



EST II – Individual Subject Test

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.

1. If $3^{x+3} = 243$, what is the value of 5^{x-1} ?
 - A. 5
 - B. 25
 - C. 125
 - D. 625
 - E. 3125
2. Given the equation $x + 2y - 8i = 7 + 2xi + 8yi$, what real values of x and y satisfy the equation?
 - A. $x = 4, y = -5.5$
 - B. $x = 4, y = -1.5$
 - C. $x = 10, y = -1.5$
 - D. $x = 18, y = -5.5$
 - E. $x = 8, y = -0.5$
3. If $f(x) = -3 \cos x$, $g(x) = 3\sqrt{7}$, and $h(x) = x^2 - 3$, find the value of $f[(h \circ g)(2)]$.
 - A. -2.99
 - B. -1.5
 - C. 1
 - D. 5.94
 - E. 7.93
4. If we shade a region in a semi-sphere with radius r , what would be the area of the shaded region?
 - A. $4\pi r$
 - B. $\frac{5}{2}\pi r^2$
 - C. $\frac{7}{2}\pi r^2$
 - D. $4\pi r^2$
 - E. $\frac{4}{3}\pi r^2$
5. If $\frac{1}{x+1} - \frac{2}{x+3} > 2$, which of the following could not be a value for x ?
 - A. -3.5
 - B. -3.1
 - C. -0.7
 - D. -1
 - E. -0.95

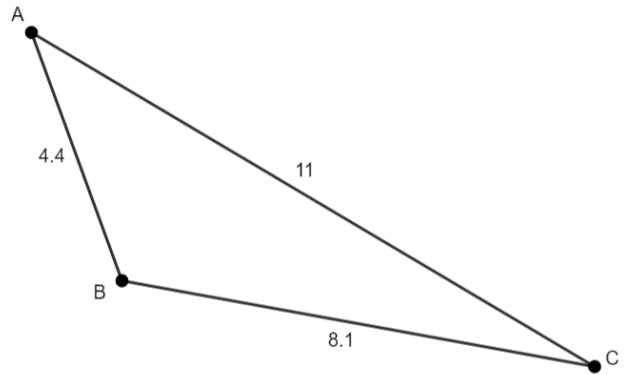
6. Given two points $A(1, -2, 1)$ and $B(5, 6, z_B)$, find a value of z_B if the distance in space between the two points is equal to 9.
- A. 1
 - B. 2
 - C. 3
 - D. -1
 - E. -2

7. If $\vec{V} = 2\vec{i} + 7\vec{j}$ and $\vec{M} = -3\vec{i} + \vec{j}$, the resultant vector of $5\vec{V} + 2\vec{M}$ equals:

- A. $-11\vec{i} + 19\vec{j}$
- B. $4\vec{i} + 37\vec{j}$
- C. $16\vec{i} + 37\vec{j}$
- D. $4\vec{i} + 33\vec{j}$
- E. $16\vec{i} + 33\vec{j}$

8. Find the measure of the obtuse angle in triangle ACB .

- A. 20.2
- B. 100.2
- C. 115
- D. 118.4
- E. 120.4



9. If $2^{\log_2 x} + \log_3 3^{4x} = 25$, then $x = ?$

- A. 5
- B. 0.83
- C. -1.66
- D. 1.78
- E. 1.92

10. In a Chemistry test, John has two papers, A and B, containing 7 and 11 questions respectively. He has to attempt 12 questions in total, selecting at least 4 from each paper. How many ways can John select a question?

- A. 1.52×10^{10}
- B. 19041
- C. 16401
- D. 15939
- E. 10164

11. If $\sin\left(\frac{\pi}{2} - \theta\right) = 0.8$, what is the value of $\sin \theta \times \cot \theta$?
- A. 0.36
 - B. 0.44
 - C. 0.59
 - D. 0.8
 - E. 1
12. Consider the ages of your 6 cousins as follows:
6, 19, 14, 13, 7, 11
What is the standard deviation of their ages?
- A. 3.8
 - B. 4.38
 - C. 5.14
 - D. 11.49
 - E. 22
13. If $x = 4(2i - 3)$, find x^3 .
- A. $2944i + 576$
 - B. $2944i - 2496$
 - C. $-192i + 80$
 - D. $-192i + 208$
 - E. $46i + 9$
14. The driving distance from Giza to Ashmoun is 104 Km. On a road trip from Giza to Ashmoun, Wassim drove the first 50 Km at 65 Km per hour, then the next 50 Km at 80 Km per hour, and the rest at 54 Km per hour. What was his average speed, in Km per hour, for the entire trip?
- A. 6.3
 - B. 23.6
 - C. 66.3
 - D. 70.8
 - E. 78.5
15. $2k$, $3k + 1$, and 22 are the consecutive terms of an arithmetic sequence. What is the value of k ?
- A. -10
 - B. -1
 - C. 5
 - D. 10
 - E. 16

16. The sum of the roots of $(x - \sqrt{2})^2(2x - \sqrt{2})(x + \sqrt{2}) = 0$ is

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

17. Which of the following could be the asymptote of $\frac{(y-3)^2}{16} - \frac{x^2 - 14x + 49}{25} = 1$

- A. $y = \frac{-5x + 47}{4}$
- B. $y = \frac{-4x + 43}{5}$
- C. $y = \frac{-5x + 43}{4}$
- D. $y = \frac{-4x + 47}{5}$
- E. $y = \frac{-5x - 23}{4}$

18. If $\cos x = 0.24$, what is the value of $\sin^2 x$?

- A. 0.97
- B. 0.9424
- C. 0.76
- D. 0.52
- E. 0.5

19. In rectangle $ABCD$, $AC = 5$ cm and $m\angle BAC = 25^\circ$. Find the perimeter of triangle ABC .

- A. 15 cm
- B. 11.64 cm
- C. 11 cm
- D. 9.57 cm
- E. 4.78 cm

20. Find the coordinates of the foci of $\frac{(x-3)^2}{9} + \frac{y^2}{49} = 1$.

- A. $(3, 2\sqrt{10})$ and $(3, -2\sqrt{10})$
- B. $(3 - 2\sqrt{10}, 0)$ and $(3 + 2\sqrt{10}, 0)$
- C. $(3, 2\sqrt{10})$ and $(3 - 2\sqrt{10}, 0)$
- D. $(0, 3 - 2\sqrt{10})$ and $(0, 3 + 2\sqrt{10})$
- E. $(0, 0)$ and $(3, 2\sqrt{10})$

21. What is the oblique/slant asymptote of the following function: $(x) = \frac{5x^2 - 2}{x - 3}$?

- A. $y = x + 15$
- B. $y = 5x$
- C. $y = 5x + 15$
- D. $y = 5x + 13$
- E. $y = 5x + 15 + \frac{43}{x - 3}$

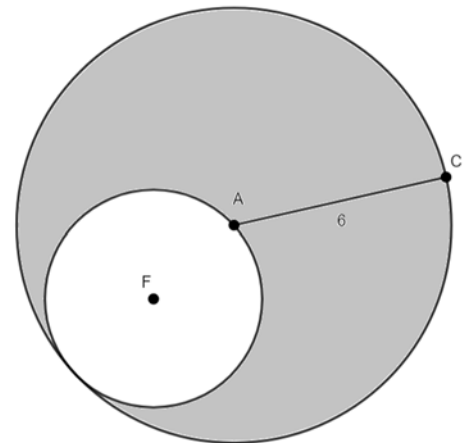
22. Mr. Hernandez has 8 Christmas greeting cards and he wants to send them to 5 of his friends. How many ways can he send a greeting card?

- A. 6720
- B. 3136
- C. 112
- D. 56
- E. 40

23. In the figure to the right, the two circles touch each other internally with A being the center of the big circle with a radius equal to 6 m , and F being the center of the small circle that passes through A .

Find the area of the shaded region in the figure.

- A. 141.37 m^2
- B. 9.42 m^2
- C. 84.823 cm^2
- D. 8482.3 cm^2
- E. 848230 cm^2

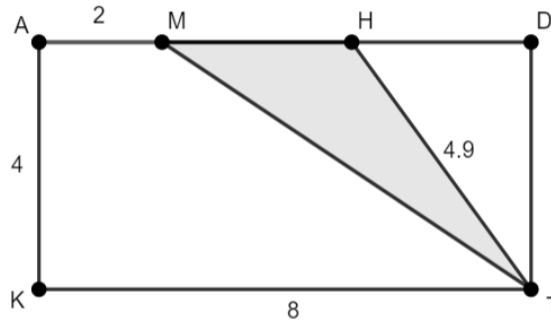


24. In a graph of $y = -3^x$, which following statement/s is/are true?

- I. The graph is continuous and decreasing.
- II. The graph passes through points $(0, -1)$ and $(-1, 0)$.
- III. The range is $\{y \mid y < 0\}$.

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

25. $ADTK$ is a rectangle. Find the area of triangle MHT .



- A. 3.34
- B. 6.34
- C. 10.34
- D. 12
- E. 16

26. If $1 - 2 \sin^2 \theta = -\frac{1}{3}$, what is the value of $\frac{\sin \theta}{2 \cos 2\theta}$ ($0 \leq \theta \leq 90^\circ$)?

- A. -2.4
- B. -1.2
- C. $\frac{3}{2}$
- D. $-\frac{3}{2}$
- E. 1

27. Patrick organized a sports event at his village. 243 people joined the tournaments in which they had to choose to play ping-pong, boxing, or golf. The ratio of ping-pong to boxing to golf was 9: 10: 8. How many people joined the boxing tournament?

- A. 72
- B. 81
- C. 90
- D. 99
- E. 100

28. What is the slope of the line perpendicular to the line whose equation is $\frac{-x}{3} + \frac{7y}{2} = -1$?

- A. $\frac{2}{21}$
- B. $-\frac{21}{2}$
- C. $\frac{21}{2}$
- D. $-\frac{2}{21}$
- E. $-\frac{6}{7}$

29. In the set of numbers: 5, 10, 20, 10, 30, 25, consider M as the median and m as the mode of the set. What is the average of M and m ?

- A. 10
- B. 12.5
- C. 13.33
- D. 13.75
- E. 16.25

30. What is the domain of the function defined by $f(x) = \frac{x-3}{x^2-5x-14}$?

- A. All real numbers
- B. All real numbers except 7
- C. All real numbers except 0 and 7
- D. All real numbers except 0 and -2
- E. All real numbers except -2 and 7

31. In 2018, the population in China was 1,427,647,786.

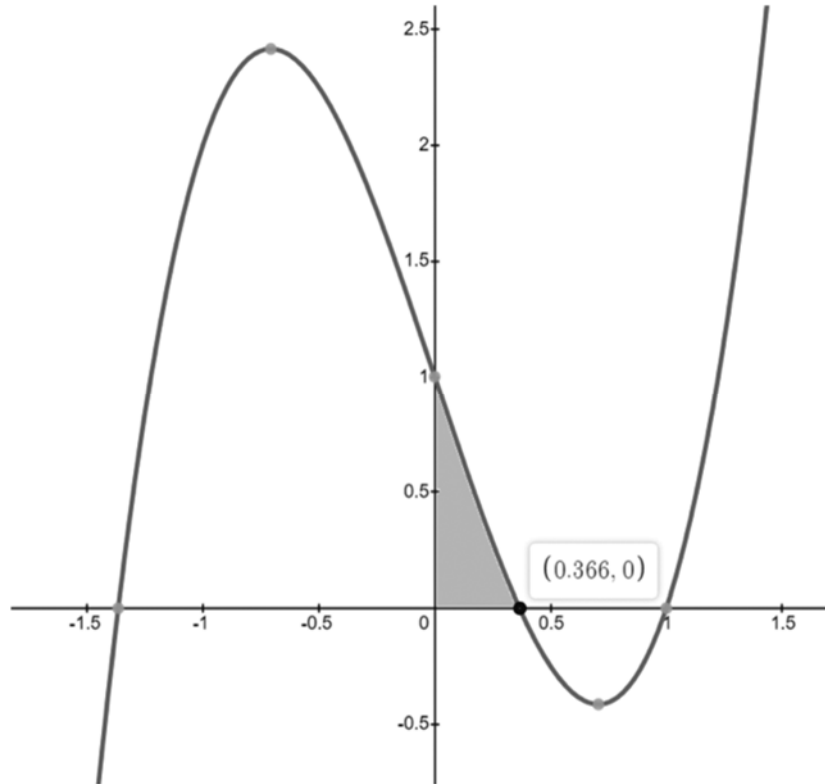
According to data, China's population growth rate is 0.59% per year. What will the population be in China in 2021?

- A. 8,423,121
- B. 1,436,070,908
- C. 1,444,543,726
- D. 1,452,917,152
- E. 1,453,142,111

32. $ABCD$ is a parallelogram such that the base $AB = 4h$, with h being the height of the parallelogram. Find the length of \overline{AB} if the area of the parallelogram is equal to 625 cm^2 .
- A. 50 m
 - B. 2500 m
 - C. 50 cm
 - D. 2500 cm
 - E. 100 cm
33. Which of the following cannot be the sides of an obtuse triangle?
- A. 9, 10, 13.6
 - B. 8, 12, 14.5
 - C. 6, 7, 10
 - D. 7, 9, 11
 - E. 9, 11.2, 15
34. If $y = \frac{2x+1}{x} - 1$, what value does y approach as x gets infinitely large?
- A. -1
 - B. 0
 - C. 1
 - D. 2
 - E. y approaches a positive infinite number
35. Consider the function $f(x) = 2x^5 - 3x^3 + x$. Which of the following statement/s is/are true?
- I. It is an even function
 - II. It is an odd function.
 - III. It is symmetric about the x -axis.
- A. I only
 - B. II only
 - C. III only
 - D. I and III
 - E. II and III

36. What could be the area of a rectangle whose width is equal to $(2x - 1)$ in centimeters, and its length is triple its width? (Consider $x = 5$)

- A. 344 cm^2
- B. 324 cm^2
- C. 81 cm^2
- D. 95 cm^2
- E. 243 cm^2



37. In the figure above, the graph represents the function $f(x) = 2x^3 - 3x + 1$. How many roots does it have? Consider the shaded region is bound by the x -axis, y -axis, and a straight line passing through $(0, 1)$ and $(0.366, 0)$. What is the area of the shaded region?

- A. 2 roots, and 0.183 square units
- B. 3 roots, and 0.183 square units
- C. 2 roots, and 0.366 square units
- D. 3 roots, and 0.366 square units
- E. 4 roots, and 0.366 square units

38. Given the two functions: $f(x) = \begin{cases} x + 5, & x < 0 \\ 2x - 1, & x \geq 0 \end{cases}$, and $g(x) = \begin{cases} 3x - 1, & x < -3 \\ 2x + 3, & -3 \leq x < 5, \\ 4x + 1, & x \geq 5 \end{cases}$,

find the value of $(f \circ g)(-2)$.

- A. -3
- B. -2
- C. -1
- D. 4
- E. 9

39. ADF is an isosceles triangle at F inscribed in circle (C) of center O and diameter \overline{AD} . What is the value of $1 - \tan^2 A$ if the radius of the circle is equal to 6 cm ?

- A. 0
- B. 1
- C. $6\sqrt{2}$
- D. 6
- E. 12

40. Which translation in comparison to its parent function is true about the graph of $f(x) = 2x - 1$?

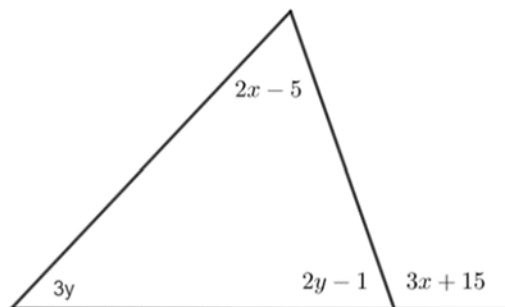
- A. The graph is translated 1 unit up, and it is stretched vertically.
- B. The graph is translated 1 unit up, and it is stretched horizontally.
- C. The graph is translated 1 unit down, and it is stretched vertically.
- D. The graph is translated 1 unit down, and it is stretched horizontally.
- E. The graph is translated 1 unit down only.

41. Given the two functions: $f(x) = x - 2$, and $g(x) = x + 2$, which of the following statement/s is/are true about graph f and g in the xy -plane?

- I. The two functions are inverse functions.
- II. They intersect at the origin.
- III. Both functions are parallel.

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

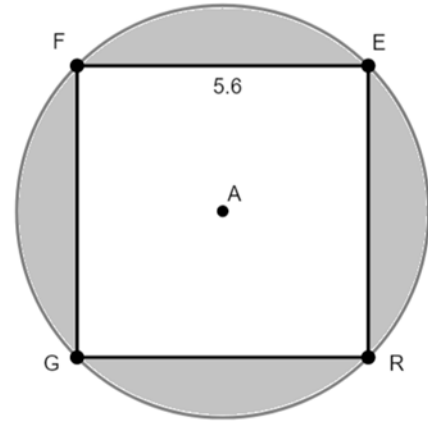
42. What are the values of x and y in the figure to the right?



- A. $x = 20.54, y = 41.63$
B. $x = 41.63, y = 20.54$
C. $x = 55, y = 1$
D. $x = 31, y = 17$
E. $x = 17, y = 31$
43. $A(1, 3)$ and $B(4, 2)$ are two points on a xy -plane of origin O . \overrightarrow{Bx} is parallel to \overline{OA} , and T is a point on \overrightarrow{Bx} such that $OABT$ is a parallelogram. Find the area of triangle OTN with N as the intersection of \overline{BT} with the x -axis.
- A. 1.67
B. 3.33
C. 6.66
D. 10
E. 20
44. Solve $4 \sin^2 x - 1 = 0$ for x .
- A. $x = -60^\circ$
B. $x = 0^\circ$
C. $x = 15^\circ$
D. $x = 30^\circ$
E. $x = 45^\circ$
45. $FGHI$ is a parallelogram such as the base is equal to $(2x - 3)^2$ while the height is double the base. Which expression represents half the area of this parallelogram?
- A. $16x^4 - 96x^3 + 216x^2 - 216x + 81$
B. $2(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
C. $3(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
D. $4(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
E. $8x^2 - 24x + 18$

46. $FERG$ is a square inscribed in the circle of center A . What is the area of the shaded region in the figure?

- A. 1.64
- B. 4.475
- C. 6.72
- D. 17.9
- E. 165.7



47. The equation circle (C) is $(x - 3)^2 + (y + 2)^2 = r^2$. It passes through $G(6, 3)$. Find the circumference of the circle.

- A. 7.58
- B. 15.17
- C. 17.77
- D. 18.32
- E. 36.63

48. Which matrix equation represents the system: $\begin{cases} 3y + 1 = 2x \\ 3x - 4y = 1 \end{cases}$

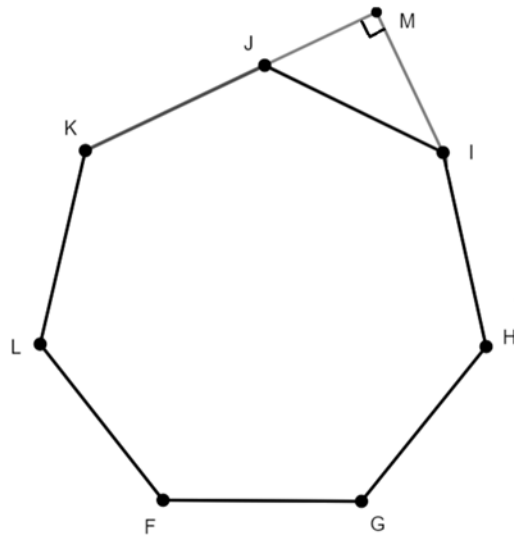
- A. $\begin{bmatrix} 3 & 1 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$
- B. $\begin{bmatrix} 3 & -2 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$
- C. $\begin{bmatrix} -2 & 3 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$
- D. $\begin{bmatrix} 3 & -2 \\ -4 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$
- E. $\begin{bmatrix} -2 & 3 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x & y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

49. If $f(x) = cx + b$ and $g(x) = -dx + e$ are the equations of two consecutive sides of a parallelogram, which of the following is true in order for the parallelogram to be a rectangle?

- A. $c = 2$
- B. $c = -d$
- C. $c = -\frac{1}{d}$
- D. $cd = 0$
- E. $cd = 1$

50. The figure to the right shows a regular heptagon and a right triangle MJI .

If $m\angle KJI = \frac{1}{7}x - 10$ and $m\angle MIJ = 3y + 4$, what would be the values of x and y ?



- A. $x = 970$ and $y = 51.43$
- B. $x = 11.52$ and $y = 51.43$
- C. $x = 138.57$ and $y = 11.52$
- D. $x = 970$ and $y = 11.52$
- E. $x = 970$ and $y = 138.57$

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 the volume of 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 the volume of a sphere with a radius of r .

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