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Hillside @ ethionet.et

Full Name _____ **Grade -12** **Section** _____ **Final Model Exam**

Subject – Mathematics For SOCIAL SCIENCE **Year: 2012 E.C** ***Time allowed 3hours***

Choose the correct answer and write the letter of your choice in BLOCK letter in the space provided.

1. Let $f(x)=\dfrac{3x+1}{x-2}$. Then what is the range of the inverse of f ?

   (A) $\Re/\{3\}$ **(B)** $\Re/\{2\}$ **(C)** $\Re$ **(D)** $\Re/\{1.5\}$

2. Let A and B be two events. Suppose that the probability that neither event occurs is $\dfrac{3}{8}$. What is the probability at least one of the events occurs?

   (A) $\dfrac{1}{8}$ **(B)** $\dfrac{5}{8}$ **(C)** $\dfrac{1}{4}$ **(D)** $\dfrac{3}{4}$

3. If $f(x)=\sqrt{x^3}$ and $(f\circ g)(x)=\sqrt[4]{x}$, then what is the value of $g(8)$?

   (A) $\sqrt[3]{2}$ **(B)** 2 **(C)** $\sqrt{2}$ **(D)** $2\sqrt{2}$

4. If the truth value of $(p\wedge\neg p)\Leftrightarrow\left[(q\vee\neg q)\Rightarrow r\right]$ is true, then which one of the following **must** be true?

   (A) q **(B)** p **(C)** $\neg q$ **(D)** $\neg r$

5. Let $Z=\left(\dfrac{1-i}{1+i}\right)^{18}$. Which one of the following is equal to Z?

   (A) -1 **(B)** i **(C)** $-i$ **(D)** $1-i$

6. If the lines $y=x$ and $y=x-4$ are tangent to a circle at $(2,2)$ and $(4,0)$ respectively, then which of the following is the equation of the circle?

   (A) $(x+3)^2+(y+1)^2=8$ **(C)** $(x-3)^2+(y-1)^2=2$

   (B) $(x-3)^2+(y-1)^2=4$ **(D)** $(x-1)^2+(y-1)^2=4$

7. What is the value of $\int_1^e x\ln(x)\,dx$?

   (A) e^2-e+1 **(B)** $2e-1$ **(C)** 0 **(D)** 1

8. Let $f(x)=x^3$ .For a function g , which one of the following expressions represents $\frac{dy}{dx}\left[\left(f\left(g(x)\right)\right)\right]$?

(A) $g'\left(x^3\right)$ **(B)** $3x^2g'(x^3)$ **(C)** $3\left[g(x)\right]^2$ **(D)** $3\left[g(x)\right]^2 g'(x)$

9. Which one of the following is correct about the function $f(x)=\frac{x^2+1}{x^2-1}$?

(A) The graph crosses the x-axis at $(1,0)$ and $(-1,0)$

(B) The line $y=0$ is its horizontal asymptote.

(C) It is symmetric with respect to the origin.

(D) The point (0,-1) is its y-intercept.

10. Let $\mathrm{A}=\left(a_{ij}\right)$ be a 3×3 matrix such that $a_{ij}=\begin{cases}0, & \text{if } i>j\\ i+j, & \text{if } i\le j\end{cases}$. Which of the following is equal to A?

(A) $\begin{pmatrix}2&0&4\\3&4&5\\4&0&0\end{pmatrix}$ **(B)** $\begin{pmatrix}2&3&4\\1&4&5\\1&1&6\end{pmatrix}$ **(C)** $\begin{pmatrix}2&3&4\\0&4&5\\0&0&6\end{pmatrix}$ **(D)** $\begin{pmatrix}2&3&4\\3&4&5\\4&5&6\end{pmatrix}$

11. Which one of the following is true about signum, absolute value and greatest integer functions?

(A) $Sgn(x)=\pm|x|,\forall x\in\Re$ **(C)** $|x|=xSgn(x),\forall x\in\Re$

(B) $Sgn(x)\le\lfloor x\rfloor,\forall x\in\Re$ **(D)** $Sgn(x)\le\lfloor x\rfloor,\forall x\le0$

12. Let $x,y\in\Re$. Which one of the following statements is true?

(A) $(\exists x)(\forall y)\left(y+1\ge x^2\right)$ **(C)** $(\exists y)(\forall x)\left(y+1\ge x^2\right)$

(B) $(\forall x)(\exists y)\left(y=\sqrt{x^2-1}\right)$ **(D)** $(\forall y)(\exists x)\left(y=\sqrt{x^2-1}\right)$

13. Suppose the eccentricity of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is a reciprocal to that of the eccentricity of the ellipse $x^2+4y^2=4$. If the hyperbola passes through a focus of the ellipse, then what is the equation of the hyperbola?

(A) $x^2-2y^2=2$ **(B)** $x^2-3y^2=3$ **(C)** $\frac{x^2}{3}-\frac{y^2}{2}=1$ **(D)** $\frac{x^2}{2}-\frac{y^2}{3}=1$

14. Which one of the following is the conjugate of $|3+4i|-\frac{25i}{3+4i}$?

(A) $5+3i$ **(B)** $1+3i$ **(C)** $3-5i$ **(D)** $1-3i$

15. If $\frac{dy}{dx}=\pi y$, which of the following could represent y?

(A) $\frac{1}{\pi}e^x$ **(B)** πe^x **(C)** $\pi+e^{\pi x}$ **(D)** $\pi e^{\pi x}$

16. The ratio of student to teachers in a school is 39:2. If the number of students is 819 and the number of female teachers is 25, then what is the number of male teachers in the school?

(A) 17 **(B)** 25 **(C)** 32 **(D)** **35**

17. What is the slope of the tangent line to the graph of $f(x)=3e^x+\sin x+2$ at $(0,5)$?

(A) 0 **(B)** 2 **(C)** 3 **(D)** 4

18. What is the value of f_2 in the following frequency distribution, if the first quartile of the dataset is 7.5?

\

class	**0-5**	**5-10**	**10-15**	**15-20**	**20-25**	**25-30**	**30-35**	**35-40**
frequency	8	f_2	6	8	5	5	1	1

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

19. If A and B are 2×2 matrices with $\det(A)=3$ and $\det(B)=2$, which one of the following is not true?

(A) $\det(AB)=6$ **(B)** $\det(2A^T)=12$ **(C)** $\det\left(A(3B)\right)=18$ **(D)** $\det\left(A^{-1}\right)=\frac{1}{3}$

20. Which one of the following is a convergent sequence?

(A) $\left\{\frac{1+2^n}{3^n}\right\}$ **(B)** $\left\{\frac{1}{n}+\sin(n)\right\}$ **(C)** $\left\{\frac{1-3^n}{2^n}\right\}$ **(D)** $\left\{\frac{(-1)^n}{2}\right\}$.

21. What is the value of k so that $f(x)=\begin{cases}\frac{\tan(2x)}{x}, & if\ \ x>0\\ k-e^{2x}, & if\ \ x\le 0\end{cases}$ is continuous at $x=0$?

(A) 2 **(B)** 3 **(C)** 1 **(D)** 0

22. What is the value of $\lim\limits_{n\to\infty}\left(\frac{3^n+2^n}{6^n}\right)$?

(A) 1 **(B)** 0 **(C)** ∞ **(D)** $\frac{5}{6}$

23. What are the greatest lower bound and least upper bound of the sequence $\left\{(-1)^n\left(1+\frac{1}{n}\right)\right\}$ respectively?

(A) -2 and 2 **(B)** $-\frac{3}{2}$ and 2 **(C)** -2 and $\frac{3}{2}$ **(D)** -2 and $-\frac{3}{2}$

24. A ball is thrown vertically from the ground up to a height of 20 meter. Each time it drops a meter, it rebounds $\frac{2}{3}$ of the height. What is the total vertical distance travelled by the ball before it comes to rest?

(A) 60 meter **(B)** 100 meter **(C)** 120 meter **(D)** 160 meter

25. What is the value of $\sum\limits_{n=2}^{20}\left(\frac{1}{n-1}-\frac{1}{n}\right)$?

(A) $\frac{17}{20}$ **(B)** $\frac{23}{20}$ **(C)** $\frac{21}{20}$ **(D)** $\frac{19}{20}$

26. What is the value of $\lim\limits_{x\to 0}\frac{\sin 3x}{x}$?

(A) 1 **(B)** 3 **(C)** 2 **(D)** 0

27. If $a\neq 0$, then what is the value of $\lim\limits_{x\to a}\frac{x^2-a^2}{x^4-a^4}$?

(A) $\frac{1}{a^2}$ **(B)** $\frac{1}{2a^2}$ **(C)** $\frac{1}{6a^2}$ **(D)** 0

28. If $\lim_{x\to\infty}\left(\frac{x+m}{x-m}\right)^x = 4$, then what is the value of m?

(A) e **(B)** 2 **(C)** $\ln 2$ **(D)** $\ln 4$

29. What is the value of $\lim_{x\to 0}\frac{\sin x\cos 2x}{x^2+3x}$

(A) $\frac{1}{3}$ **(B)** $\frac{2}{3}$ **(C) 1** **(D)2**

30. If f is continuous at $x=0$ & $h(x)=\sqrt{x}\left(2f(x)+\frac{3}{\sqrt{x}}\right)$ for all $x>0$, then what is the value of $\lim_{x\to 0^+} h(x)$?

(A) 0 **(B) 2** **(C)** 3

31. Let the universal set U be the set of real numbers. Which one of the following has a truth value False?

(A) $(\exists y)(\forall x)(x+y=0)$ **(C)** $(\forall x\neq 0)(\exists y)(xy=1)$

(B) $(\forall x)(\exists y)(x+y=0)$ **(D)** $(\exists x)(\forall y)(xy=0)$

32. If $f(x)=ax^3+\frac{b}{x}+5$ has local minimum at $(2,-3)$, what are the values of a and b?

(A) $a=-\frac{1}{4}$ and $b=12$ **(C)** $a=-\frac{1}{4}$ and $b=-12$

(B) $a=\frac{1}{4}$ and $b=12$ **(D)** $a=\frac{1}{4}$ and $b=-12$

33. Let $f(x)=\ln(\ln x)$, then $f''(e)$ is equal to

(A) $-2e^2$ **(B)** $-\frac{2}{e^2}$ **(C)** $\frac{2}{e^2}$ **(D)** $-\frac{1}{2e^2}$

34. Let $f(x)=\frac{1}{x}$, then the n^{th} order derivative of f is given by

(A) $f^{(n)}=\frac{n!}{x^{n+1}}$ **(B)** $f^{(n)}=\frac{(-1)^n n!}{x^{n+1}}$ **(C)** $f^{(n)}=\frac{(-1)^n (n+1)!}{x^{n+1}}$ **(D)** $f^{(n)}=\frac{(-1)^n (n)!}{x^{n}}$

35. If $y=x^x$, then $\frac{dy}{dx}$ is equal to

(A) $\ln x(\ln x+1)$ **(B)** $x^x(\ln x+1)$ **(C)** $x^x(\ln x+x)$ **(D)** $x(\ln x+x)$

36. What is the maximum possible area of a rectangle (in sq.units) with the length of its diagonal 16 units?

(A) 48 **(B)** 128 **(C)** 64 **(D)** 256

37. At a certain instant each edge of a cube is $5m$ long and the volume is increasing at the rate of $2m^3/\min$. How fast is the surface area of the cube (in $m^2/\min$) increasing?

(A) 0.4 **(B)** 12.5 **(C)** 1.6 **(D)** 8

38. What is the maximum value of $z=-3x+2y$ subject to $-x+y\le 1$, $x-y\le 1$ and $x+y\ge 3$?

(A) 1 **(B)** 4 **(C)** It has no maximum **(D)6**

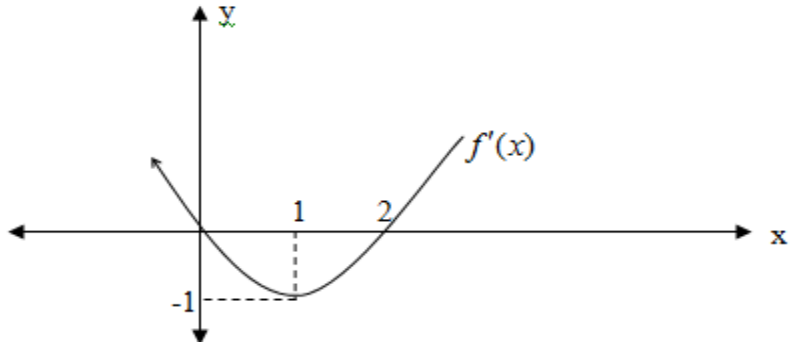
39. What is the area of the region bounded by the lines $y=x$, $x=2$ and the curve $y=\frac{1}{x^2}$?

(A) 1 **(B)** $\frac{3}{2}$ **(C)** $\frac{1}{3}$ **(D)** $\frac{2}{3}$

40. If $f(x)=\sqrt{1+\sqrt{x}}$ for $x>0$, then $f'(x)$ is

(A) $\frac{1}{f(x)}$ **(B)** $\frac{2\sqrt{x}+1}{4\sqrt{x}f(x)}$ **(C)** $\frac{1}{4\sqrt{x}f(x)}$ **(D)** $\frac{1}{2\sqrt{x}f(x)}$

41. Suppose $f:(-\infty,\infty)\to\Re$ is differentiable and the graph of its derivative $f'(x)$ is as shown in the figure below.



Which one of the following is true about f ?

(A) f is increasing on $(1,\infty)$ **(C)** f is concave upward on $(0,\infty)$

(B) f has no relative maximum value. **(D)** f has a relative minimum value at $x=2$.

42. The domain of the function $y=\sqrt{x^2-1}$ is

(A) $[-1,1]$ **(B)** $[1,\infty)$ **(C)** $(-\infty,-1]\cup[1,\infty)$ **(D)** $(-\infty,-1]$

43. $\lim\limits_{x\to a}\frac{f(x)-f(a)}{x-a}$ is equal to

(A) $f(x)$ **(B)** $f'(x)$ **(C)** $f'(a)$ **(D)** $f(a)$

44. $\int x e^x\,dx=$

(A) e^x+xe^x+c **(B)** x^2e^x+c **(C)** $-xe^x+e^x+c$ **(D)** xe^x-e^x+c

45. Which one of the following intervals is the largest interval where $f(x)=\frac{x}{x^2+1}$ is increasing?

(A) $[0,\infty)$ **(B)** $(-\infty,1]$ **(C)** $(1,\infty)$ **(D)** $[-1,1]$

46. If $f(x)=\int_0^x e^{-t}dt$, then what is the value of $f'(x)$?

(A) e^{-x} **(B)** $-e^{-x}+1$ **(C)** $\frac{e^{-x+1}}{-x+1}$ **(D)** $-e^{-x}-1$

47. What is 25% of 50% of 400 ?

(A) 50 **(B)**100 **(C)** 150 **(D)** 75

48. If the region enclosed by the graphs of $f(x)=x^2$ and $g(x)=x^3$ from $x=0$ to $x=1$ rotates about the x-axis, what is the volume (in cubic units) of the solid of revolution?

(A) $\frac{2\pi}{27}$ **(B)** $\frac{2\pi}{25}$ **(C)** $\frac{2}{5}\pi$ **(D)** $\frac{2\pi}{35}$

49. Let $A=\{1,2,3,4,5,6,7\}$, $B=\{7,8,9\}$ and $C=\{8,9,10\}$. If one number is deleted randomly from each of these sets, what is the probability that all the three deleted numbers are even or multiples of 3?

(A) $\frac{4}{5}$ **(B)** $\frac{2}{21}$ **(C)** $\frac{1}{9}$ **(D)** $\frac{8}{63}$

50. If the equation $(ax+4)(bx-1)=21x^2+kx-4$ is true for all values of x and $a+b=10$, what are the possible values for the constant k?

(A) 8 and 14 **(B)** 5 and 25 **(C)** 9 and 15 **(D)** 19 and 31

51. Let A be a 3×3 matrix and $|A|=-2$, then what is the value of $|adj(A)|$?

(A) -8 **(B)** -2 **(C)** 4 **(D)** $-\frac{1}{2}$

52. The value of x and y that minimize the value $z=2x-y$ subject to the constraints

$$\begin{cases} 2x+3y=12 \\ 2x-3y\geq 0 \\ x,y\geq 0 \end{cases}$$

(A) (0,0) **(B)** (3,2) **(C)** (2,3) **(D)** (2,5)

53. If Birr 2000 is deposited in a Bank with interest rate 10% per annum compounded semi-annually, then how much Birr will it be by the end of one year?

(A) 2100 **(B)** 2200 **(C)** 2205 **(D)** 2250

54. A sweater with a regular price of Birr 340 is first discounted by 20% and then by 10%. What is the final selling price (in Birr) of the sweater after the discount?

(A) 238 **(B)** 102 **(C)** 244.80 **(D)** 95.20

55. Abdu bought a bike from the manufacturer by Birr 10,000 and sold it to Kebede by making a profit of 10%. Kebede also sold the bike by making a profit of 15%. At what price (in Birr) did Kebede sell the bike?

(A) 12,500 **(B)** 12,650 **(C)** 11,500 **(D)** 11,550

56. A farmer borrows a certain amount of money from a money lender. The money lender charges interest at a rate of 20% compounded yearly. If the money lender sends a letter of demand of Birr 400,000 after 2 years how much (in Birr) did the farmer borrow?

(A) 320,000 **(B)** 240,000 **(C)** 384,467.50 **(D)** 277,777.80

57. A company wants to buy two cars from Adiss General Motors. The price of each car including VAT (15%) is Birr 402,500. If the company wants to subtract a 2% withholding tax before VAT, what is the amount (in Birr) to be subtracted?

(A) 16,000 **(B)** 14,250 **(C)** 14,000 **(D)** 16,250

58. In a company, a regular work time is 40 hours per week. For the service above the regular work time, the normal overtime pay rate (per hour) is 1.5 times the regular rate and the holiday over time rate is twice of the regular rate. If an employee whose regular pay is Birr 50 per hour, has worked 55 hours per week among which 5 hours are holyday overtime, how much (in Birr) is his payment for the week?

(A) 2500 **(B)** 3125 **(C)** 3250 **(D)** 3500

59. In a shop, the marked price of an item was Birr260 with 30% markup based on its cost price. Later on, the shop owner sold the item with 30% discount. What is the profit or loss from the item?

(A) Birr78 loss **(C)** Birr18 profit

(B) Birr 18 loss **(D)** No profit and no loss.

60. Mr. Tilahun invested Birr 52,000 in a share company by which he bought shares each at the cost of Birr 500. If the company is to pay dividend Birr 70 per share for shareholders and the dividend is subjected to 10% income tax which will be withheld by the company, what is amount of the dividend (in Birr) that Mr. Tilahun will receive after tax?

(A) 882 **(B)** 6,300 **(C)** 6,552 **(D)** 7,280

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