

CERT - Grade 12 - MATHEMATICS TEST 1

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer sheet.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may be best done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed:

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

-
1. Linda purchased $1\frac{1}{2}$ pounds of potatoes on Friday and $2\frac{1}{3}$ pounds of potatoes on Saturday. What was the total weight, in pounds, of potatoes purchased by Linda in the two-day period?

- A. $3\frac{1}{6}$
- B. $3\frac{2}{3}$
- C. $3\frac{1}{3}$
- D. $3\frac{2}{3}$
- E. $3\frac{5}{6}$

2. $2x^2 \cdot 2x^3y \cdot 3x^2y$ is equivalent to:

- F. $7x^7y^2$
- G. $7x^{12}y^2$
- H. $12x^7y^2$
- J. $12x^{12}y$
- K. $12x^{12}y^2$

3. There are a total 12,715 seats in an arena. Of the total, 7,512 seats are currently occupied by spectators. How many seats, to the nearest percent, are currently occupied?

- A. 12
- B. 52
- C. 59
- D. 61
- E. 75

4. A gardener wants to use rope to section off a rectangular plot of land to grow vegetables. The plot measures 11 feet by 15 feet. Assuming no waste and that no extra rope is required to tie the ends, what is the minimum number of feet of rope the gardener will need to section off the plot of land?

- F. 26
- G. 52
- H. 104
- J. 139
- K. 165

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5. In the first 4 of 5 consecutive days, Martha delivered 144, 152, 139, and 171 newspapers. How many newspapers did Martha deliver on the fifth day, if the average number of newspapers she delivered per day during the five-day period was 155?

- A. 154
- B. 162
- C. 169
- D. 171
- E. Given the number of newspapers delivered by Martha on the first four days, she cannot average 155 per day for the five-day period.

6. Mr. Lee regularly spends a total \$145 commuting to work by train Monday through Friday. On Wednesday of a given five-day week, however, Mr. Lee decides to commute to work by car, instead of by train. If the cost of commuting by car is \$7, how much money does Mr. Lee save commuting to work that week? (Assume the regular train fare is the same each day of the week.)

- F. \$ 7
- G. \$ 12
- H. \$ 22
- J. \$138
- K. \$143

7. If x is a real number such that $x^3 = 125$, then $x^2 - \sqrt{5x} = ?$

- A. 0
- B. 5
- C. 10
- D. 20
- E. 25

8. The expression $a[(b - c) + d]$ is equivalent to:

- F. $ab - ac + ad$
- G. $ab - ac - ad$
- H. $b - c + ad$
- J. $ab + ac + ad$
- K. $ab + ac - ad$

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9. If $5x + 7 = 8x - 3$, then $x = ?$

- A. $-\frac{10}{3}$
- B. $-\frac{10}{13}$
- C. $\frac{3}{10}$
- D. $\frac{10}{13}$
- E. $\frac{10}{3}$

10. If a coin is randomly chosen from a bag that contains exactly 4 pennies, 3 nickels, and 8 dimes, what is the probability that the coin will NOT be a nickel?

- F. $\frac{1}{5}$
- G. $\frac{1}{4}$
- H. $\frac{3}{4}$
- J. $\frac{4}{5}$
- K. $\frac{5}{4}$

11. If the difference between the consecutive numbers in the sequence below is the same, which two numbers should be placed in the blanks?

19, ____, ____, 37

- A. 25, 31
- B. 22, 25
- C. 24, 32
- D. 26, 33
- E. 28, 36

12. A spherical rubber ball has a diameter of $2\frac{1}{3}$ inches. If the formula for the volume of a sphere with radius r is $V = \frac{4}{3}\pi r^3$, what is the volume of the ball to the nearest cubic inch?

- F. 3
- G. 7
- H. 9
- J. 10
- K. 21

13. In the table below, the sums of the integers in each row, column, and diagonal are equal. Which of the following integers accurately expresses the value of x ?

| | | |
|----|----|-----|
| 2 | 9 | x |
| -1 | 3 | 7 |
| 8 | -3 | 4 |

- A. 2
 B. 1
 C. 0
 D. -1
 E. -2
14. The matrix below summarizes the number of students who tried out for various sports teams Central High School.

| | soccer | lacrosse | track | tennis | |
|---|--------|----------|-------|--------|---|
| [| 60 | 40 | 46 | 30 |] |

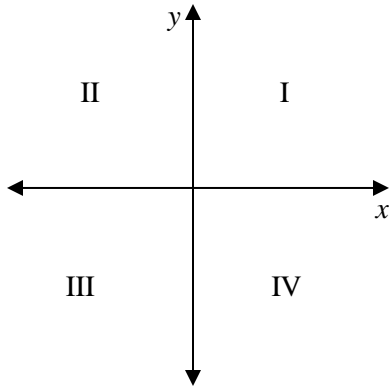
The following matrix represents the percentage of students who were ultimately chosen to participate in each of the four sports.

| | |
|----------|------------------------------------------------------|
| soccer | $\begin{bmatrix} 30 \\ 40 \\ 50 \\ 40 \end{bmatrix}$ |
| lacrosse | |
| track | |
| tennis | |

Given the two matrices, what is the total number of students accepted to participate on the four sports teams at Central High School?

- F. 47
 G. 50
 H. 62
 J. 69
 K. 72
15. A manufacturer needs 57 pounds of grapes to make 24 cartons of raisins. How many pounds of grapes would the manufacturer need to make 16 cartons of raisins?
- A. 28
 B. 33
 C. 38
 D. 40
 E. 41

16.



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Point A, not shown, is in one of the four quadrants of the xy -coordinate plane above. If the x and y coordinates of point A are both negative, in which quadrant must A be located?

- F. Quadrant I
- G. Quadrant II
- H. Quadrant III
- J. Quadrant IV
- K. Quadrants II or IV

17. Which of the following is a solution of the equation

$$x^2 - 16x = 0?$$

- A. -4
- B. 4
- C. 12
- D. 16
- E. 20

18. A sandwich shop has 2 types of bread, 3 types of cheese, and 5 types of meat. How many different sandwiches can be made using one type of bread, one type of cheese, and one type of meat?

- F. 10
- G. 16
- H. 20
- J. 26
- K. 30

19. Given $A = \frac{3}{4}B + 0.23$ and $A = 0.65$, what is the value of B?

- A. 0.30
- B. 0.48
- C. 0.56
- D. 0.67
- E. 0.76

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Use the information that follows to answer questions 20-21.

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The following chart represents the current enrollment in three art classes at a community college.

| Course Title | Day | Time | Enrollment |
|---------------|-----|-------|------------|
| Basic Drawing | Mon | 9 am | 21 |
| | Wed | 9 am | 26 |
| | Fri | 9 am | 22 |
| Watercolors | Mon | 11 am | 28 |
| | Wed | 9 am | 24 |
| Art History | Fri | 11 am | 27 |

20. What is the average number of students enrolled per day in the Basic Drawing class?

- F. 23
- G. 24
- H. 25
- J. 26
- K. 69

21. Room 12 of the community college can be occupied by a maximum 30 students. All but one of the art classes meets in Room 12. Such class cannot meet in Room 12 due to a scheduling conflict. On which day and at what time does the conflict occur?

- A. Monday at 9 am
- B. Friday at 9 am
- C. Monday at 11 am
- D. Wednesday at 9 am
- E. Friday at 11 am

22. If a rectangular plot measures 36 feet by 15 feet, what is the length, in feet, of the diagonal of the plot?

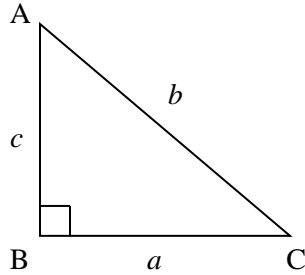
- F. 39
- G. 47
- H. 51
- J. 126
- K. 540

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23. For right triangle ABC below, what is the $\cos A$?

DO FIGURING HERE

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



24. Which of the following is the slope-intercept form of $9x + y - 3 = 0$?

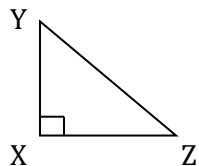
- F. $y = -9x - 3$
- G. $y = -9x + 3$
- H. $y = 9x - 3$
- J. $y = 3x - 9$
- K. $y = 3x + 9$

25. For all positive integers a, b, and c, which of the following expressions equals $\frac{a}{c}$?

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

26. Right triangle XYZ below has a hypotenuse that is 12 inches long. If $\sin Z = \frac{3}{4}$, how long is \overline{XY} , in inches?

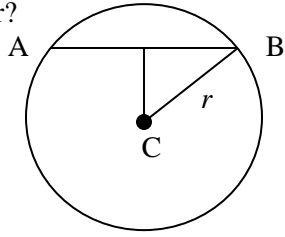
- F. 4
- G. 7
- H. 8
- J. 9
- K. 16



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27. Line AB intersects circle C at points A and B, as shown, and is 12 cm long. If line AB is 2 cm from the center of the circle C, what is the radius of circle C to the nearest tenth of a centimeter?



- A. 7.5
- B. 6.3
- C. 5.2
- D. 4.0
- E. 3.4

28. Points Q, R, S, and T lie on \overline{QT} as shown below. Given that \overline{QT} is 20 units long, \overline{QS} is 18 units long, and \overline{RT} is 9 units long, what is the unit length of \overline{RS} ?



- F. 7
- G. 8
- H. 10
- J. 11
- K. It cannot be determined based on the information given.

29. Lines $y = 3x + 5$ and $y = 4x + 2$ intersect on a standard (x, y) coordinate plane. What is the x -coordinate of the point where the two lines intersect?

- A. 0
- B. 2
- C. 3
- D. 5
- E. 8





30. An aquarium in the shape of a rectangular box can hold 180 gallons of water when completely filled. Given that the width of the aquarium is 3 feet and its length is 7 feet, what is the minimum depth, in feet, of the aquarium? (Assume that 1 cubic foot of water is equal to 3 gallons of water.)


- F. 2.54
- G. 2.61
- H. 2.72
- J. 2.86
- K. 3.12

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31. The chart below displays information regarding the number and type of pizza delivered on a given day by a pizzeria.

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| Type of Pizza | Number Delivered |
|---------------|-----------------------------------------------------------------------------------|
| Pepperoni |  |
| Cheese |  |
| Mushroom |  |
| Sausage |  |

 = 10 Pizzas

According to the chart, what fraction of the pizzas delivered were mushroom?

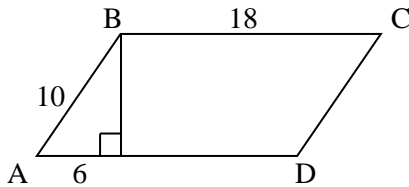
- A. $\frac{1}{12}$
- B. $\frac{1}{10}$
- C. $\frac{1}{6}$
- D. $\frac{1}{3}$
- E. $\frac{1}{2}$
32. If $2a = 2b + 4$, then $(b - a)^3 = ?$
- F. -8
- G. -4
- H. -2
- J. 8
- K. 16
33. For all real numbers R and S, if $R = 2S + 10$, then $S = ?$
- A. $\frac{R}{2} - 10$
- B. $\frac{R}{2} + 10$
- C. $\frac{R}{2} - 20$
- D. $\frac{R + 10}{2}$
- E. $\frac{R - 10}{2}$

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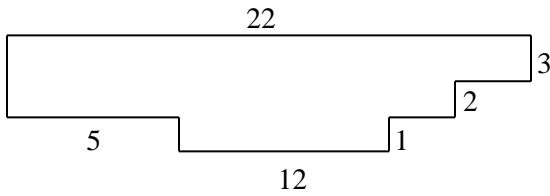
34. A 12-foot ladder is leaning against the wall of a building. If the bottom of the ladder touches the ground 5 feet from the base of the building, approximately how far is the top of the ladder from the base of the building?
- F. 9
 - G. 11
 - H. 12
 - J. 13
 - K. 15

35. Given the diagram as labeled below, what is the area, in square units, of parallelogram ABCD?



- A. 40
 - B. 72
 - C. 80
 - D. 110
 - E. 144
36. The ratio of the lengths of the sides of a triangle is 6:8:9. The longest side of a second, similar triangle is 12 cm in length. What is the length, in centimeters, of the shortest side of the second triangle?
- F. 6
 - G. 8
 - H. 9
 - J. 10
 - K. The length cannot be determined based on the information given.
37. The larger of two numbers exceeds 3 times the smaller number by 6. The sum of 3 times the larger number and twice the smaller number is 62. Which equation correctly identifies x as the smaller number?
- A. $3(3x + 6) + 2x = 62$
 - B. $3(3x - 6) + 2x = 62$
 - C. $3(3x + 6) + 3x = 62$
 - D. $2(3x + 6) + 2x = 62$
 - E. $(3x + 6) + 3x = 62$

38. In the figure below, all angles shown are right angles and the line segment lengths are given in centimeters. What is the perimeter of the figure, in centimeters?



- F. 42
- G. 48
- H. 52
- J. 56
- K. 58

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Use the information that follows to answer questions 39-41.

For all $x \neq 0$:

$$f(x) = 2x - 8$$

$$h(x) = x^2 + 4$$

$$g(x) = 2x^0$$

39. $h(2) - g(3) + f(-2) =$

- A. -6
- B. -5
- C. 0
- D. 2
- E. 3

40. $f(h(g(x))) =$

- F. $(4x^2 - 16)^0$
- G. $2(4x^2 - 16)^0$
- H. $8x^2 + 4$
- J. 8
- K. 0

41. If $p(x) = 4x^2 - 32x + 68$, then $p(x) =$

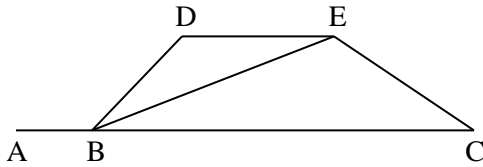
- A. $h(g(x))$
- B. $h(h(x))$
- C. $h(f(x))$
- D. $f(g(x))$
- E. $f(h(x))$

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42. In the figure below, BCED is a trapezoid and points A, B, and C are collinear. If the measure of angle ABD is 110° and the measure of angle DEB is 30° , what is the measure of angle DBE?

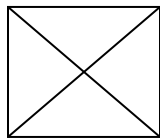
- F. 15°
- G. 30°
- H. 35°
- J. 40°
- K. 60°



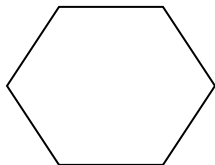
43. Of the total 365 cookies baked one day, $\frac{3}{5}$ were chocolate chip. If $\frac{1}{3}$ of the chocolate chip cookies also had walnuts, how many chocolate chip cookies with walnuts were baked?

- A. 65
- B. 70
- C. 73
- D. 82
- E. 90

44. A square has two diagonals as shown below.



How many diagonals does the hexagon below have?



- F. 0
- G. 3
- H. 6
- J. 7
- K. 9

45. If 135% of a number is 540, what is 65% of the number?

- A. 260
- B. 280
- C. 300
- D. 320
- E. 400

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46. Which of the following complex numbers is equivalent to $\frac{1}{1-i} \cdot \frac{1+i}{1+i}$, where $i^2 = -1$?
- F. $2 + i$
 - G. $1 + i$
 - H. $1 - i$
 - J. $(1+i)/2$
 - K. $(1-i)/2$
47. In a standard (x, y) coordinate plane, what is the distance between the points $(1, 0)$ and $(0, 4)$?
- A. $\sqrt{19}$
 - B. $\sqrt{17}$
 - C. 16
 - D. 5
 - E. 4
48. If the ratio of the radii of two circles is 3:5, what is the ratio of area of the smaller circle to the area of the larger circle?
- F. 3:5
 - G. 6:10
 - H. 9:25
 - J. 18:50
 - K. It cannot be determined based on the information given.
49. A circle in the standard (x, y) coordinate plane is tangent to the x -axis at the point $(3, 0)$ and to the y -axis at the point $(0, 3)$. Which of the following is an equation of the circle?
- A. $x^2 - y^2 = 9$
 - B. $x^2 + y^2 = 9$
 - C. $(x - 3)^2 - (y - 3)^2 = 9$
 - D. $(x + 3)^2 + (y + 3)^2 = 9$
 - E. $(x - 3)^2 + (y - 3)^2 = 9$
50. If $\tan \theta = \frac{3}{4}$ and $\pi < \theta < \frac{3}{2}\pi$, then $\sin \theta$?
- F. $-\frac{3}{5}$
 - G. $-\frac{3}{4}$
 - H. $-\frac{5}{4}$
 - J. $\frac{3}{5}$
 - K. $\frac{5}{3}$

DO FIGURING HERE

51. Mary drew a circle graph (not shown) that included all of the various types of flowers in her garden. The garden included the following:

20% tulips;
25% daisies;
15% roses; and
10% pansies.

The last sector of her graph included the remaining flowers that were not tulips, daisies, roses, or pansies. What is the degree measure of the last sector of the circle graph?

- A. 30°
B. 35°
C. 54°
D. 108°
E. 150°
52. The chart below shows the relationship between rows and blocks. What is the total number of blocks in row n , in terms of n ?

| | | | | | | |
|-------------------------------|---|---|---|----|-----|-----|
| Row Number | 1 | 2 | 3 | 4 | ... | n |
| Total Number of Blocks in Row | 4 | 6 | 8 | 10 | ... | ? |

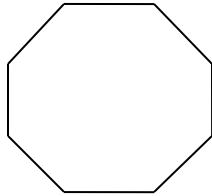
- F. $2n - 2$
G. $2n + 2$
H. $2n$
J. n^2
K. n
53. $\begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ 3 & 4 \end{bmatrix} =$
- A. $\begin{bmatrix} 2 & 0 \\ 0 & -4 \end{bmatrix}$
B. $\begin{bmatrix} 8 & 7 \\ 4 & 3 \end{bmatrix}$
C. $\begin{bmatrix} 12 & 0 \\ 0 & 0 \end{bmatrix}$
D. $\begin{bmatrix} 8 & 8 \\ -3 & -4 \end{bmatrix}$
E. $\begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$

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54. Which of the following is the set of all real numbers x , such that $2x + 2 > 2x + 4$?
- F. The set containing all real numbers.
 - G. The set containing all positive real numbers.
 - H. The set containing all negative real numbers.
 - J. The set containing only zero.
 - K. The empty set.

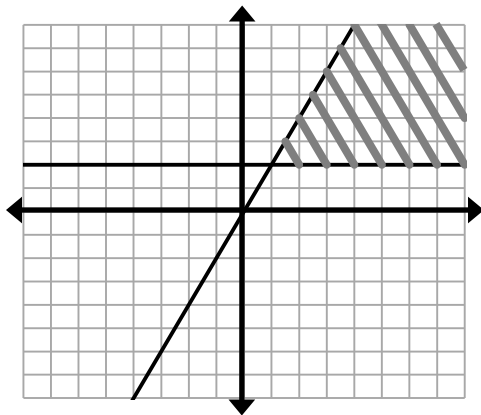
55. The figure below is an octagon with 8 equal interior angles. What is the measurement of one of the interior angles?

- A. 60°
- B. 85°
- C. 110°
- D. 135°
- E. 145°



56. If $x = t + 7$ and $y = 2 - 3t$, which of the following properly expresses y in terms of x ?
- F. $y = 23 - 3x$
 - G. $y = 23 + 3x$
 - H. $y = -23 - 3x$
 - J. $y = -19 - 3x$
 - K. $y = 19 + 3x$

57. Which system of inequalities is represented by the shaded region below?

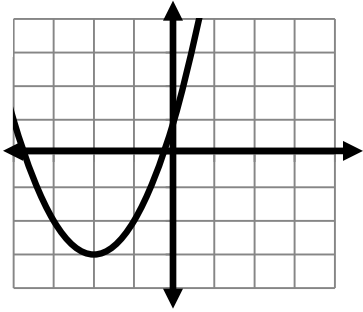


- A. $y \leq 4x$ and $y \geq 2$
- B. $y \leq 4x$ and $x \leq 2$
- C. $y \leq 2x$ and $y \geq 2$
- D. $y \leq 2x$ and $x \leq 4$
- E. $y \leq 2x$ and $x \leq 2$

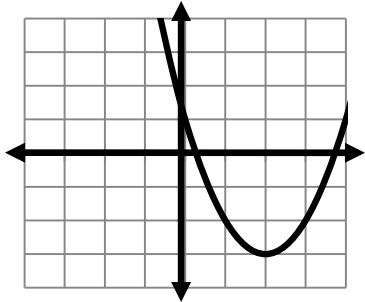
58. In the standard (x, y) coordinate plane, which of the following is the graph $y = (x + 2)^2 - 3$?

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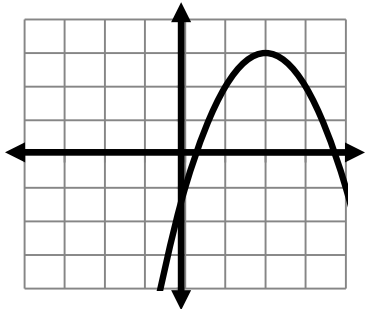
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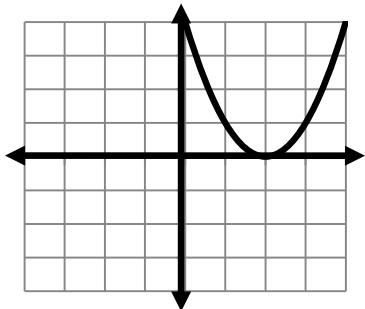
G.



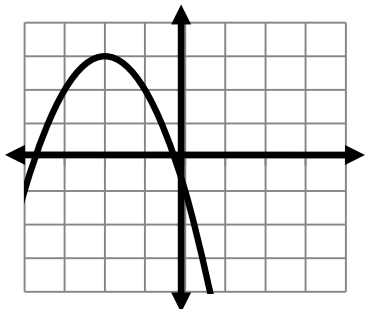
H.



J.



K.



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59. If the diagonal of a square is 6 inches long, what is the area of square?

- A. 6
- B. $3\sqrt{2}$
- C. 18
- D. 24
- E. $36\sqrt{2}$

60. If $f(x) = 2x^2 - 3$, then $f(x + a) = ?$

- F. $2x^2 + 2ax + 2a^2 - 3$
- G. $2x^2 + 4ax + 2a^2 - 3$
- H. $2x^2 - 4ax + 2a^2 - 3$
- J. $4x^2 + 8ax + 4a^2 - 3$
- K. $4x^2 + 4ax + 4a^2 - 3$

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