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Full Name _____ **Grade -11** **Section** _____ **4th Quarter Final Exam**

Subject – MATHEMATICS for NATURAL SCIENCE **Year: 2012 E.C** ***Time allowed 2.5 hrs.***

ALL answers for ALL parts should be given on the separate answer sheet.

PART I: Choose the correct answer and write the letter of your choice in BLOCK LETTERS on the Separate answer sheet provided. (Total of 40 pts.)

1. If $x<0$, then the simplest form of the expression $\frac{x-|x|}{x}$ is equal to

(A) $2x$ **(B)** 2 **(C)** -2 **(D)** 0

2. If $f(x)=\frac{\sqrt{x+2}}{x+2}$ and $g(x)=\frac{1}{x}-2$, then $f\left(g(x)\right)$ is equal to

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

3. Which one of the following is the domain of $f(x)=x-\frac{x^2+1}{x^4+x}$?

(A) $\Re/\{0\}$ **(B)** $\Re/\{-1\}$ **(C)** $\Re/\{0,1\}$ **(D)** $\Re/\{-1,0\}$

4. What are the values of a and b which make the mathematical sentence $\frac{x+1}{x^2-9}=\frac{a}{x-3}+\frac{b}{x+3}$ true for all real numbers $x\neq 3,-3$?

(A) $a=1,b=0$ **(B)** $a=\frac{1}{3},b=\frac{3}{5}$ **(C)** $a=-\frac{2}{5},b=1$ **(D)** $a=\frac{2}{3},b=\frac{1}{3}$

5. What is the solution set of equation $1-\frac{5}{x^2+4}=\frac{x-1}{x^2-x}-\frac{1}{x}$?

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

6. If $f(x)=\ln\left(\frac{x}{x-1}+2\right)$, then for $x>1$, which one of the following is the inverse of f?

(A) $f^{-1}(x)=\frac{e^x-2}{e^x-3}$ **(C)** $f^{-1}(x)=\frac{e^x-2}{e^x+1}$

(B) $f^{-1}(x)=\frac{e^x}{e^x+1}-2$ **(D)** $f^{-1}(x)=e^{\left(\frac{x}{x-1}\right)}-2$

7. The line ℓ passes through $(0,5)$ and $(-5,0)$. What is the measure of the angle between the y-axis and the line ℓ?

(A) $\frac{\pi}{4}$ **(B)** $\frac{\pi}{3}$ **(C)** $\frac{\pi}{2}$ **(D)** $\frac{3}{2}\pi$

8. Consider a circle whose center is on the x-axis. If a line given by $y=x$ is tangent to the circle at point $(2,2)$, what is the equation of the circle?

(A) $x^2+y^2=8$ **(C)** $(x-2)^2+y^2=4$

(B) $(x-4)^2+y^2=8$ **(D)** $(x-1)^2+y^2=5$

9. What is the vertex and the equation of the directrix, respectively, of the parabola $x+y^2+2y+1=0$?

(A) $(0,-1), x=-\frac{1}{4}$ **(C)** $(0,-1), x=\frac{1}{4}$

(B) $(-1,0), y=-\frac{1}{4}$ **(D)** $(-1,0), y=\frac{1}{4}$

10. Let the center of an ellipse be at $(1,4)$ and two of its vertices be at $(10,4)$ and $(1,2)$. What is the equation of the ellipse?

(A) $4(x-1)^2+81(y-4)^2=324$ **(C)** $9(x-1)^2+4(y-4)^2=4$

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

11. The equation $x^2-4y^2=-1$ represents

(A) a hyperbola with one of its foci at the at the origin.

(B) a parabola with vertex at the origin.

(C) a hyperbola with vertices at $\left(-\frac{1}{2},0\right)$ and $\left(\frac{1}{2},0\right)$.

(D) a hyperbola with foci at $\left(0,-\frac{\sqrt{5}}{2}\right)$ and $\left(0,\frac{\sqrt{5}}{2}\right)$.

12. Which of the following is an asymptote to the hyperbola $4x^2-y^2+2y=5$

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

13. Let $p(x): x^2+x>0$. Which of the following is not equivalent to $\neg(\exists x)(x^2+x>0)$?

(A) $(\exists x)\neg(x^2+x>0)$ **(B)** $(\forall x)(x^2+x<0)$ **(C)** $(\exists x)(x^2+x\le 0)$ **(D)** $(\forall x)(x^2+x\le 0)$

14. If compound proposition $(p\wedge q)\Rightarrow(\neg s\vee r)$ is false, which of the following is true?

(A) $s\Rightarrow r$ **(B)** $\neg p\vee\neg s$ **(C)** $(p\wedge\neg q)\Rightarrow r$ **(D)** $p\wedge r$

15. The population a, b, 8, 5, 7 has a mean of 6 and variance of 2. If $a>b$, then the values of a and b respectively are

(A) 7 and 3 **(B)** 8 and 2 **(C)** 9 and 1 **(D)** 6 and 4

16. Let $A=\begin{pmatrix}-2 & 0 & x\\ 2y & x+y & -4\end{pmatrix}$ and $B=\begin{pmatrix}1 & -y\\ 0 & 3\\ 1-x & 2\end{pmatrix}$ such that $A+2B^{T}=0$. Then which one of the following is the value of y?

(A) 0 **(B)** $-\frac{13}{2}$ **(C)** -8 **(D)** any real number.

17. If $A=\begin{pmatrix}4 & -3\\ -1 & x\end{pmatrix}$ is an invertible matrix and $\left|A^{-1}\right|=1$, then what is the value of x?

(A) 1 **(B)** 7 **(C)** 11 **(D)** 17

18. What is the inverse of $A=\begin{pmatrix}5 & -4\\ 3 & -2\end{pmatrix}$?

(A) $\begin{pmatrix}1 & -2\\ \frac{3}{2} & -\frac{5}{2}\end{pmatrix}$ **(B)** $\begin{pmatrix}-1 & 2\\ -\frac{3}{2} & \frac{5}{2}\end{pmatrix}$ **(C)** $\begin{pmatrix}\frac{3}{2} & -\frac{5}{2}\\ 1 & -2\end{pmatrix}$ **(D)** $\begin{pmatrix}-1 & -2\\ -\frac{3}{2} & \frac{5}{2}\end{pmatrix}$

19. Let $A=\begin{pmatrix}1 & 1 & 1\\ 1 & \alpha & \alpha\\ 1 & \alpha & \beta\end{pmatrix}$. Which one of the following is equal to the det(A)?

(A) $(1-\alpha)(\beta-\alpha)$ **(B)** $(1-\beta)(\alpha-\beta)$ **(C)** $(1-\alpha)(\alpha-\beta)$ **(D)** $(\beta-1)(\alpha-\beta)$

20. The solution set of the system $\begin{cases}x-3y=5\\ y+z=1\\ -x+y-z=0\end{cases}$ is

(A) $\{(2,-1,2)\}$ **(B)** $\{(5,0,1)\}$ **(C)** $\{(-13,-6,7)\}$ **(D)** $\{\ \}$

21. Let A and B be 3×3 matrices such that $A=\begin{pmatrix}2 & 0 & 0\\ 1 & 5 & 0\\ 0 & -1 & \frac{1}{2}\end{pmatrix}$ and $|B|=\frac{1}{10}$. Which one of the following is equal to $\left|2AB^{T}\right|$?

(A) 1 **(B)** 4 **(C)** 100 **(D)** 400

22. Which one of the following is the simplest form of $\frac{4-3i}{3+4i}+\overline{1-2i}$?

(A) $1+i$ **(B)** $1+3i$ **(C)** $2-i$ **(D)** $1-3i$

23. In the set of complex numbers, the solution set of $x^{2}-2x+5=0$ is

(A) $\{2+4i,2-4i\}$ **(B)** $\{2+i,2-i\}$ **(C)** $\{1+2i,1-2i\}$ **(D)** ϕ

24. For $i=\sqrt{-1}$, the simplest form of the expression $i^{99}+i^{38}+1$ is

(A) $-i$ **(B)** $-i+1$ **(C)** $-i+2$ **(D)** $-2i$

25. The value of x and y that satisfy the equation $(2x-yi)(3+i)=20i$

(A) $x=0, y=-20$ **(B)** $x=3, y=7$ **(C)** $x=1, y=-6$ **(D)** $x=-5, y=3$

26. The polar form of $\frac{7-i}{3-4i}$ is

(A) $\sqrt{2}\left(\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}\right)$ **(C)** $2\left(\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}\right)$

(B) $\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$ **(D)** $2\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$

27. A three-digit library ID-card is to be printed from the numbers 0,1,2,3,4,5 and 6 in a such a way that the first is non-zero and no number is to be repeated. How many such cards can be printed?

(A) 180 **(B)** 216 **(C)** 210 **(D)**343

28. A student needs to select three books from 4 different Mathematics, 4 different Physics and one Geography book. What is the probability that one of them is Mathematics and the other two are either Physics or Geography books?

(A) $\frac{10}{21}$ **(B)** $\frac{19}{21}$ **(C)** $\frac{13}{21}$ **(D)** $\frac{17}{21}$

29. The following frequency distribution displays the age of students in a certain primary school.

AGE	**8**	**10**	**11**	**12**	**13**
NUMBER OF STUDENTS	5	15	8	10	2

Which one of the following is NOT true about the data?

(A) The median is 10.5 **(C)** The mean is 10.6.

(B) The mode is 10. **(D)** The range is 5.

30. If $(\neg p\vee q)\Rightarrow(r\wedge\neg r)$ is true, then which of the following is necessarily true?

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

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

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

32. Suppose the proposition $p\Rightarrow\neg q$ is false (F), which of the following is true?

(A) $\neg q\wedge(p\Rightarrow q)$ **(B)** $\neg p\vee(q\Rightarrow\neg p)$ **(C)** $(\neg q\vee p)\Leftrightarrow q$ **(D)** $(q\vee p)\Leftrightarrow\neg p$

33. Which one of the following is NOT true about the graph of $f(x)=\frac{x^2-1}{x^2+1}$?

(A) The range of f is $(-\infty,1)$ **(C)** The line $y=1$ is a horizontal asymptote.

(B) f is an even function **(D)** As $x\to-\infty$, $f(x)\to1$

34. If $\vec{A}=(3,-3)$ and $\vec{B}=(1,-3)$, what is the unit vector in the direction of the unit vector in the direction of $\vec{C}=3\vec{A}-\vec{B}$?

(A) $\left(\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}\right)$ **(B)** $\left(\frac{1}{\sqrt{10}},-\frac{3}{\sqrt{10}}\right)$ **(C)** $\left(\frac{4}{5},-\frac{3}{5}\right)$ **(D)** $\left(-\frac{6}{10},\frac{8}{10}\right)$

35. If $\vec{u}$ is a vector in the direction of the vector $\vec{v}=(-3,4)$ having length three times the length of the vector $\vec{u}-\frac{3}{2}\vec{v}-2\vec{j}$, where $\vec{j}$ is the unit vector in the direction of the positive y-axis?

(A) $\frac{1}{2}\sqrt{185}$ **(B)** $\frac{1}{2}\sqrt{145}$ **(C)** $\frac{21}{2}$ **(D)** $\frac{17}{2}$

36. Consider the circle given by $x^2+y^2=2$ and the line ℓ given by the parametric vector equation $(x,y)=(2,0)+t(-1,1)$. Which of the following is true?

(A) The line ℓ is tangent to the circle at $\left(\frac{1}{2},\frac{\sqrt{7}}{2}\right)$.

(B) The line ℓ intersects with the circle at two distinct points.

(C) The line ℓ and the circle have no common points.

(D) The distance from the center of the circle to the line ℓ is $\sqrt{2}$.

37. Which one of the following is not equal to the expression $\left(1+\tan^2 x\right)\sin\left(x-\frac{3}{2}\pi\right)$?

(A) $\sec x$ **(B)** $\cos x$ **(C)** $-\sec x$ **(D)** $-\cos x$

38. What are the period and amplitude of the function $f(x)=\frac{1}{2}\sin\left(3-\frac{2\pi}{3}x\right)$, respectively?

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

39. The solution set of the equation $\sin 3x=1$ in the interval $\left[0,\frac{\pi}{2}\right]$ is

(A) $\left\{\frac{\pi}{2}\right\}$ **(B)** $\left\{\frac{\pi}{3},\frac{\pi}{2}\right\}$ **(C)** $\left\{\frac{\pi}{6}\right\}$ **(D)** $\left\{-\frac{\pi}{2},\frac{5\pi}{6}\right\}$

40. If θ is a fourth quadrant angle and $Sec\,\theta=\sqrt{2}$, then what is $Csc\,\theta$ equals to?

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

PART II: Fill in the blank spaces with a correct item that completes the sentence best.

1. The coefficient of the term x^2y^3 in the expansion of $(2x+5y)^5$ is _____.

2. The standard deviation of the dataset **20, 16, 12, 8, 18, 5, 9, 24** is _____.

3. If $\vec{u}=3i+\frac{5}{2}j$ and $\vec{v}=\frac{7}{2}i-\frac{1}{4}j$, then the modulus of the vector $w=2\vec{u}-\vec{v}$ is equal to_____.

4. The image of the circle $x^2+y^2-2x+3y=8$ after being reflected by the line $y=2x-3$ is _____.

5. If A is a square matrix of order 3 and $\det(A)=5$, then the value of $\det(A\times adj(A))$ is _____.

PART III: Work out each of the following questions clearly and neatly. Answers without sufficient supporting work will receive no credit. (Total of 5 Points)

1. Find the solution set of the trigonometric equation $\sqrt{3}Sin\,2x = Cos\,2x$ in the interval $[0, 2\pi]$.

2. Find the values of A, B and C that make the following mathematical statement true for all $x \neq 0$.

$$\frac{x-1}{x^3+x} = \frac{A}{x} + \frac{Bx+C}{x^2+1}$$

3. Given the second-degree equation $3x^2 - 6x = y^2$.

(a) Identify what the equation represents to.

(b) Sketch the graph of curve.

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GOOD LUCK