EST II – Individual Subject Test

Level 1

Student's Name _____

National ID _____

Test Center: _____

Subject: Math

Duration: 60 minutes

50 Multiple Choice Questions

Instructions:

- Place your answer on the answer sheet. Mark only one answer for each of the multiple choice questions.
- Avoid guessing. Your answers should reflect your overall understanding of the subject matter.
- Calculator is allowed. When a calculator is used, be aware of switching between radian mode and median mode.
- Formula sheet is available at the end of the booklet for your reference.

THE FORMULAS BELOW MAY BE USEFUL IN ANSWERING QUESTIONS ON THIS TEST.

$S = 4\pi r^2$ is the formula for the surface area of a sphere with a radius of r.

$V = \frac{1}{3}\pi r^2 h$ is the formula for a right circular cone with a radius of r and a height of h.

$V = \frac{4}{3}\pi r^3$ is the formula for a sphere with a radius of r.

$V = \frac{1}{3}Bh$ is the formula for a pyramid with a base area of B and a height of h.

1. The remainder when $t^{16} + 5$ is divided by $t + 1$ is

A. 6
B. 0
C. -1
D. 4
E. 1

2. If two roots of the equation $y^3 + a\ y^2 + b\ y + c = 0$ (with a, b, and c integers) are 1 and $2 - 8i$, then the value of a is

A. $2 + 8i$
B. -5
C. 5
D. $4 + 8i$
E. $4 - 8i$

3. The root(s) of the equation $\sqrt{a+6} = -a$ is / are:

A. 3
B. -2
C. $3\ and\ -2$
D. $3\ or\ -2$
E. No Roots

4. What are all p such that $\frac{p+100}{p} \leq 1$?

A. $p > 0$
B. $p < 0$
C. $p \leq 0$
D. $-1 < p < 0$
E. $-1 \leq p < 0$

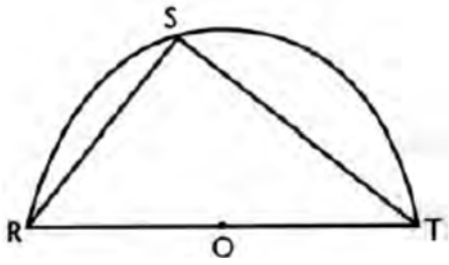
5. The graph of $t^2 - \sqrt{5}\ t - 2$ has its minimum value at which the approximate value of t

A. 83
B. 1.12
C. 1.21
D. 1.35
E. 2.47

6. The diagonals of a parallelogram divide the figure into four triangles that are

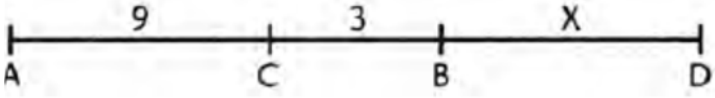
A. congruent
B. similar
C. equal in area
D. isosceles
E. equal in perimeter

7. In the adjacent figure, $\overline{RT}$ is a diameter of the semicircle. If $RS = 2$ and $ST = 3$, then the area of the semicircle is



A. $\frac{13\pi}{2}$
B. $\frac{13\pi}{4}$
C. $\frac{\pi}{6}$
D. $\frac{13\pi}{8}$
E. $\frac{\pi}{4}$

8. In the adjacent figure, AC = 9, D is three times as far from A as from B and BC = 3. What is BD?



A. 9
B. 12
C. 18
D. 6
E. 15

9. The graph of the equation y = 50 cos 3x has a period, in radians, of

A. 3π
B. $\frac{2}{3}\pi$
C. $\frac{2}{5}\pi$
D. 50π
E. $\frac{50}{3}\pi$

10. A right circular cone is cut into two equal parts. The lateral surface area of one of the parts is equal to thrice the lateral surface area of a hemisphere with a radius equal to 8 cm. What is the area of the right circular cone?

A. $768\pi\ cm^2$
B. $512\pi\ cm^2$
C. $384\pi\ cm^2$
D. $192\pi\ cm^2$
E. $128\pi\ cm^2$

11. If $a \neq b$, then $x = a\ sin\ t$ and $y = b\ cos\ t$ represent the parametric equations of a(n):

A. Circle
B. Ellipse
C. Straight line
D. Parabola
E. Hyperbola

12. $2\ \cos^3 B\ \sin B + 2\ \sin^3 B\ \cos B$ is equal to

A. $2\ sin\ B$
B. $cos^2\ B$
C. $cos\ 2\ B$
D. $sin\ 2B$
E. $2\ cos\ B$

13. The irrational number is

A. $\frac{3\sqrt{18}}{2\sqrt{6}}$
B. $\sqrt[3]{-27}$
C. $\sqrt{2}\ (3\sqrt{2} + 2\sqrt{8}\ )$
D. $\frac{2\sqrt{5}}{\sqrt{45}}$
E. $\sqrt{\frac{1}{2}} . \sqrt{\frac{25}{2}}$

14. A car moved a distance of x meters to a distance of y meters. The percent of increase was

A. $\frac{100\ (y-x)}{y}$
B. $\frac{100\ (x-y)}{x}$
C. $\frac{y-x}{x}$
D. $\frac{x-y}{x}$
E. $\frac{100\ (y-x)}{x}$

15. The solution of $3x^2 - x\,y = 3$ and $6x - y = 10$ is

A. $\frac{1}{3}$ and 3
B. 8 and -8
C. $\frac{1}{3}$ and -8
D. 3 and 8
E. $\frac{1}{3}$ and -8; 3 and 8

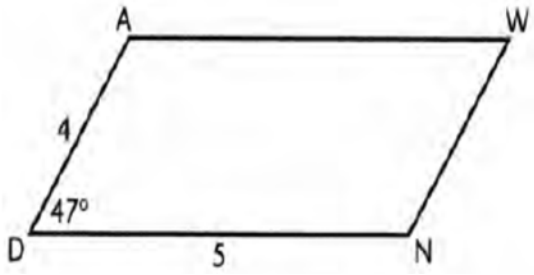
16. If graphed on the same set of axes and $0 \leq x \leq 2\pi$, then $y = \sin x$ and $y = \cos x$ will intersect in quadrant(s)

A. I only
B. III only
C. I and III
D. II only
E. I and II

17. If A represents the set of rectangles and B the set of rhombi, then A ∩ B represents the set of

A. Trapezoids
B. Parallelograms
C. Squares
D. Rectangles
E. Quadrilaterals

18. The approximate area of the parallelogram DAWN, in the adjacent figure, is



A. 20
B. 17.25
C. 14.63
D. 11.5
E. 13.64

19. If the line of equation $5x + 12y - 60 = 0$ is tangent to the circle of equation $(x - 1)^2 + (y - 3)^2 = r^2$, then the value of r is

A. $2\sqrt{3}$
B. $\sqrt{3}$
C. $\sqrt{10}$
D. $\frac{19}{13}$
E. $\frac{13}{12}$

20. *If* $[\sqrt{2}\ (\cos 30^o + i \sin 30^o)]^2 = a + bi$, then a = … and b = …

A. $a = 2, b = \sqrt{3}$
B. $a = \frac{3}{2}, b = \frac{1}{2}$
C. $a = 1, b = -\sqrt{3}$
D. $a = \frac{3}{2}, b = -\frac{1}{2}$
E. $a = 1, b = \sqrt{3}$

21. The probability of getting 80 % or more of the questions correct on a 10- question true-false exam merely by guessing is

A. $\frac{5}{32}$
B. $\frac{1}{16}$
C. $\frac{3}{16}$
D. $\frac{7}{128}$
E. $\frac{7}{32}$

22. The ratio of the diagonal of a cube to the diagonal of a face of this cube is

A. 3: $\sqrt{6}$
B. 2: $\sqrt{6}$
C. 3: $\sqrt{2}$
D. 6: $\sqrt{2}$
E. 2: $\sqrt{3}$

23. The intersection of the three lines of equations x= 3y, y = 0 and 3 x + y = 7 form a(n) ---------- triangle

A. Acute
B. Obtuse
C. Right
D. Isosceles
E. Equilateral

24. The distance AB between the points A(-3, 7) and B(6, -5) in a coordinate system in which the y-axis is inclined 60º to the positive x- axis is

A. $\sqrt{117}$
B. $\sqrt{120}$
C. $\sqrt{189}$
D. $\sqrt{333}$
E. $\sqrt{108}$

25. The municipality in a certain hospital administered a survey on diabetes. Blood tests for 150 patients gave the following results in millimoles per liter:

Level of glucose in $mmol/L$	$[6-8[$	$[8-10[$	$[10-12[$	$[12-14[$	$[14-16[$
Frequency	50	10	20	30	40

The Median is

A. 11
B. 10
C. 11.5
D. 10.5
E. 12

26. A bag B_1 contains **two red balls numbered 0** and **three blue balls numbered 1, 2, 3**

A bag B_2 contains **three red balls numbered 2, 3, 4** and **one blue ball numbered 0.**

One ball is selected from B_1, then another ball is randomly selected from B_2. Thus a 2-digit number is formed. The number of possible outcomes is

A. 25
B. 12
C. 20
D. 16
E. 144

27. The following table gives information about a population of smokers and of those having lung diseases due to smoking.

	Men		Men and Women	
	Smokers	Sick	Smokers	Sick
20 - 40 years	2500	30	4500	50
40 - 60 years	3000	50		75
60 - 80 years	2000		4000	
Total		160	13500	265

An individual is selected at random from this population. The probability that this individual is sick knowing that he/she is between 60 and 80 years old is

A. $\frac{265}{13500}$
B. $\frac{140}{4000}$
C. $\frac{80}{2000}$
D. $\frac{140}{13500}$
E. $\frac{265}{4000}$

28. The solution of the system $\begin{cases} 3 - x^2 \leq 0 \\ \dfrac{x-11}{x-4} \geq 2 \end{cases}$ is

A. x ∈ [- 3, -√3] ∪ [√3 , 4[
B. x ∈]- 3, -√3] ∪ [√3 , 4[
C. x ∈] - 3, -√3[∪[√3 , 4[
D. x ∈ [- 3, -√3] ∪ [√3 , 4]
E. x ∈ [- 3, -√3] ∪]√3 , 4[

29. The real numbers *m, n* and *p* such that $P(x) = (x^2 - 2)(mx^2 + nx + p)$ will be identical to $x^4 - x^3 - 3x^2 + 2x + 2$ are:

A. m = 1, n = -1, p = -1
B. m = -1, n = -1, p = -1
C. m = 1, n = 1, p = 1
D. m = 1, n = 1, p = -1
E. m= -1, n= -1, p = 1

30. A fair die is tossed and a card is randomly chosen from a deck of 52 cards. The probability that "a multiple of three appears and a king or an ace is selected" is:

A. $\frac{8}{312}$
B. $\frac{16}{312}$
C. $\frac{8}{52}$
D. $\frac{16}{52}$
E. $\frac{16}{36}$

31. In a given school, the class of grade 12 is divided into three sections: Sociology and economics (SE), Life Sciences (LS) and General Sciences (GS). The students of this class are distributed as follows:

Sections/Students	Boys	Girls	Total
SE	17	21	38
LS	13	14	27
GS	14	5	19
Total	44	40	84

The number of ways that three students can be selected from this class if exactly two of them are girls and if the order is respected is

A. 205,920
B. 68,640
C. 411,840
D. 70,400
E. 211,200

32. A mining company extracts oil from an oilfield since the year 1963. The following table shows the quantity y_i, in tons, extracted during each year indicated by its rank x_i.

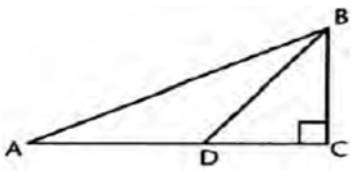
Year	**1963**	**1968**	**1973**	**1978**	**1983**	**1988**	**1993**	**1998**	**2003**	**2008**
Rank x_i	0	1	2	3	4	5	6	7	8	9
Quantity y_i (in tons)	18.1	15.7	13.3	11	9.3	7.8	7.1	6.1	5.2	4.3

The means $\overline{x}$ and $\overline{y}$ of the variables x and y respectively are

A. $\overline{x} = 4.5 \quad \overline{y} = 9.79$
B. $\overline{x} = 4 \quad \overline{y} = 9.79$
C. $\overline{x} = 4.5 \quad \overline{y} = 9$
D. $\overline{x} = 5 \quad \overline{y} = 9.79$
E. $\overline{x} = 4.5 \quad \overline{y} = 7.9$

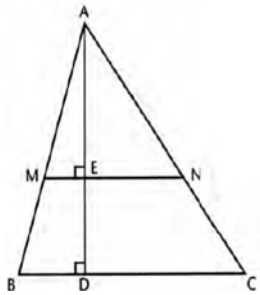
33. The length of $\overline{AB}$ in the adjacent right triangle at C such that AD = DB, DC = BC = 1 is

A. $\sqrt{10}$
B. $2\sqrt{2}$
C. $2\sqrt{10}$
D. $\sqrt{4+2\sqrt{2}}$
E. $4+2\sqrt{2}$



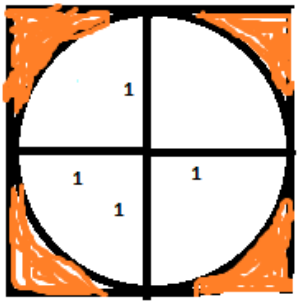
34. In the adjacent ΔABC, AD = 10, $\overline{MN}$ is parallel to $\overline{BC}$ and $\overline{MN}$ bisects the area of Δ ABC. The value of ED

A. $10 - 5\sqrt{2}$
B. $10 + 5\sqrt{2}$
C. $5\sqrt{10+2\sqrt{2}}$
D. $5\sqrt{2}$
E. $2\sqrt{10}$



35. A circle is inscribed in the square as shown in the adjacent figure. The area of the shaded region is:

A. $4 - \pi$
B. $4 + \pi$
C. $1 - \pi$
D. $1 + \pi$
E. $2 - \pi$



36. The total price of one kilogram of sugar and one kilogram of salt is 20 EGP. During an economic crisis, the price of sugar increased by 12 % and that of salt decreased by 15% such that the total price of 1 Kg of sugar and 1 Kg of salt became 22 EGP.

Reem bought 5 Kg of sugar and 2 Kg of salt during the crisis. How much did she pay, rounded to the nearest integer?

A. 106 EGP
B. 100 EGP
C. 120 EGP
D. 96 EGP
E. 48 EGP

37. Consider the polynomial

$E(x) = (2x - 1)^2 + (x - 2)(1 - 2x)$

$E(1 + \sqrt{2}) = c + d\sqrt{2}$, where c and d are two integers such that

A. c = d = 5
B. c = 6, d = -5
C. c = -6, d = -5
D. c = -6, d = 5
E. c = 6, d = 5

38. In the xy-plane, consider a straight line (D) passing through $A(-\sqrt{3}; -3 - 2\sqrt{3})$ and making an acute angle α with the $x-$ axis such that $\cos\alpha = \frac{\sqrt{3}}{3} \times \sin\alpha$.

The value of $\sin\alpha$ and $\cos\alpha$ are respectively

A. $-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}$
B. $\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}$
C. $\frac{\sqrt{3}}{2}, \frac{1}{2}$
D. $\frac{-\sqrt{3}}{2}, \frac{1}{2}$
E. $\frac{\sqrt{3}}{2}, \frac{-1}{2}$

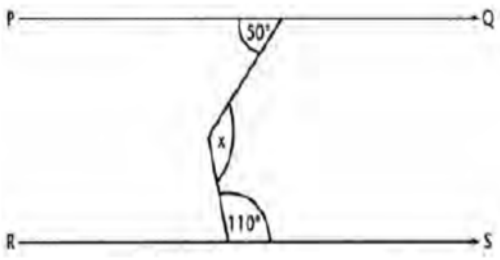
39. Consider the three expressions:

$A = (x - 1)(x - 2)$, $B = (x - 2)(x - 3)$ and $C = (x - 3)(x - 4)$

$A - 2B + C$ is equal to

A. 1
B. 2
C. 3
D. 4
E. 5

40. In the adjacent figure, if the two lines (PQ) and (RS) are parallel, then x is equal to



A. 50°
B. 110°
C. 120°
D. 60°
E. 100°

41. .The largest real range of the function y = 1 - $\frac{1}{x}$ is

A. $y > 0$
B. All Real numbers for y except $y = 1$
C. $y \neq 0$
D. $y \geq 0$
E. $y \leq 0$

42. A company runs three production lines that together have an output of 54 parts/ hour. Twice the production of the second line is equal to the combined output of the other two lines, and the output of the third line is three parts per hour more than the second line.

The production rate of the first line x, the production rate of the second line y and that of the third one z are:

A. x = 21, y = 18, z = 15
B. x = 18, y = 21, z = 15
C. x = 15, y = 21, z = 18
D. x = 21, y = 15, z = 18
E. x = 15, y = 18, z = 21

43. What is the equation of the tangent to the curve of function f defined by $f(x) = x^2 + 6x + 8$ at a point of abscissa 1 ?

A. $y = -3x + 18$
B. $y = 8x + 18$
C. $y = 8x + 7$
D. $y = -3x + 7$
E. $y = 8x - 7$

44. The solution of the system defined by $\begin{cases} x^2 - x - 2 \geq 0 \\ \frac{x-3}{x+2} \leq 0 \end{cases}$ is

A.] -∞, -1] U [2, +∞ [
B.] -2, 3]
C.] -2, -1] U [2, 3 [
D.] -2, -1] U [2, 3]
E. [-2, -1] U [2, 3 [

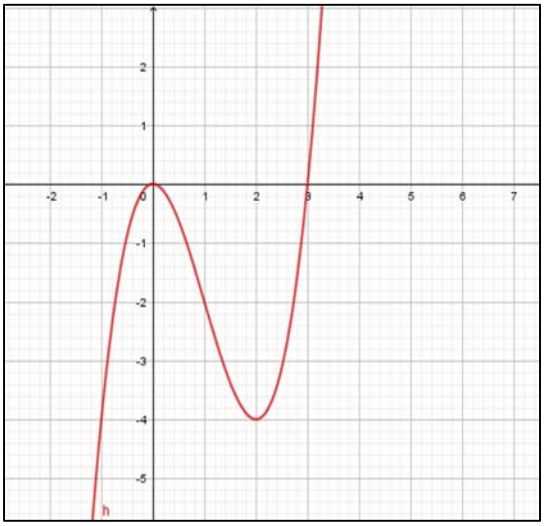
45. . $\lim\limits_{x \to +\infty} \dfrac{\sqrt{x^2 + 4x + 1} - 1}{x}$ is

A. 2
B. $+\infty$
C. 0
D. 1
E. $-\infty$

46. Suppose that the adjacent curve (h) is the curve representing the function f defined by $f(x) = ax^3 + bx^2$.

Graphically,

A. a = 1 and b = -3
B. a = -1 and b = -3
C. a = -3 and b = 1
D. a = 1 and b = 3
E. a = 3 and b = -1



47. The function f defined by $f(x) = \dfrac{x^2 - 3x - 3}{x - 4}$ admits the center of symmetry

A. (- 4, 5)
B. (4, - 5)
C. (-4, -5)
D. (5, 4)
E. (4, 5)

48. On a given day, a department store sold 40 shirts. The shirts come in three styles: Casual, sports and dress. A casual shirt costs $20, a sports shirt costs $40, and a dress shirt costs $60. The store sold $1080 worth of these shirts on that day and the number of casual shirts exceeded by 20 the combined numbers of the sports and dress shirts.

The number of shirts of each type is:

A. 6 casual shirts, 30 sport and 4 dress shirts
B. 30 casual shirts, 7 sport and 3 dress shirts
C. 30 casual shirts, 6 sport and 4 dress shirts
D. 4 casual shirts, 6 sport and 30 dress shirts
E. 6 casual shirts, 4 sport and 30 dress shirts

49. If a, b, and c are three positive numbers and if a >b, which of the following is not necessarily true?

A. $a + c > b + c$
B. $a - c > b - c$
C. $\frac{a}{c} > \frac{b}{c}$
D. $\frac{c}{a} > \frac{c}{b}$
E. $\frac{a}{b} > 1$

50. The simplest form of $\frac{2^{y+4}-2(2^y)}{2(2^{y+3})}$ is:

A. $\frac{1}{4}$
B. $\frac{1}{2}$
C. $\frac{1}{8}$
D. $\frac{5}{8}$
E. $\frac{7}{8}$