is a rectangle" is
- A. $p \vee q$ B. $p \Rightarrow q$ C. $p \Leftrightarrow q$ D. $p \wedge q$
6. Let p , q and r be statements. If $(p \wedge \neg q) \Rightarrow \neg r$ is false, then the truth value of p , q and r respectively are:
- A. T, F, F C. F, T, T
B. T, F, T D. T, T, F
7. If $f(x) = \frac{x+2}{\sqrt{x+2}}$ and $g(x) = x - 2$, then $f(g(x))$ is equal to
- A. $\frac{\sqrt{x}}{x}$ B. \sqrt{x} C. $\sqrt{x} + 2$ D. $\sqrt{x} - 2$

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8. If $f(x) = \begin{cases} 5 - \sqrt{9 - x^2} & \text{if } |x| \leq 3, \\ 10 - 2x & \text{if } x > 3 \end{cases}$, then $f(0) - f(4)$ is equal to
 A. 1 B. 3 C. -2 D. 0
9. Let $g(x) = x + 1$ and $f(g(x)) = x^2 - 2$, then $g(3)$ is
 A. 1 B. 2 C. -2 D. 7
10. $5[\sqrt{3}] - 4[-\sqrt{10}]$ is equal to ---- A.21 B. -11 C. 19 D. -19
11. If $f = \{(-3, -2), (0, 4), (-1, -2), (1, 5)\}$ and
 $g = \{(-1, -3), (0, 1), (-2, 4), (1, 7), (2, 0)\}$, then which of the following is true?
 A. $(g \circ f)(-3) = 2$.
 B. $(f \circ g)(2) = 0$
 C. $(f \circ g) = \{(-1, -2), (0, 5), (1, 7)\}$
 D. $-2f - g = \{(-1, -7), (0, -9), (1, -17)\}$
12. Which one of the following does not define a rational function?
 A. $f(x) = \frac{x^2+3x}{x^2-1}$ B. $h(x) = \frac{\sqrt{x+1}}{x+2}$
 C. $g(x) = \frac{\sqrt{2}x+1}{x+3} + \frac{x+2}{x+1}$ D. $k(x) = \frac{2x+1}{\sqrt{(x^2+1)^2}}$
13. The simplest form of the expression $\left(\frac{x(x+1)}{x^2+2x+1}\right)\left(\frac{x+1}{x}\right)$ is _____
 A. 1 B. 2 C. $x + 2$ D. x
14. The solution set of the equation $\frac{x+4}{x-5} - \frac{1}{x+5} = \frac{10}{x^2-25}$ is
 A. $\{2 \pm \sqrt{26}\}$ B. $\{1 \pm \sqrt{26}\}$ C. $\{3\}$ D. $\{-3\}$
15. Which one of the following is true about the function $(x) = \frac{x^3+1}{x^2-1}$?
 A. It has a horizontal asymptote at $x = \pm 1$.
 B. Its domain is the set of real numbers.
 C. It has an oblique asymptote $y = x$.
 D. It has only a horizontal asymptote.

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16. The sum of infinite terms in a geometric progression is 2 and the sum of their squares is $\frac{4}{3}$, then what is the series?
- A. $\{1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots\}$ B. $\{2, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots\}$ C. $\{1, \frac{2}{3}, \frac{1}{4}, \frac{1}{8}, \dots\}$ D. $\{-\frac{1}{2}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots\}$
17. $\sum_{n=1}^{\infty} \left[\left(\frac{-1}{3} \right)^n + 4^{1-n} \right]$ is equal to A. $\frac{1}{12}$ B. $\frac{19}{12}$ C. $\frac{13}{12}$ D. $\frac{25}{12}$
18. Suppose $\{a_n\}$ is an A.P such that $a_5 = 21$ and $a_{10} = 66$, then $a_2 =$
- A. -6 B. -15 C. 3 D. 9
19. The series $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)}$ is equal to
- A. $\frac{n}{n(n+3)}$ B. $\frac{n}{n(n+2)}$ C. $\frac{n}{(n+1)}$ D. $\frac{1}{n(n+1)}$
20. If $\log_3 2, \log_3 2^x - 5$ and $\log_3 2^x - \frac{7}{2}$ are in an A.P, then $x =$ ____
- A. 2 B. 3 C. 4 D. 2 or 3
21. If $\frac{3+5+7+\dots\text{to } n \text{ terms}}{5+8+11+\dots\text{to } 10 \text{ terms}} = 7$, then the value of n is
- A. 35 B. 36 C. 37 D. 40
22. The interior angles of a convex polygon are in A.P. The smallest angle is 120° and the common difference is 5° . The number of sides of the polygon is
- A. 7 **B. 9** C. 11 D. 16
23. The sum of three terms of an arithmetic progression is 33 and their product is 792. The least of them is
- A. 8 B. 11 C. 18 **D. 4**
24. $5x - y, 2x + y, x + 2y$ form an A.P and the numbers $(y + 1)^2, xy + 1, (x - 1)^2$ form a G.P. Then $(x, y) =$
- A. (0,0) B. $(\frac{1}{4}, \frac{1}{2})$ C. (-2, -4) D. (2,4)

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25. The sum of the first three terms of a GP is to the sum of the first six terms as 125:152. The common ratio of the G.P is
- A. $\frac{1}{5}$ B. $\frac{2}{5}$ C. $\frac{3}{5}$ D. $\frac{4}{5}$
26. The sum of integers from 1 to 100 that are divisible by 2 or 5 is
- A. 3050 B.2020 C. 2222 D. 2456
27. If $\{a_n\}$ is a sequence such that $a_1 = 2$, and $a_{n+1} = a_n + 4$ for all $n \geq 1$, then $\sum_{n=1}^{35} a_n$ is equal to;
- A. 2460 B. 2458 C. 2450 D. 2442
28. What is the 50th term of the sequence? 3,10,17,24,31, — — —?
- A. 310 B.346 C. 510 D. 531
29. How many four digit even numbers can be formed from 1, 2, 3, 4, and 5 if the numbers start with 3?
- A. 40 B. 50 C. 100 D. 120
30. A ball is thrown vertically from ground up to a height of 16m. Each time it drops h meters, it rebounds 0.8h meters. Nothing that the ball travels every height of h twice. What is the total vertical distance traveled by the ball before it comes to rest?
- A. 144m B. 80m C. 160m D. 320m
31. Let $s_n = 4n^2$, $n = 1, 2, 3, \dots$ be the sum of the first n terms of the sequence then which of the following is the third term of the sequence?
- A. 8 B. 12 C. 16 D. 20
32. Consider the sequence $\{a_n\}$, $n \geq 1$ where the first term is $a_1 = 2$, and $a_n = 3a_{n-1}$ for all $n \geq 2$. Then $\sum_{i=1}^{20} a_i$ is equal to
- A. $3^{20} - 1$ B. $1 - \frac{1}{3^{20}}$ C. $1 - \frac{1}{2^{21}}$ D. $3^{-20} - 1$
33. Consider the sequence $\{a_n\}$, $n \geq 1$, where the first term is $a_1 = 2$, and $a_{n+1} = a_n + 4$ for all $n \geq 1$, then the sum $a_3 + a_4 + a_5 + a_6 + a_7 + \dots + a_{35}$ is equal to
- A.2460 B. 2458 C. 2442 D.2450

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34. Suppose a geometric sequence $\sum_{n=1}^{\infty} G_n$ has n terms $G_{10} = 192$ and $G_6 = 12$. Which of the following is equal to G_2 ? A. $\frac{3}{2}$ B. $\frac{3}{4}$ C. $\frac{3}{8}$ D. $\frac{3}{16}$
35. If k^{th} term of a sequence is $a_k = \frac{(-1)^k(2-k)}{2k-1}$, what is its next term a_{k+1} when k is even?
A. $\frac{k-1}{2k+1}$ B. $\frac{3-k}{2k+3}$ C. $\frac{k-3}{2k+1}$ D. $\frac{1-k}{2k+1}$
36. If a geometric sequence $G_2 = -10$, $G_4 = \frac{-8}{5}$ and G_5 is positive, then which of the following is a general formula for G_n ?
A. $25\left(-\frac{2}{5}\right)^n$ B. $-25\left(\frac{2}{5}\right)^{n-1}$ C. $\frac{(2)^{n-1}}{(-5)^{n-2}}$ D. $25\left(-\frac{2}{5}\right)^{n-1}$
37. On which of the following intervals does the graph of $f(x) = \frac{x}{x^2+9}$ increasing?
A. $(-\infty, \infty)$ B. $[-3, 3]$ C. $(-\infty, -3)$ D. $[3, \infty)$
38. $\lim_{x \rightarrow \infty} \left(\frac{x+4}{x-1}\right)^x$ equal to
A. 0 B. 1 C. e D. e^5
39. The respective values of a and b for which the function $f(x) = \begin{cases} 2x^2 - 5x, & x \leq 2 \\ ax^2 + bx - 12, & x > 2 \end{cases}$ is differentiable at $x=2$ are:
A. 4 and 2 B. 6 and 3 C. 5 and -1 D. -1 and 7
40. $\lim_{n \rightarrow \infty} \left(\frac{1}{1-n^2} + \frac{2}{1-n^2} + \dots + \frac{n}{1-n^2}\right)$ is equal to
A. 0 B. $\frac{-1}{2}$ C. $\frac{1}{2}$ D. 2
41. Find $\lim_{n \rightarrow \infty} (6^n + 7^n)^{\frac{1}{n}}$. A. 6 B. 7 C. 4 D. 5
42. Let $q_n = n + \sin(n\pi)$, $n=1, 2, 3, \dots$ be the nth term of sequence, then which one of the following is true
A. 4 B. 3 C. 5 D. 0
43. Which one is true for the sum of the series $\sum_{n=0}^{\infty} 2^n 3^{2-n}$
A. 6 B. ∞ C. 18 D. 27

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44. A ball is dropped from height of 5 meter the ball rebounds 60% of the distance after each fall find the total distance
- A. 10m B. 20 m C. 30 m D. 80 m
45. A person is scheduled to get raise of birr 250 every 6 month during his first 5 years on the job if his starting salary is birr 25,250 per year what will his salary be at the end of the 3rd year
- A. 25250 B. 26750 B. 26570 D. 25750
46. The monthly rent of machinery birr 200 is to be paid at the end of each month. If it is not paid at the end of the month, the amount due will increase birr 3 per day. What will be the amount to be paid after a delay of 10 days?
- A.2300 B.230 C. 2000 D.6000
47. Which one of the following is a convergent sequence?
- A. $\left\{\frac{(-1)^n}{(0.1)^n}\right\}$ B. $\left\{\frac{3+3^n}{2^n}\right\}$ C. $\left\{\frac{1}{n} + \cos n\right\}$ D. $\left\{\frac{1-4^n}{5^n}\right\}$
48. $\lim_{x \rightarrow 6^-} \sqrt{x - \sqrt{72 - x^2}} =$ _____ A.0 B.6 C. ∞ D.Does not exist
49. Which one of the following is not true statement?
- A. $\{1^n\}$ is monotonic sequence.
- B. The sequence $\{(n)^{\frac{1}{n}}\}$ is converges to zero
- C. The sequence $\{10 + \frac{1}{n}\}$ is strictly decreasing.
- D. The sequence $\{\frac{2n-1}{n+4}\}$ is monotonic and bounded
50. For which of the following sets of values of x will x+2, x+4 and 2x+11 be consecutive terms of a geometric sequence?
- A. $\{-1, 0\}$ B. $\{-1, 3\}$ C. $\{-1, -6\}$ D. $\{1, 6\}$
51. $\sum_{n=1}^{60} (-1)^n (2n + 1)$ is equal to?
- A.60 B.240 C. ∞ D.40

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52. Given $f(x) = \frac{4x^3 - ax^2 + bx + c}{x^2 + 2x - 3}$ where a, b and c are real number. If f has a finite limit at every real number and $\lim_{x \rightarrow 1} f(x) = 8$, then which one of the following is False?

A. $\lim_{x \rightarrow -3} f(x) = -8$ B. $a=c$ C. $\lim_{x \rightarrow -1} f(x) = 0$ D. $a + 3b=0$

53. What is the value of $\lim_{x \rightarrow 2} (4x-7)^{\frac{3}{2x-7}}$?

A. e^4 B. e^5 C. e^6 D. e^{-5}

54. $\lim_{x \rightarrow 1} \left(\frac{1 + \cos \pi x}{x^2 - 2x + 1} \right)$ is equal to:

A. $\frac{-\pi}{2}$ B. π^2 C. $\frac{\pi}{2}$ D. $\frac{\pi^2}{2}$

55. Which one of the following is True about the series $25\frac{1}{4} + 24\frac{1}{2} + 23\frac{1}{4} + 22\frac{1}{2} + 21\frac{1}{4} + \dots$

A. It is an arithmetic sequence B. Its smallest positive term is $1\frac{1}{4}$
C. Its maximum sum is 334.75 D. It is a convergent series.

56. What is the value of $\lim_{x \rightarrow 0} \frac{(30)^x - (6)^x + (5)^x - 1}{2x - x^2}$?

A. $\ln 5$ B. e^5 C. $\ln b$ D. does not exist

57. Which one of the following is necessarily true?

A. If the sum of two sequence is convergent, then both sequences are convergent.
B. If the function f is not differentiable at c, then f is not continuous at c.
C. If f is differentiable both from the right and left at c, then f is differentiable at c.
D. If f is continuous both from the right and left at c, then f is continuous at c.

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58. Which one of the following sequences is unbounded?

- A. $\left\{(-1)^n \sqrt{2n-1} - \sqrt{2n+3}\right\}_{n=1}^{\infty}$ B. $\left\{\cos\left(\frac{1}{n}\right)\right\}_{n=1}^{\infty}$
- C. $\left\{\ln\left(\frac{1}{n}\right)\right\}_{n=1}^{\infty}$ D. $\{\sin(n)\}_{n=1}^{\infty}$

59. For non-zero real number p, let f be defined by $f(x) = \begin{cases} \frac{\tan px}{x}; & \text{for } x < 0 \\ 3x + 2p^2; & \text{for } x \geq 0 \end{cases}$ what value of p make f continuous at x=0?

- A. 2 B. -2 C. $\frac{1}{2}$ D. $-\frac{1}{4}$

60. Let $f(x) = \frac{6\cos(2x) + \sin(2x)\sin x - 6}{x^2}$, then $\lim_{x \rightarrow 0} f(x)$ is

- A. 0 B. -10 C. -6 D. -1

61. Let $h(x) = e^{3x-1}$ and $g(x) = \tan x$ /. If $f(x) = xh(x) + h(g(x))$, which of the following is equal to $f'(0)$

- A. $4e^{-1}$ B. $\frac{1}{e}\left(1 + \frac{1}{e}\right)$ C. $3e^{-1}$ D. $\frac{1}{e}\left(1 - \frac{1}{e}\right)$

62. Which one of the following function continuous and differentiable at the indicate point?

- A. $f(x) = \sqrt[3]{x-3}$ at x=3 B. $f(x) = |2x-1|$ at $x = \frac{1}{2}$.
- C. $f(x) = \sqrt[3]{x^2}$ at x=0 D. $f(x) = |x^2 + 1| + |x|$ at $x = -1$

63. Let $f(x) = 3 - e^{4-5x}$, then $\frac{d}{dx}(f^{-1})(1) = \text{-----}$

- A. $\frac{1}{10}$ B. $\frac{1}{5}$ C. $\frac{1}{2}$ D. $\frac{1}{\ln 2}$

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64. What is the derivative of $f(x) = \ln(\cos \sqrt{x^2 + 4})$?

A. $\frac{-x \tan \sqrt{x^2 + 4}}{\sqrt{x^2 + 4}}$

B. $\frac{-x \sin \sqrt{x^2 + 4}}{\sqrt{x^2 + 4}}$

C. $\frac{2x \tan \sqrt{x^2 + 4}}{\sqrt{x^2 + 4}}$

D. $\frac{-2x}{\sqrt{x^2 + 4}} \sin \sqrt{x^2 + 4}$

65. Let $f(x) = \frac{\ln x}{e^x}$, which of the following is the equation of line tangent to the curve of $f(x)$ at

$x=1$? A. $y - e^x + 1 = 0$ B. $y - x + e = 0$ C. $y - x e^x + e = 0$ D. $ey - x + 1 = 0$

66. Let $f(x) = \cos(\ln \sqrt{e^x})$, then what is the value of $f'(\frac{\pi}{2})$?

A. $\frac{\sqrt{2}}{2}$

B. $-\frac{\sqrt{2}}{2}$

C. $\frac{\sqrt{2}}{2}$

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

67. Which one of the following is the second derivative of $f(x) = \frac{1}{2} \ln\left(\frac{1 + \sin x}{-1 + \sin x}\right)$?

A. $\frac{1}{2} \ln(\sin x)$

B. $-\sec x \tan x$

C. $\csc x \cot x$

D. $-\sec x \tan x$

68. What is the value of a and b respectively if $f(x) = \begin{cases} 2x^2 - 5x, & x \leq 2 \\ ax^2 + bx - 12, & x > 2 \end{cases}$ is differentiable at $x=2$?

A. 5 & -1

B. 4 & 1

C. 6 & 3

D. -1 & 7

69. Which one of the following is **true** about $f(x) = \begin{cases} x-1, & \text{if } x < -1 \\ x^2-1, & \text{if } -1 \leq x < 1 \\ 7x-2, & \text{if } 1 \leq x < 5 \\ 3-x, & \text{if } x \geq 5 \end{cases}$?

A. $f'(-1) = -1$

B. $f'(5) = -1$

C. $f'(3) = 7$

D. $f'(1) = 7$

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70. What is the point of tangency on the curve $f(x) = x^3 + x^2 + 3x - 1$ where the tangent line parallel to $y = 4x - 3$?
- A. $(-1, -4)$ B. $\left(\frac{-1}{3}, \frac{-2}{27}\right)$ C. $(1, 4)$ D. $\left(\frac{-1}{3}, \frac{1}{9}\right)$
71. What is the maximum interval where $f(x) = \frac{x}{\sqrt{1+x^4}}$ differentiable?
- A. $x > 0$ B. $[0, \infty)$ C. $[1, \infty)$ D. $(-\infty, \infty)$
72. One of the following is an asymptote of the hyperbola $y^2 - x^2 + 4x - 5 = 0$.
- A. $y = x + 2$ B. $y = -x + 2$ C. $y = -x - 2$ D. $y = x - 4$.
73. The general second degree equation $4x^2 + 4xy - 2y^2 - 6 = 0$ is
- A. a degenerate circle B. a parabola C. an ellipse D. a hyperbola
74. If the foci and the end points of the major axis of an ellipse coincides respectively with the vertices and foci of the hyperbola $x^2 - 3y - 3 = 0$, then which of the following is the equation of the ellipse?
- A. $3x + y^2 - 3 = 0$. B. $x^2 + 4y^2 - 4 = 0$.
C. $4x^2 + y^2 - 4 = 0$. D. $x^2 + 3y - 3 = 0$.
75. Which of the following is true about the ellipse whose equation is given by $4x^2 + y^2 = 16$?
- A. Length of the minor axis is 2. C. the foci are $(0, -2)$ and $(0, 2)$
B. Length of the major axis is 16. D. $(0, -4)$ and $(0, 4)$ are vertices.
76. For what values of k is the equation $x^2 + y^2 + 6x - 4y + k = 0$ represents a circle?
- A. For all $k \geq 0$. B. For all $k \geq 10$.
C. For all $k < 13$ D. For all $k = 16$
77. Let l be the line containing $(1, 5)$ and its angle of inclination be $\theta = 135^\circ$. Which of the following is the distance from l to $(-1, 1)$?
- A. $2\sqrt{2}$ B. $3\sqrt{2}$ C. $4\sqrt{2}$ D. $6\sqrt{2}$

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78. Which of the following is the eccentricity of the ellipse,
- $$4x^2 + y^2 - 8x + 2y + 4 = 1. \quad \text{A. } \frac{1}{2}\sqrt{3} \quad \text{B. } \frac{2\sqrt{3}}{3} \quad \text{C. } \frac{1}{2} \quad \text{D. } \frac{\sqrt{3}}{4}.$$
79. The acute angle b/n the lines: $3x + 2y = 11$ and $2x + y = -12$ is
- A. $\tan^{-1}\left(\frac{1}{8}\right)$ B. $\tan^{-1}\left(\frac{9}{8}\right)$ C. $\tan^{-1}\left(\frac{7}{8}\right)$ D. $\tan^{-1}\left(\frac{6}{8}\right)$
80. The equation of the hyperbola with foci $(\pm 2\sqrt{3}, 0)$ and asymptotes $y = \pm\sqrt{2}x$ is
- A. $\frac{y^2}{8} - \frac{x^2}{4} = 1$ B. $\frac{x^2}{8} + \frac{y^2}{4} = 1$ C. $\frac{x^2}{8} - \frac{y^2}{4} = 1$ D. $\frac{x^2}{36} + \frac{y^2}{16} = 1$
81. The equation of the line passes through P (1, 2) and the intersection point of $x + y = 5$ and $2x - y = 1$ is
- A. $y + x + 1 = 0$ B. $y - x + 1 = 0$ C. $y - x - 1 = 0$ D. $y + x - 1 = 0$
82. Which of the following is the equation of the parabola with vertex at (1, 2) and directrix the line $x = 0$?
- A. $y^2 - 4x - 4y + 8 = 0.$ B. $x^2 - 2x + 4y - 7 = 0.$
 C. $y^2 + 4x - 4y = 0.$ D. $x^2 - 2x + y - 1 = 0.$
83. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals
- A. $\frac{1}{2}$ **B. $\frac{7}{15}$** C. $\frac{2}{15}$ D. $\frac{1}{3}$
84. There are four machines and it is known that exactly two of them are faulty. They are tested one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is
- A. $\frac{1}{3}$ B. $\frac{1}{6}$ C. $\frac{1}{2}$ D. $\frac{1}{4}$
85. Bag A contains 6 red & 4 black balls & bag B contains 4 red & 6 black balls. One ball is drawn at random from bag A & placed in bag B. Then one ball is drawn at random from bag B & placed in bag A. If one ball is now drawn at random from bag A, the probability that it is found to be red is
- A. $\frac{18}{110}$ B. $\frac{8}{110}$ C. $\frac{56}{550}$ **D. $\frac{32}{55}$**

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86. Three faces of a die are yellow two faces red and one blue. The die is tossed three times. The probability that the colors yellow, red & blue appear in the first, second & the third tosses respectively is
- A. $\frac{18}{36}$ **B. $\frac{1}{36}$** C. $\frac{8}{36}$ D. $\frac{3}{36}$
87. A bag contains 7 green and 5 yellow balls. Two balls are drawn at a time. The probability that both balls are of same color is A. $\frac{1}{33}$ B. $\frac{5}{33}$ C. $\frac{7}{22}$ **D. $\frac{31}{66}$**
88. A letter is selected at random from the letters of the word "PROBABILITY". The chance that it is a vowel is
- A. $\frac{3}{11}$ B. $\frac{2}{11}$ C. $\frac{4}{11}$ D. $\frac{8}{11}$
89. Eight chairs are numbered from 1-8. Two women and three men wish to occupy one chair each. First the women choose the chairs amongst chairs numbered from 1-4, then the men select the chairs from amongst the remaining. The number of possible arrangement is
- A. 20 B. 288 C. 96 **D. $4 \times 2 \times 6 \times 3$**
90. The sum of the digits in the unit place of all the numbers formed with the help of 3, 4, 5, 6 taken all at a time is A. 18 **B. 108** C. 432 D. 144
91. The number of ways in which 10 persons can go in to boats, so that there may be 5 in each boat, supposing that two particular persons will not go in same boat is
- A. $\frac{1}{4} \binom{10}{5}$ **B. $\frac{1}{2} \binom{8}{5}$** C. $\binom{2}{1} \binom{8}{5}$ D. $\binom{8}{5}$
92. In a foot ball championship 153 matches were played. Every team played one match with the other. The number of teams participating in the championship is ____.
- A. 17 **B. 18** C. 9 D. 12
93. If $nPr = 720 \binom{n}{r}$, then r is equal to A. 6 B. 4 C. 7 D. 8
94. 12 persons are to be arranged along a round table. If two particular persons among them are not to sit side by side, the total number of arrangement is
- A. $9 \times 10!$ B. $45 \times 8!$ C. $2 \times 10!$ D. $10!$

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95. In how many ways can a consonant and a vowel be chosen out of the letters the word "GUARDEN?" A. $\binom{7}{2}$ B. $7P2$ C. $4p1 \times 3p1$ D. $\binom{4}{1}\binom{3}{1}$
96. A determinant is unaltered if,
 A. two rows are interchanged.
 B. Two column are interchanged.
 C. Every element in a column is multiplied by the same factor
 D. To each element of any row is added the corresponding element of the other row multiplied by a given factor.
97. If $A = \begin{pmatrix} 1 & a & 2 \\ 1 & 2 & 5 \\ 1 & 1 & 1 \end{pmatrix}$ is non invertible, then a = A. 2 B. 1 C. 0 D. -1
98. If A is a non-singular square matrix of order 3, then $|adj(A^3)|$ equals
 A. $|A|^8$ B. $|A|^6$ C. $|A|^9$ D. $|A|^{12}$
99. If the matrix $\begin{pmatrix} 1 & 3 & x+2 \\ 2 & 4 & 8 \\ 3 & 5 & 10 \end{pmatrix}$ is singular, then $x =$ ___ A. -2 B. 4 C. 2 D. -4
100. If $A = \begin{pmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ -2 & -3 & 0 \end{pmatrix}$ then $A + 2A^T =$ ___
 A. A B. $-A^T$ C. A^T D. $2A^2$
101. Let $x = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$, $A = \begin{pmatrix} 1 & -1 & 2 \\ 2 & 0 & 1 \\ 3 & 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 3 \\ 1 \\ 4 \end{pmatrix}$ and if $Ax = B$, then $x =$ ___
 A. $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ B. $\begin{pmatrix} -1 \\ -2 \\ -3 \end{pmatrix}$ C. $\begin{pmatrix} -1 \\ -2 \\ 3 \end{pmatrix}$ D. $\begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix}$
102. A root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ -3 & 3 & -6-x \end{vmatrix} = 0$ is A. 6 B. 0 C. 3 D. 9
103. What is the value of x, if $\begin{vmatrix} 8 & -5 & 1 \\ 5 & x & 1 \\ 6 & 3 & 1 \end{vmatrix} = 2$? A. 4 B. 8 C. 5 D. 9

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104. If A is a non-singular matrix of order 3, then $|adj(adjA)|$ is equal to
 A. $|A|^4$ B. $|A|^6$ C. $|A|^3$ D. $|A|^9$
105. If $a \neq b \neq c$, one value of x which satisfies the equation $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$ is given by
 A. $x = c$ B. $x = a$ C. $x = 0$ D. $x = b$
106. If each element of a 3×3 matrix A is multiplied by 3, then the determinant of the newly formed matrix is
 A. $3\det A$ B. $9\det A$ C. $(\det A)^3$ D. $27\det A$
107. If A and B are two matrices such that $AB = B$ and $BA = A$, then $A^2 + B^2 =$ _____
 A. $2AB$ B. $2BA$ C. $A + B$ D. AB
108. The system of the equation $\begin{cases} x + 2y = 5 \\ 4x + 8y = 20 \end{cases}$ has
 A. unique solution B. no solution
 C. infinitely many solution D. two distinct solution
109. Let A be a 4×4 matrix and $|A| = -2$, then what is the value of $|adj(A)|$?
 A. 8 B. -8 C. 4 D. -4
110. Let A be a 3×3 invertible Matrix and B be any 3×3 matrix. If $|A| = 2$ and $|B| = -1$, then $|2A^{-1}B|$ is:
 A. -1 B. -8 C. -4 D. -2
111. The modulus and principal argument of $\frac{-\sqrt{3}+i}{1+i}$ are respectively
 A. $2\sqrt{2}; \frac{7\pi}{12}$ B. $2\sqrt{2}; \frac{-11\pi}{12}$ C. $\sqrt{2}; \frac{-11\pi}{12}$ D. $\sqrt{2}; \frac{7\pi}{12}$
112. If $z = x + yi$; where x and y are real numbers, then which of the following is **not true**?
 A. $|z| = |\bar{z}|$ B. $|z\bar{z}| = |z|^2$ C. $Arg(z) = Arg(\bar{z})$ D. $z\bar{z}$ is real number
113. If $\frac{x+yi}{i-1} = (2-i)^3$, then the value of x and y are respectively
 A. 10 and 14 B. 6 and 5 C. 9 and 13 D. 8 and 12

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114. If $z = 1 - i$, then what is the value of z^6 ?
- A. $1 + \frac{1}{i}$ B. $8i$ C. $\frac{i}{8}$ D. $\frac{i}{360}$
115. The polar form of $z = \frac{1+i\sqrt{3}}{1+i}$ is
- A. $\sqrt{2}(\cos 60^\circ + i \sin 60^\circ)$ B. $2(\cos 30^\circ + i \sin 30^\circ)$
 C. $\frac{\sqrt{2}}{2}(\cos 105^\circ + i \sin 105^\circ)$ D. $\sqrt{2}(\cos 15^\circ + i \sin 15^\circ)$
116. If $z_1 = \frac{2-i}{1+i}$ and $z_2 = \frac{1+i}{1-i}$, then what is the value of $z_1 + 2z_2$?
- A. $1 + i$ B. $\frac{1+i}{2}$ C. $\frac{1-i}{2}$ D. $1 - i$
117. If $z = \sqrt{2} \cos(\frac{\pi}{12}) + i\sqrt{2} \sin(\frac{\pi}{12})$, the value of z^3 is:
- A. $2 + 2i$ B. $\sqrt{2} + \sqrt{2}i$ C. $2\sqrt{2} + 2\sqrt{2}i$ D. $3\sqrt{2} + 3\sqrt{2}i$
118. If $z^3 = -8$, then the solution set of z in the set of complex number is:
- A. $\{-2, -1 + \sqrt{3}i, -1 - \sqrt{3}i\}$ B. $\{-2, 1 + \sqrt{3}i, 1 - \sqrt{3}i\}$
 C. $\{2, -1 + \sqrt{3}i, -1 - \sqrt{3}i\}$ D. $\{2, 1 + \sqrt{3}i, 1 - \sqrt{3}i\}$
119. If $P(A \cap B) = 0.15$, $P(B') = 0.10$, then $P(A/B)$ is
- A. $\frac{1}{3}$ B. $\frac{1}{4}$ C. $\frac{1}{5}$ D. $\frac{1}{6}$
120. If A is a square matrix of order $n \times n$ and k is a scalar, then $adj(kA)$ is equal to
- A. $k adj A$ B. $k^n adj A$ C. $k^{n-1} adj A$ D. $k^{n+1} adj A$
121. Which one of the following is a valid logical argument?
- A. $p \Rightarrow q, q \vdash p$ B. $p \Leftrightarrow q, p \Rightarrow p \vdash q$
 C. $\neg p \wedge q, q \Rightarrow r \vdash r$ D. $\neg p, p \vee q, r \Rightarrow q \vdash r$

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122. Consider the following arguments, “If there is no rain, then there is a starvation. There is rain. Therefore, there is no starvation.” Letting r : there is rain. S : there is starvation. Then, which one of the following is correct symbolic form of the argument and its validity.

- A. $\neg r \Rightarrow s, r \vdash \neg s$ is valid argument
 B. $\neg r \Rightarrow s, r \vdash \neg s$ is invalid argument
 C. $\neg r \Leftrightarrow s, r \vdash \neg s$ is valid argument
 D. $\neg r \Leftrightarrow s, r \vdash \neg s$ is invalid argument

123. As show in the table below. A measurement is grouped in to five class intervals with frequency distribution.

Class interval	45-55	55-65	65-75	75-85	85-95
Frequency	26	38	33	16	7

What are the 1st quartile Q_1 and the 75th percentile p_{75} of the measurement?

- A. $Q_1=30.50$ B. $Q_1= 30.50$ C. $Q_1= 56.05$ D. $Q_1=56.05$
 $P_{75}=90.50$ $P_{75}=72.88$ $P_{75}=90.50$ $P_{75}=72.88$

124. Let x and y be real numbers. Which of the following statements is not true?

- A. $(\forall y)(\exists x)(x^2-y=0)$ C. $(\exists x)(\exists y)(x+1 > y^2)$
 B. $(\exists x)(\exists y)(x+1 < y^2)$ D. $(\forall x)(\exists y)(y^3-x^2+1 = 0)$

125. Given $f'(x)=3^x+\sin x$ and $f(0)=2$, then $f(x)$ is given by:

- A. $3^x \ln 3 + \cos x$ C. $3^x \ln 3 - \cos x + 3-1/\ln 3$
 B. $\frac{3x}{\ln 3} - \cos x + 3-1/\ln 3$ D. $\frac{3x}{\ln 3} - \cos x - 3+ 1/\ln 3$

126. Given $xy^2-x^2y = 4$, then which one is the rate of change of x with respect to y ?

- A. $\frac{x^2-2xy}{y^2-2xy}$ C. $\frac{y^2-2xy}{x^2-2xy}$
 B. $\frac{x^2-2xy}{y^2}$ D. $\frac{y^2-xy}{x^2-xy}$

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127. A closed box with a square base is to contain 252 cubic feet. The bottom costs Birr 5 per a square foot, the top costs Birr 2 per square foot and the sides cost Birr 3 per square foot. What are the dimensions that will minimize the cost in feet?
- A. $s = 6, h = 7$. B. $s = 6, h = 6$.
C. $s = 5, h = 8$ D. $s = 4, h = 7$
128. The total cost (in Birr) of producing x radio sets per day is given by the expression $\frac{1}{4}x^2 + 35x + 25$ and the price per set at which they may be sold is given by $50 - \frac{1}{2}x$. What should be the daily output to obtain the maximum total profit?
- A. 50 sets per day B. 23sets per day C. 10 sets per day D. 7 sets per day
129. A 5 foot girl is walking toward a 20foot lamppost at the rate of 6feet per second. How fast is the tip of her shadow moving toward the base of the post?
- A. 8 feet per second. B. 6 feet per second.
C. 5feet per second . D. 10 feet per second.
130. Let $F(x) = f(3x + 1)g(\cos x)$, such that $f(1) = -2, g(1) = 3, f'(1) = \frac{1}{4}$ and $F(x) = \frac{1}{2}$, then which one of the following is equal to $F'(0)$
- A. 0 B. $\frac{9}{4}$ C. $\frac{-33}{4}$ D. $\frac{-11}{4}$
131. When allocating Birr 1500 in the ratio 2:3:7, it will respectively be
- A. 250, 375, 875 B. 875, 250, 125 C. 300, 400, 800 D. 400, 500, 600
132. What is the ratio of 1.6 meters to 180 centimeters?
- A. 8:9 B. 9:8 C. 6:8 D. 8:6
133. On a residence plan of Ato Admasu 1cm on a plan represents 150cms on the ground. What is the distance on the ground for the distance represented by 3.2cms on the plan?
- A. 480cms B. 400cms C. 460cms D. 420cms
134. What is 3% of Birr 57? A. 1.71 B. 3.1 C. 4.1 D. 2.1
135. A wool suit discounted by 30% for a clearance sale has a price tag of Birr 399. What were the suits original price and the amount of discount in Birr respectively?
- A. 570, 171 B. 171, 570 C. 500, 250 D. 600, 170

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136. If you buy gold ring for Birr 498 and sell it for Birr 750, what is the markup percent with respect to selling price? A. 33.6% B. 50.6% C. 70% D. 80%
137. What is the amount of interest on a deposit of Birr 1000 in an account compounded annually with annual interest rate of 6% for 5 years?
A. 338.23 B. 328.9 C. 350.31 D. 360.89
138. A machine costing Birr 35,000 is estimated to have a useful life time of 8 years and a salvage value of Birr 3,000. What is the accumulated depreciation at the end of 5 years and the book value of an asset?
A. 20000, 15000 B. 30000, 15000 C. 6000, 5000 D. 600, 500
139. Ato Alemu has a deposit with Awash Bank on which he is eligible to get interest of Birr 140,000 in a year. How much of this is withheld by Awash Bank for a tax Purpose?
A. 7000 B. 14,000 C. 1000 D. 10,000
140. The price of a pair of shoes is reduced from birr 450 to 360. What is a percentage of reduction?
A. 30% B. 25% C. 20% D. 10%
141. A sales person earns a weekly salary of Birr 400 plus commission depending on the level of weekly sales as follows .5% commission on all sales up to Birr 50,000, .10% commission on all sales over Birr 50,000. If the sale in a week is Birr 80,000, how many Birr does the sales person earn in the week?
A. 8, 400 B. 5, 900 C. 2, 900 D. 5, 500
142. What is the number whose 30% is 600?
A. 600 B. 3000 C. 2000 D. 1000
143. From a population of size 180 whose list is numbered 1 to 180. Suppose you need to select a sample of Size 20 using the technique of systematic sampling. If the first individual selected randomly is number 5. What is the number of the last individual that should be included in the sample?
A. 14 B. 176 C. 169 D. 5
144. If birr 1000 is deposited in the commercial bank of Ethiopia with interest rate of 10% per annum, then what is the amount if it is compounded annually?
A. 1100 B. 2100 C. 110 D. 210

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145. Which of the following is least affected by extreme values?
- A. Mean B. median C. Mode D. range
146. Which of the following statements is correct?
- A. Ratio is a comparison of two or more quantities expressed in the same unit.
- B. Rate is a comparison of two or more quantities expressed in the same unit.
- C. A proportion is a comparison of two or more quantities expressed in the same unit.
- D. A percentage is the numerator of a fraction whose denominator is 1.
147. The firm manager has designed the constraint equation for two different types of product unit with the objective function as follows
- Objective function: $P(x, y) = 3x + 2y$.
- Subject to:
$$\begin{cases} x \geq 0 \\ y \geq 0 \\ x + 3y \leq 15 \\ 4x + y \leq 16 \end{cases}$$
 what is the maximum profit?
- A. 15 B. 20 C. 8 D. 32
148. A machine costing birr 37,000 is estimated to have a useful life time of 7 years and a salvage value of birr 2000. What is the book value of the asset at the end of 4 years?
- A. 15,000 B. 17,000 C. 20,000 D. 5000
149. The price of gypsum mortar per sack in Addis Ababa in the last year was birr 350. But the current price is birr 430. What is the percent of increase in the price of one sack of gypsum mortar from last year to now?
- A. 18.6% B. 80% C. 20.7% D. 22.85%
150. If the value added tax (VAT) on sales is 15% and a sale of refrigerator costs birr 4800, then what is the total cost of the refrigerator?
- A. 720birr B. 5520birr C. 7200birr D. 6520birr