est

EST II – Individual Subject Test

Date:

Test Center:

Room Number

Student's Name

National ID

EST ID

Subject: Math Level 1

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 on the following page 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. Three consecutive odd integers have a sum equal to 39.

   How many of these numbers are prime?

   A. 0
   B. 1
   C. 2
   D. 3
   E. No three consecutive odd integers can add up to 39.

2. An amount of 17,500 EGP is divided between three people in a ratio $3 : 3 : 8$.

   The highest amount of money taken is:

   A. 2,187 EGP
   B. 3,750 EGP
   C. 7,500 EGP
   D. 10,000 EGP
   E. 13,750 EGP

3. Given that $i^2 = -1$, and $\frac{2i-1}{3i+5} + \frac{2i-3}{i-1} = \frac{a(i-b)}{i+c}$, what is the value of $a + b + c$?

   A. 75
   B. 16
   C. 14
   D. 6
   E. -16

4. The curve of equation $f(x) = 4x^2 + 9x - 4$ intersect with the line of equation $y = x - a$ at $x = \frac{-2 \pm \sqrt{10}}{2}$. What is the value of a?

   A. -2
   B. 0
   C. 2
   D. 4
   E. 6

5. $\frac{2x-5}{3x} = \frac{x-1}{x+1}$

   Using the equation above, find the value of x^2.

   A. -5
   B. -1
   C. 1
   D. $\sqrt{5}$
   E. 5

6. If $8^x \cdot 4^{2x-1} = 16$, what is the value of 3^x ?

   A. $3\sqrt[6]{3}$

   B. $\sqrt[7]{3^6}$

   C. $27\sqrt{3}$

   D. $3\sqrt[7]{3}$

   E. 27

7. ABC is a right isosceles triangle at A.

   M is a point on $\overline{BC}$ such that $\overline{AM}$ is the perpendicular bisector of $\overline{BC}$.

   Which of the following statements is not true?

   A. $\overline{AM}$ is the angle bisector of the right angle in triangle ABC.
   B. AMC is a right isosceles triangle at M.
   C. $\triangle AMC \cong \triangle AMB$
   D. If N is the symmetric of A with respect to M, then $ABNC$ is a square.
   E. If K is the symmetric of M with respect to A, then BKC is an equilateral triangle.

8. The coefficient of x^2 in the expanded form of $3(4x - 3) + (x^2 + 8x)(x - 5)$ is:

   A. -28
   B. -9
   C. 1
   D. 3
   E. 9

9. Which of the following is the equation of the oblique asymptote of the curve of equation
   $$f(x) = \frac{2x^3 - 13x^2 + 17x + 12}{x^2 - 16}\,?$$

   A. $y = -2x - 13$
   B. $y = 2x - 13$
   C. $y = 2x + 13$
   D. $y = -2x + 13$
   E. None of the above
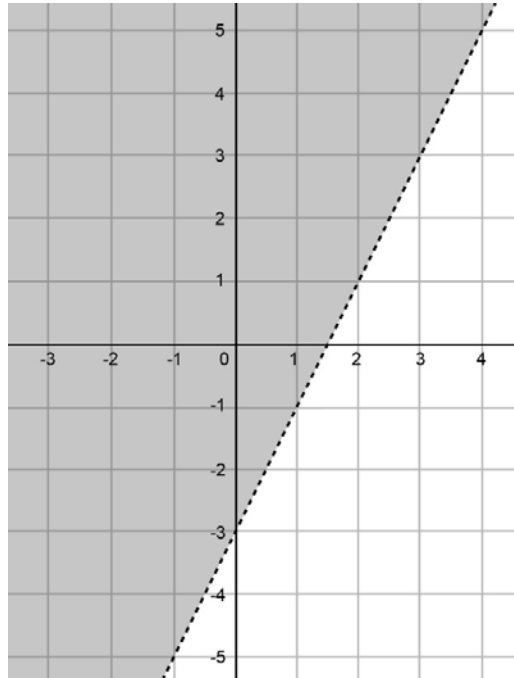
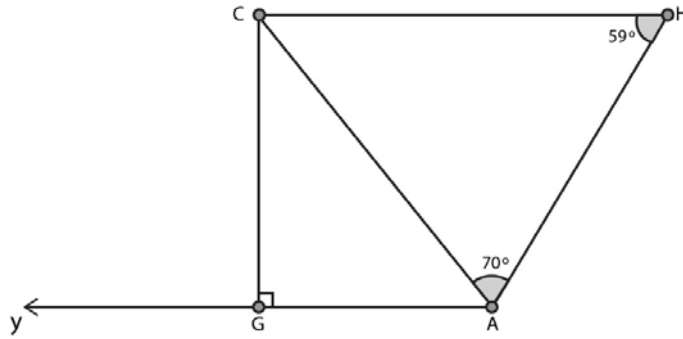**10.** The inequality represented in the graph above is $ax + by > c$.

Which of the following can be the expression representing the value of $a + b - c$?

A. $-3b$
B. $-b$
C. b
D. $2b$
E. $3b$
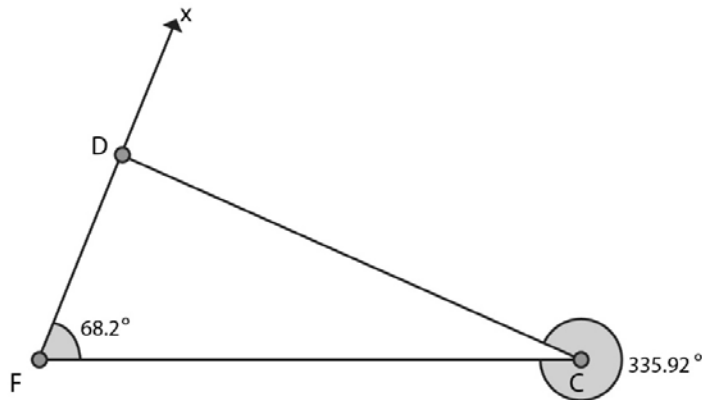
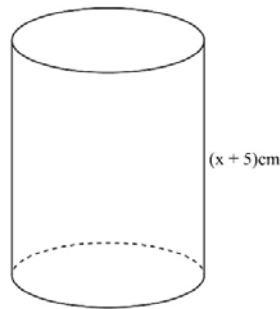**11.** Use the figure above to find $m\angle CDx$. *(Figure not drawn to scale)*

A. $21.8°$
B. $24.08°$
C. $68.2°$
D. $90°$
E. $92.28°$

5

12. In the figure above, $m\angle ACG = 3x° - 7°$, and $m\angle CAG = 2t° + 10°$ where x and t are two positive integers.

What is the value of $5x° - t°$ if $\overrightarrow{AC}$ is the angle bisector of $\angle GAH$? *(Figure not drawn to scale)*

A. 12
B. 15
C. 46.67
D. 98.33
E. 123.33

13. The cylinder above has a diameter equal to $18\ cm$, and it is opened from the top. If its surface area is $198\pi\ cm^2$, what is the value of x ? *(Figure not drawn to scale)* *Given: The surface area of a cylinder is $2\pi rh + 2\pi r^2$.*

A. $1.5\ cm$
B. $3.5\ cm$
C. $4.5\ cm$
D. $6.5\ cm$
E. $9\ cm$

14. A line T passes through the midpoint of a segment with endpoints $A\ (3,7)$ and $H\ (4,-5)$. Given that T is parallel to line L of equation $y = 5x + 8$, what is the sum of the intercepts of T ?

A. -16.5
B. -13.2
C. 3.3
D. 4.5
E. 13.2

6

15. Which of the following is the vertex form of the equation $y = 3x^2 - 4x + 1$?

A. $y = 3\left(x + \frac{2}{3}\right)^2 - \frac{1}{3}$

B. $y = -3\left(x - \frac{2}{3}\right)^2 - \frac{1}{3}$

C. $y = -3\left(x - \frac{2}{3}\right)^2 + \frac{1}{3}$

D. $y = 3\left(x - \frac{2}{3}\right)^2 + \frac{1}{3}$

E. $y = 3\left(x - \frac{2}{3}\right)^2 - \frac{1}{3}$

16. If $-4 \le -3x - 5 \le 9$, and the greatest possible value for $2x$ is $\frac{a+7}{3}$, what is the value of $-2a$?
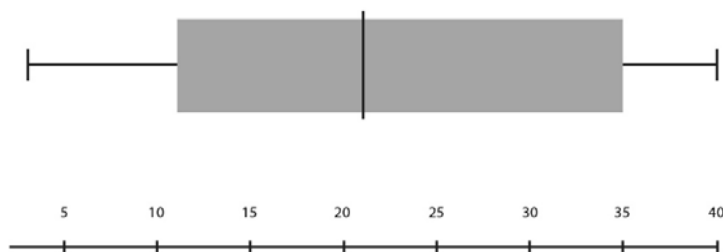
A. -2
B. -1
C. 2
D. 10
E. 18

17. Use the box-and-whisker plot above to find the approximate value of $a + 2b - c$ if a is the lower quartile, b is the interquartile range, and c is the maximum value in the data.

A. 11
B. 15
C. 19
D. 24
E. 40

18. A cone of radius r and height $7\ cm$ has a volume approximately equal to $9.33 \times 10^{-6}\pi\ m^3$. What is the value of r?

A. $1\ cm$
B. $2\ cm$
C. $3\ cm$
D. $4\ cm$
E. $5\ cm$

19. A tour bus company in Giza serves 150 people and charges each passenger an amount of 25 EGP. In June, the company decides to increase the fare by 3 EGP starting the next month. This increase will cause a loss of 15 passengers. *(Hint: the tour bus makes daily trips.)*
What is the maximum income the company could get in the next month?

A. 113,400 EGP
B. 113,437.50 EGP
C. 117,180 EPG
D. 117,218.75 EGP
E. 117,567.50 EGP

20. A square $ABCD$ is inscribed in a circle C of radius $10\ cm$.

What is the area of the square $ABCD$?

A. $100\ cm^2$
B. $100\sqrt{2}\ cm^2$
C. $150\ cm^2$
D. $200\ cm^2$
E. $200\sqrt{2}\ cm^2$

21. Given U as an arithmetic sequence with a difference $d = 7$, and the 15th term of this sequence is $a_{15} = 95$. If T is a geometric sequence such that its infinite sum of terms is equal to a_{15}, and its first term is equal to the first term of U, what is r, the common ratio of T, to the nearest hundredth?

A. 0.78
B. 0.97
C. 1.03
D. 1.09
E. 1.14

Item	Price in $	Number of items sold by Ali	Number of items sold by Jamal
Laptop	1,200	6	2
Earbuds	180	1	4
Smartwatch	390	3	2
Hard disk	150	x	1

22. Ali and Jamal work as sales associates in a store. The table above shows the number of items sold by each one of them during a certain week. Ali earns $300 per week untaxable with 1.2% commission on each item he sells. Jamal earns $500 per week and gets 1.5% commission on each item he sells, but 13% taxes are applied on his total earnings.

How many hard disks should Ali sell to earn more than what Jamal earned during the week shown in the table?

A. 5
B. 18
C. 19
D. 47
E. 48

23. In the figure above, each square has dimensions of $1.5 \times 1.5\ cm$.

What is the difference between the areas of $FGMHJB$ and $BJHK$? (Extending $\overleftrightarrow{HJ}$ will intersect F).

A. $30.375\ cm^2$
B. $31.5\ cm^2$
C. $54.75\ cm^2$
D. $60.75\ cm^2$
E. $85.5\ cm^2$

24. If two angles $\angle 1$ and $\angle 2$ are complementary, and $m\angle 1 = m\angle 2$, and $m\angle 1 = 4x + 15$, what is the value of x ?

A. $x = 2.5$
B. $x = 5$
C. $x = 7.5$
D. $x = 10$
E. $x = 30$

25. What is the square of the distance between $A\ (-4, -9)$ and $B\ (7, 11)$?

A. 521
B. 409
C. 125
D. 75
E. 13

26. If $f(x) = \frac{2}{x+4}$ and $g(x) = -\frac{3}{x^2} + 1$, what is $g(f(x))$?

A. $-3x^2 - 6x - 11$

B. $-\frac{3}{4x^2} - 6x - 11$

C. $-\frac{3}{4}x^2 - 6x - 44$

D. $-\frac{3}{4}x^2 - 6x - 11$

E. $-3x^2 - 6x - 44$

9

27. Scientifically, the half-life of caffeine in a human body is about 6 hours. Sophie had 2 cups of coffee 10 hours ago.

How much is left in her system?

Hint: The equation of half-life is $y(t) = ae^{-kt}$.

  A. About 0.09 of the original amount
  B. About 0.19 of the original amount
  C. About 0.31 of the original amount
  D. About 0.38 of the original amount
  E. About 0.63 of the original amount

28. The center of a circle is on the line of equation $y = -2x + 1$. The circle passes through point $M\ (-5, 6)$ and has a radius equal to $\sqrt{130}$ units.

Which of the following is the correct equation of this circle?

  A. $(x - 2)^2 + y^2 + 6x + 9 = \sqrt{130}$

  B. $(x - 2)^2 + y^2 - 6x + 9 = 130$

  C. $x^2 - 4x + y^2 + 6y = 117$

  D. $x^2 - 4x + y^2 - 6y = 117$

  E. $(x - 2)^2 + (y + 3)^2 = \sqrt{130}$

29. ATE is a right triangle at T with $AT = 5$ units, and $TE = 7$ units.

What is the value of $\tan(A) + \sin^2(E)$?

  A. 1.981
  B. 1.738
  C. 1.655
  D. 1.411
  E. 1.129

**30.** The product of two consecutive integers is 156. The smallest integer between them is referred to as m.

What is the value of $\sqrt{m}$?

  A. $\sqrt{3}$
  B. $2\sqrt{3}$
  C. 4
  D. $3\sqrt{3}$
  E. 12
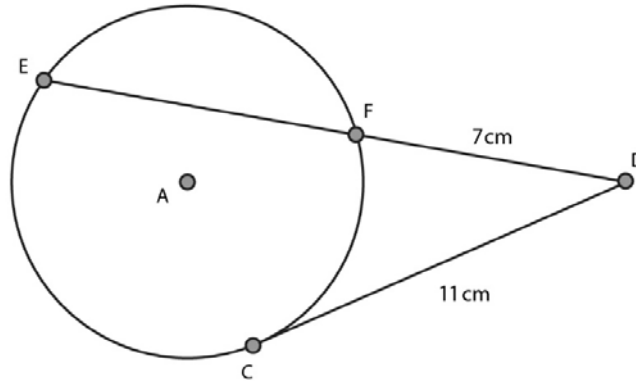
31. In the figure above, $\overline{DE}$ is a secant to the circle, $\overline{DC}$ is a tangent to the circle, and $DA = 16\ cm$.

Find the perimeter of triangle AEF. *(Figure not drawn to scale)*

A. 28.3 *cm*
B. 28.7 *cm*
C. 30.1 *cm*
D. 32.2 *cm*
E. 33.5 *cm*

32. The average of n numbers is 19. When adding 7 to the numbers, the new average is 18.25.

What is the value of n?

A. 15
B. 16
C. 17
D. 18
E. 19

33. The measures of the interior angles in a hexagon are respectively $(2x + 1)°$, $(x + 15)°$, $(3x)°$, $(3x - 18)°$, $(2x - 5)°$, and $(x + 7)°$. If y is the measure of one angle in a regular nonagon, which regular polygon will have $(x + y)°$ as a measure of one of its interior angles?

A. 18-gon
B. 100-gon
C. 180-gon
D. 200-gon
E. No regular polygon has $(x + y)°$ as a measure of its interior angle.

34. The sum of three consecutive odd integers is 609. What is the greatest integer between these three integers?

A. 199
B. 201
C. 205
D. 207
E. 209

35. Which of the following is not the equation of a line perpendicular to the line of equation $4y = -16x + 1$?

A. $4y - x - 12 = 4$

B. $-16y + 4 = 4 - 4x$

C. $2(4x + 1) = 4(8y - 5)$

D. $8(4x^2 - x) = 32(-y + x^2 - 4)$

E. $3y - 5 = -\frac{3}{4}x + 1$
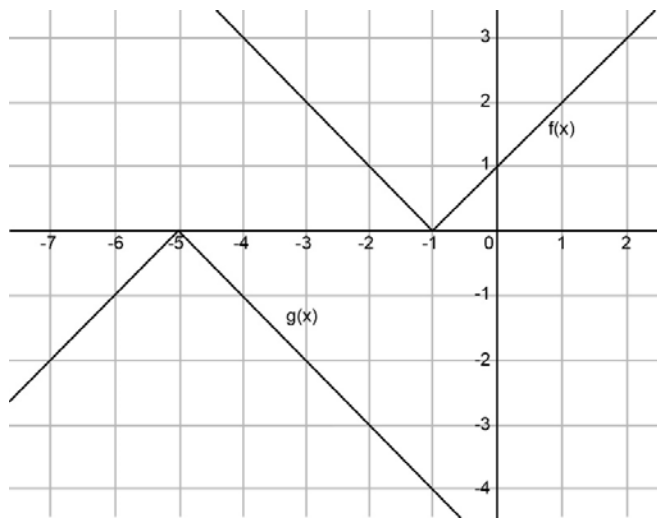
36. Explain what was done to the graph of $f(x)$ to get the graph of $g(x)$.

A. Reflection over the y-$axis$, then shifting 4 steps to the left
B. Reflection over the x-$axis$, then shifting 4 steps to the left
C. Reflection over the x-$axis$, then shifting 4 steps to the right
D. Horizontal compression, followed by reflection over the x-$axis$, then shifting 4 steps to the left
E. Horizontal compression, followed by reflection over the x-$axis$, then shifting 4 steps to the right

37. All the following statements are true except

A. An equilateral triangle is also isosceles.
B. A right triangle cannot have an obtuse angle.
C. A square cannot be similar to another square.
D. An isosceles triangle can be obtuse.
E. A right triangle cannot have three congruent sides.

38. Which of the following cannot be the length of the third side in a triangle given that the two other sides have lengths equal to $8.5\ cm$ and $11.4\ cm$?

A. $4\ cm$
B. $10\ cm$
C. $14\ cm$
D. $19\ cm$
E. $20\ cm$

39. $10, 10, 15, 18, 18, 21, 22, 30, 33$

Which of the following is not true regarding the set of data above?

A. The sum of the mean and median is an irrational number.
B. The range is equal to 23.
C. The sum of the numbers in this data is a prime number.
D. The median is 18.
E. There are two modes in this set of data.

40. What is the value of x if $\sin\left(\frac{\pi}{2} - x\right) - \cot\left(\frac{\pi}{2} - x\right) = \frac{\sqrt{3}}{6}$?

A. $x = \frac{\pi}{2}$

B. $x = \frac{\pi}{4}$

C. $x = \frac{\pi}{5}$

D. $x = \frac{\pi}{6}$

E. $x = \frac{\pi}{8}$

41. What is the domain of the function $f(x) = \sqrt{\frac{x^2 - 1}{x + 5}}$?

A. $(-5, -1) \cup [1, +\infty)$
B. $(-5, -1] \cup [1, +\infty)$
C. $(-5, -1) \cup (-1, +\infty)$
D. $(-\infty, -5) \cup [1, +\infty)$
E. $(-5, -1] \cup (1, +\infty)$

42. Which of the following could be the lengths of the sides of a right triangle?

A. $\sqrt{2}, 5, \sqrt{3}$

B. $\sqrt{2}, 4, 2\sqrt{2}$

C. $3.5, 8, \frac{\sqrt{305}}{3}$

D. $\sqrt{3}, 6, \sqrt{39}$

E. $3, 5, 9$

43. A man drove his car $70\ km$ with an average speed of $80\ km/h$, stopped at a restaurant for two hours, then drove $55\ km$ with an average speed of $60\ km/h$. If he left his house at the beginning at $9{:}00$ a.m., approximately at what time did he reach his destination?

A. $11{:}30$ a.m.
B. $12{:}47$ p.m.
C. $12{:}55$ p.m.
D. $01{:}35$ p.m.
E. $01{:}47$ p.m.

13

44. $f(x) = x^2 + 4x - 1$

$g(x) = -2x^2 - 4x + 2$

The graphs of the two functions above intersect at two points. The point of intersection, such that $x < 0$, is the vertex of the graph of a third function $h(x)$ whose y-intercept is the same as the y-intercept of g.

Which of the following is the correct equation of h?

A. $3h(x) = 2x^2 + 12x + 6$

B. $h(x) = 2x^2 + 4x + 1$

C. $3h(x) = 2x^2 + 12x + 2$

D. $3h(x) = -2x^2 + 12x - 2$

E. $h(x) = 2x^2 + 12x - 6$

45. $\dfrac{x+1}{x^2 + 2x - 1} = \dfrac{3x + 4}{2x - y}$

In reference to the equation above, which of the following represents the expression of y in terms of x?

A. $y = \dfrac{3x^3 + 8x^2 + 9x - 4}{-x - 1}$

B. $y = \dfrac{3x^3 + 8x^2 + 3x + 4}{-x - 1}$

C. $y = \dfrac{3x^3 - 8x^2 + 3x - 4}{-x - 1}$

D. $y = \dfrac{3x^3 + 12x^2 + 3x - 4}{-x - 1}$

E. $y = \dfrac{3x^3 + 8x^2 + 3x - 4}{-x - 1}$

46. Johan has two bags. The first bag contains 2 red and 7 white balls, while the second contains 4 red and 5 white balls. One of the bags is selected randomly, and a ball is drawn from this bag. If the ball drawn is white, what is the probability that it is drawn from the second bag?

A. $\dfrac{5}{12}$

B. $\dfrac{1}{2}$

C. $\dfrac{5}{9}$

D. $\dfrac{7}{9}$

E. $\dfrac{70}{81}$

14

47. $\begin{cases} y = \dfrac{-36 + ax}{12} \\ \dfrac{x}{3} = -3 - y \end{cases}$

What should be the value of a in the above system of equations so that it has infinite number of solutions?

A. 4
B. 3
C. −2
D. −3
E. −4

48. $\begin{bmatrix} 1 & 0 & -5 \\ 3 & -3 & 3 \\ 4 & 7 & 1 \end{bmatrix}$

What is the determinant of the matrix above?

A. 189
B. 144
C. 98
D. −144
E. −189

49. A right trapezoid with bases equal to $7\ cm$ and $12\ cm$ has an area equal to the area of a triangle with a base equal to $5\ cm$ and a height of $4.2\ cm$.

What is the length of the height of the trapezoid?

A. $0.25\ cm$
B. $0.905\ cm$
C. $1.105\ cm$
D. $1.782\ cm$
E. $2.333\ cm$

50. What is the probability of selecting the letter E from the letters in the word "Hostesses"?

A. $\dfrac{1}{3780}$

B. $\dfrac{2}{9}$

C. $\dfrac{1}{4}$

D. $\dfrac{2}{7}$

E. $\dfrac{1}{2}$