EST I – Math

Student's Name _____

National ID _____

Test Center _____

Duration: 90 minutes

Test sections: I- Calculator is not required, II – Calculator is required

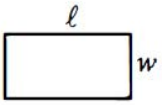
45 Multiple Choice Questions and 13 Short Constructive Response Questions

Instructions:

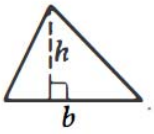
- Place your answer on the answer sheet. Mark only one answer for each of the multiple choice questions.
- Write your final result only on the answer sheet for the constructive response questions.
- Avoid guessing. Your answers should reflect your overall understanding of the subject matter.
- Calculator 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.

Reference:

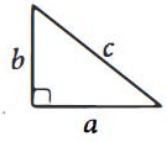
$A = \pi r^2$
$C = 2\pi r$



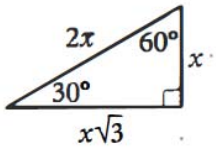
$A = \ell w$

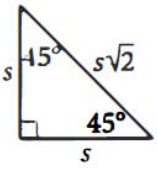


$A = \frac{1}{2}bh$

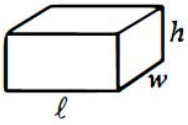


$c^2 = a^2 + b^2$

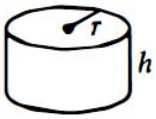




Special Right Triangles



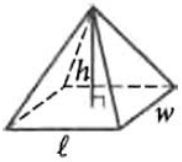
$V = \ell wh$



$V = \pi r^2 h$

$V = \frac{4}{3}\pi r^3$

$V = \frac{1}{3}\pi r^2 h$



$V = \frac{1}{3}\ell wh$

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

Section I
Calculator is not required
(30 minutes)

1. Given $2x - 8 = 3y + 4$, what is the value of x if y is equivalent to the square of 2?

A. 4
B. 8
C. 12
D. 24

2. Amina went to the flower shop and bought 2 roses and 5 daisies for 6 EGP. Lara bought from the same shop, 4 roses and 2 daisies for 4 EGP. How much should Ahmad pay to buy 2 roses and 2 daisies?

A. 1 EGP
B. 1.5 EGP
C. 2 EGP
D. 3 EGP

3. What is the simplified form of $2(3i - 7) + i(2i - 1)$ given that $i = \sqrt{-1}$?

A. $-16 + 7i$
B. $-14 + 3i$
C. $-16 + 5i$
D. $-15 + 4i$

4. If $\frac{2a-1}{b} = 6$, what is the value of $a - 3b$? $(b \neq 0)$

A. 0.5
B. 1
C. 2
D. 3

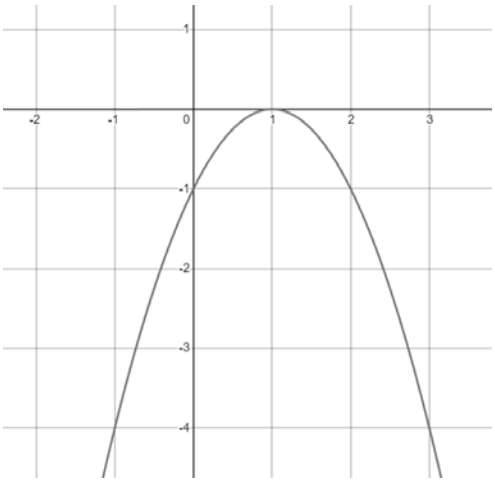
5. Given $f(x) = x^2 + 3x - 1$, and $g(x) = 2x - 1$, what is the equivalent expression representing $f(g(x))$?

A. $2x^2 + 2x - 3$
B. $4x^2 + 2x - 3$
C. $2x^2 + 4x - 1$
D. $4x^2 + 4x - 1$

6. The equation of a line is $\frac{2}{x} - \frac{3}{y-1} = 0$. What is the slope of the line?

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

Questions 7-8 refer to the following graph.



7. Which of the following statement(s) is/are true regarding the graph above?

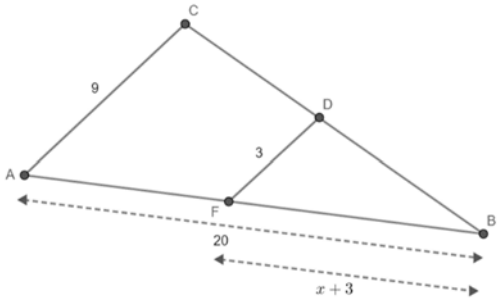
I. The coordinates of the vertex of the parabola are $(1;\ 0)$.
II. The axis of symmetry is at $x = -1$.
III. The equation of the parabola is $y = -x^2 + 2x - 1$.

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

8. What is the equation of the tangent to this parabola at the vertex?

A. $x = 0$
B. $y = 0$
C. $y = x$
D. $y = -x$

9. Using the figure below, what is the value of $3x - 1$ if $\overline{AC}$ is parallel to $\overline{FD}$? (figure not drawn to scale)



A. $\frac{8}{3}$
B. 8
C. 10
D. 32

10. The distance between Giza and Luxor is approximately 500 Km. To travel that distance, Bilal received offers from 4 different taxi companies:

	Fixed Amount (EGP)	Amount per 25 Km (EGP)
Taxi "A"	160	15
Taxi "B"	210	13
Taxi "C"	185	14
Taxi "D"	150	16

Which company gave Bilal the cheapest offer?

A. Taxi "A"
B. Taxi "B"
C. Taxi "C"
D. Taxi "D"

11. In order to prepare for the boxing tournament, Jamison needs to work out for at least 90 hours during the next 3 weeks. In the first week, he practiced for 42 hours, and decided to divide the rest of the hours equally over the next two weeks. How much should he practice minimum each week?

A. 12 hours
B. 24 hours
C. 46 hours
D. 48 hours

12. Given $f(x) = 2x^2 + ax - 1$. What is the value of a if the axis of symmetry of the graph of f is equal to -2.5 ?

A. -10
B. 5
C. 10
D. 20

13. If $3 < 2x + 7 \leq 15$, which of the following integers represents the smallest value for $x + 3$?

A. 1
B. 2
C. -2
D. -1

14. Given $\frac{d^2 - 4m^2}{2d + 4m} = \frac{3}{8}$. What is the value of $\boldsymbol{d - 2m}$?

A. $\frac{3}{8}$
B. $\frac{3}{6}$
C. $\frac{3}{4}$
D. $\frac{3}{16}$

15. Which of the following is the equation of the line perpendicular to the line with equation $2x - 3y = -1$ and passing through the midpoint of segment $\overline{AB}$ given $A(2;\ 7)$ and $B(-1;\ 3)$?

A. $y = \frac{2}{3}x + \frac{14}{3}$

B. $y = \frac{2}{3}x + \frac{16}{3}$

C. $y = -\frac{3}{2}x + \frac{17}{4}$

D. $y = -\frac{3}{2}x + \frac{23}{4}$

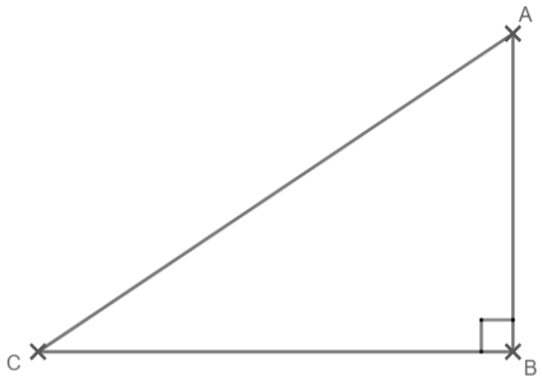
16. What is the value of $m + \frac{3}{4}$ if $4^{2m+1} = 32^3$? (Grid-in)

17. What is the product of the solutions of the equation $x^2 - 3x = -2$? (Grid-in)

18. The function $y = 2x^2 + dx - 1$ has zero at $x = -2$. What is the value of d ? (Grid-in)

19. If $\frac{1}{x-1} - \frac{1}{x+1} = 1$, and $x \neq \pm 1$, what is the value of $11x^2$?(Grid-in)

20. In triangle ABC, $\sin C = 0.5$.
What is the measure of $\angle A$?
(figure not drawn to scale)(Grid-in)



Section II
Calculator is required
(60 minutes)

1. If f is a linear function with $f(0) = \frac{1}{2}$ and $f(-3) = -\frac{3}{2}$, what is the value of $f(3)$?

A. 0.5
B. 1.5
C. 2.5
D. 5

Questions 2-3-4 refer to the following information.

The table below shows the distance Amir walked every day during the first week of April, 2021.

	Distance (in m)
Thursday, April 1st	1678
Friday, April 2nd	2091
Saturday, April 3rd	1245
Sunday, April 4th	1566
Monday, April 5th	2100
Tuesday, April 6th	1989
Wednesday, April 7th	1888

2. What is the average (arithmetic mean) of the data shown in the table?

A. 2511.4
B. 1888
C. 1793.9
D. 1672.5

3. If on Thursday, April 8th, Amir walked the same distance he did the second day of April with an addition of 20%. What is the distance he walked?

A. 4182 m
B. 2509.2 m
C. 2420.6 m
D. 2007.6 m

4. By what approximate percent did Amir increase the distance he walked from April 3rd to April 5th?

A. 34%
B. 60%
C. 67%
D. 69%

5. What is the vertex form of the function $f(x) = 3x^2 - 9x + 1$?

A. $f(x) = 3\left(x - \frac{3}{2}\right)^2 - \frac{23}{4}$
B. $f(x) = 3\left(x - \frac{3}{2}\right)^2 + \frac{23}{4}$
C. $f(x) = 3\left(x + \frac{3}{2}\right)^2 - \frac{23}{4}$
D. $f(x) = 3\left(x + \frac{3}{2}\right)^2 + \frac{23}{4}$

6. In a village, 25% of the residents own a German Shepherd, 45% own a Swiss Shepherd, and 35% do not own a dog. Which of the following statement(s) is/are correct?

I. 11% of the residents own both a German Shepherd and a Swiss Shepherd at the same time.

II. If we select a resident randomly, the probability of him having a Swiss Shepherd even though he has a German Shepherd is 0.8.

III. If we select a resident randomly, the probability of him having a Swiss Shepherd even though he has a German Shepherd is 0.05.

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

7. Which of the following is equivalent to $\frac{4m\sqrt{3a} - 2\sqrt{27am^2} + m\sqrt{12a}}{\sqrt{243a^5}}$ for all positive values of a and m ?

A. $\frac{2m}{9a^2}$

B. $\frac{m}{9a^2}$

C. $-\frac{m}{9a^2}$

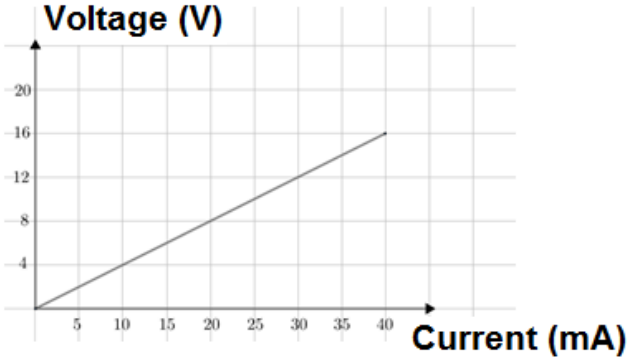
D. 0

8. The sum of two numbers is 119. The product of the two numbers is 3430. What is half the greater number?

A. 24.5
B. 35
C. 49
D. 70

Questions 9-10 refer to the following information.

The resistance (R) of a resistor is expressed by $R = \frac{U}{I}$ with U as the voltage in volts (V), and I as the current in amperes (A). The linear graph below represents the characteristic current-voltage (U-I) of a resistor.



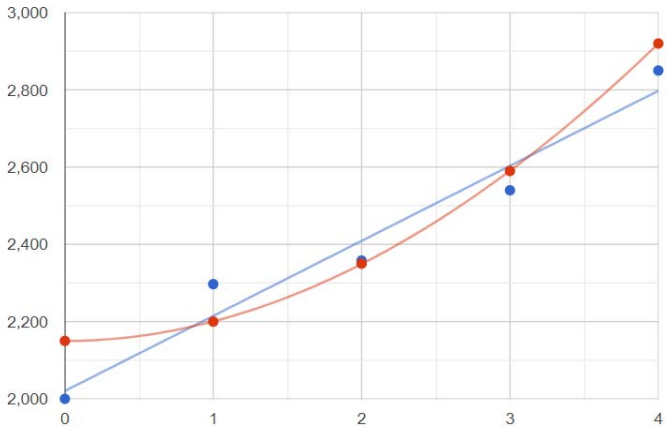
9. According to the graph, what is the value of the resistance of the resistor?

A. 400 Ω
B. 140 Ω
C. 4 Ω
D. 0.4 Ω

10. What is the inverse of the function shown in the graph above?

A. $U = 0.4I$
B. $U = \frac{I}{400}$
C. $U = \frac{I}{4}$
D. $U = 400I$

Questions 11-12 refer to the following information below.



The scatterplot above shows how many boys there are in two different villages and the changes in numbers since year 2011. The cubic curve of best fit, representing the number of boys in village A, has the following equation: $y = -0.83\,x^3 + 51.43x^2 + 0.12x + 2149.86$. The line of best fit, representing the number of boys in village B, has the following equation: $y = 194.3x + 2020.4$.

11. At which date did the two villages have approximately the same number of boys?

A. At the end of year 2011
B. 2012
C. 2013
D. At the beginning of year 2014

12. What is the closest difference between the actual number of boys in village B and the number which can be predicted from the line of best fit in 2014?

A. 13
B. 26
C. 53
D. 100

13. A bag contains 3 green balls, 5 red balls, 8 blue balls, and 4 yellow balls. What is the value of the square of the probability of choosing a yellow or a red ball from the bag?

A. 0.2025
B. 0.45
C. 0.671
D. 0.9

14. Brenda went to the mall on a sale day, and bought all the items shown in the table below. If all the items were on a 35% sale except for the socks which were on a 15% sale, how much would she pay if she bought the items on a non-sale day?

Item	Price (in $)
T-shirt	25.6
Pants	35.25
Shoes	50.22
Jacket	71.21
Socks	11.44

A. $ 193.72
B. $ 259.23
C. $ 261.52
D. $ 293.89

Questions 15-16 refer to the following information.

Intensity is the measure of the energy transmitted by a wave. Usually, it depends on the strength and the amplitude of a wave and its unit is Watts per square meters. The formula of intensity is given by $I = \frac{P}{A}$, where P is the power (in Watts), and A is the area of the cross section (in square meters).

15. What is the formula for the radius (R) of a circular surface in terms of I and P ?

A. $R = \frac{P}{I}$

B. $R = \frac{P}{I\pi}$

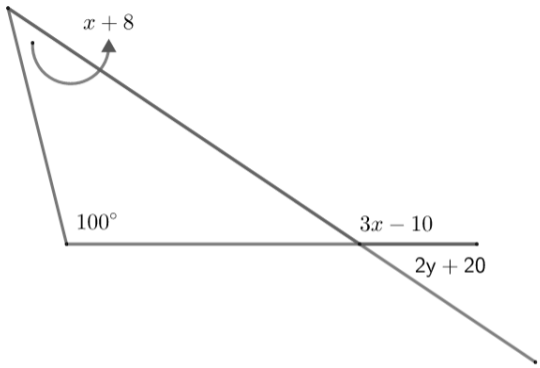
C. $R = \sqrt{\frac{P}{I}}$

D. $R = \sqrt{\frac{P}{I\pi}}$

16. Which of the following cannot be the value of the radius of the circular surface if the intensity of light incident to normal to the surface from a source of $110\ W$ power of light, is greater than $1.2 \times 10^4\ W/m^2$?

A. 5.45 cm
B. 5.35 cm
C. 5.25 cm
D. 5.15 cm

17. Using the figure below, what is the value of y? (figure not drawn to scale)



A. 80
B. 59
C. 3.5
D. -3.5

18. Given that $A(2,5), B(9,-2)$ and $J(4,h)$ lie on the same line, what is the value of h?

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

19. Which of the following systems has infinite number of solutions?

A. $\begin{cases} 2x - 3y = 1 \\ x + 3y = 4 \end{cases}$

B. $\begin{cases} -2x + y = -1 \\ 5y = -2x \end{cases}$

C. $\begin{cases} 3x + y = 2 \\ x = -5y \end{cases}$

D. $\begin{cases} -2x - 2y = 4 \\ y = -x - 2 \end{cases}$

20. How many different integers between 15 and 45 contain only digits from the following list: $1, 3, 5, 7, 9$?

A. 16
B. 7
C. 6
D. 5

21. Which quadratic function has its graph passing through the points $(3, 0), (-2, 0)$, and $(1, 7)$?

A. $f(x) = \frac{7}{6}x^2 + \frac{7}{6}x + 7$
B. $f(x) = -\frac{7}{6}x^2 + \frac{7}{6}x + 7$
C. $f(x) = -\frac{7}{6}x^2 - \frac{7}{6}x + 7$
D. $f(x) = \frac{7}{6}x^2 - \frac{7}{6}x + 7$

22. Alonso used the table below to graph the sets of ordered pairs shown. What is the type of the graph drawn and which equation best models it?

x	-7	-4	-2	1	7
y	-11	-5	-1	5	17

A. Linear function: $y = 2x + 3$
B. Linear function: $y = -2x + 3$
C. Quadratic function: $y = x^2 + 4x - 32$
D. Quadratic function: $y = -2x^2 - 10x + 17$

23. A school conducted a survey on the brand of the phone its employees are using. The survey data is shown in the table below:

	Huawei	Samsung	IPhone	Other brands
Staff	13	15	20	3
Teachers	22	56	44	7

What is the percentage of staff members using IPhone out of all the employees?

A. 39.2%
B. 31.25%
C. 11.11%
D. 9%

24. Given that the two lines $(d): 2x + ty = -1$ and $(m): -3x - gy = 2$ are perpendicular, and t and g are constants, what is the value of $-5tg$?

A. -30
B. -6
C. $\frac{3}{2}$
D. 30

25. Which of the following points is not a solution to $|2x - 1| > 3y$?

A. $(4, 2)$
B. $(2, 1)$
C. $(-1, -1)$
D. $(-2, 1)$

26. Given $2x - 7 < 5$ and $\frac{3x}{2} - 2 > \frac{19}{4}$, what is the only integer x that satisfies both inequalities?

A. 3
B. 4
C. 5
D. 6

27. What is twice the remainder of the division of $(2x^3 - 1 + 3x^2)$ by $(2x - 3)$?

A. 4.5
B. 12.5
C. 25
D. 26

28. A telecommunication company offers 4 different monthly packages of internet subscription to its customers.
The first package is for \$12 in which the customer will benefit from 1200 MBs internet in addition to 400 MBs gift after 3 consecutive months of subscription.
The second package is for \$16 in which the customer will benefit from 2000 MBs internet in addition to 550 MBs gift after 3 consecutive months of subscription.

The third package is for \$25 in which the customer will benefit from 3400 MBs internet in addition to 800 MBs gift after 5 consecutive months of subscription.
The fourth package is for \$30 in which the customer will benefit from 4000 MBs internet with no addition.
If Abdallah wants to choose the cheapest offer for him for the next 3 months, which one should he choose?

A. First package
B. Second package
C. Third package
D. Fourth package

29. If $\frac{a+2i}{3-i} = 2 - 5i$ with $i = \sqrt{-1}$, what is the value of a^2?

A. $2(19i + 180)$
B. $19i + 180$
C. $-19i - 180$
D. $-2(19i + 180)$

30. According to the data published by "Worldometer", the total cases of people infected by Covid-19 in Egypt on July 24, 2020, was 91,072, while in August 3, 2020 it went up to 94,640 cases.

If we consider the graph of the change in number of total cases over the change in days is linear, what will be the total cases reported in August 9, 2020? (Note that there are 31 days in July).

A. 96,781 cases
B. 97,138 cases
C. 98,208 cases
D. 101,776 cases

31. If h varies inversely as k, and $h = 9$ when $k = 20$, what is the value of $k + 4$ when $h = 15$? (grid-in)

32. Given the points $A(1; 4), C(-4; -1), B(4; 1)$, and $R(-1; -4)$, what is the value of the area of quadrilateral $ABRC$? (grid-in)

Questions 33-34 refer to the following information.

A company decided to create brochures to introduce their products. The printing house responsible for designing and printing the brochures will charge the company \$79 for the design with 44 cents for each brochure printed.

33. If the company decided to print 2000 brochures, how much should they pay? (grid-in)

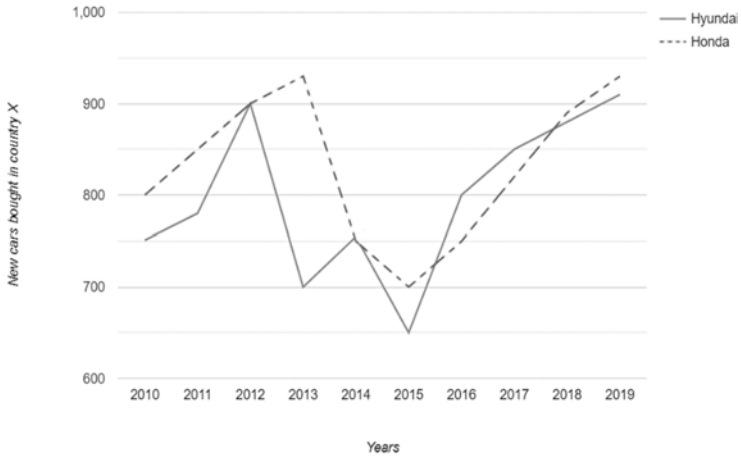
34. The maximum budget put by the company for the brochures is \$1,950. How many brochures at most can they print? (grid-in)

35. Lucas bought a car for \$3,500. He lost 12% of its price when he sold it for Brad, while Brad won 5% of what he paid when he sold it to Amira. How much did Amira pay for the car? (grid-in)

36. In 2010, at a school, 3:5 of the seniors wanted to celebrate their prom night at restaurant X, while 30% of the rest voted for restaurant Y, and the 84 students left voted for restaurant Z. How many senior students voted for restaurant X? (grid-in)

Questions 37-38 refer to the following information.

The graph below shows the number of new cars of the two brands Hyundai and Honda, bought by the citizens in country X during years 2010 and 2019.



37. According to the graph, how much was the percent decline of buying a new Honda from 2010 to 2015? (grid-in)

38. After the first tie between the number of cars bought of the two brands, how many years did it take Hyundai to sell 50 more cars than Honda in country X? (grid-in)