

THETA INDIVIDUAL TEST
FAMAT STATE CONVENTION 2005

The abbreviation NOTA denotes
"None Of These Answers."

1. A positive number divided by half of its reciprocal is 30. What is twice the number?

A. 2
B. $\sqrt{15}$
C. $2\sqrt{15}$
D. 450
E. NOTA

2. For $a > 0$, $2^{\sqrt{a}} \cdot 4^{\sqrt{a}} =$

A. 8^a
B. $2^{3\sqrt{a}}$
C. 2^{2a}
D. $8^{2\sqrt{a}}$
E. NOTA

3. $\sum_{n=1}^5 (2n-1) =$

A. 9
B. 15
C. 24
D. 25
E. NOTA

4. A line passes through the points (5, 18) (2, 6). What is the y-intercept of the line?

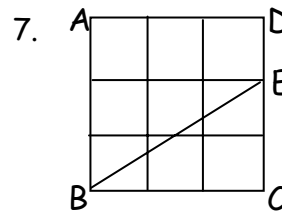
A. -58
B. -14
C. -2
D. 14
E. NOTA

5. An integer is inversely proportional to its square. Which could NOT be the constant of proportionality?

A. 1
B. 16
C. 27
D. 64
E. NOTA

6. The distance around a square is the same as the distance around a circle of radius k. Which is the length of one side of the square, in terms of k?

A. $\frac{\pi k}{2}$
B. $k\sqrt{2\pi}$
C. $\frac{\sqrt{\pi}}{k}$
D. $\sqrt{2\pi k}$
E. NOTA

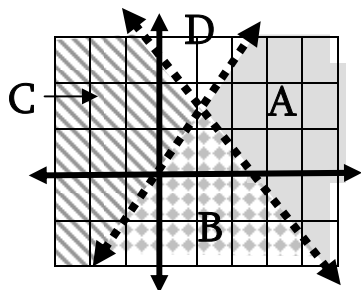


In square ABCD, point E lies on side \overline{DC} , so length EC is twice length DE. $BC=3$. Find the area of trapezoid ADEB.

A. 6
B. 5.76
C. $4\sqrt{2}$
D. 6.25
E. NOTA

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8. If the system $\begin{cases} Ax + By > C \\ Dx - Ey < F \end{cases}$ has coefficients A, B, C, D, E and F positive integers, and the solution is graphed below, then which region is the solution?



- A. Region A (solid grey, right side)
B. Region B (checkered, bottom)
C. Region C (striped, left side)
D. Region D (white, top)
E. None of these

9. If $\frac{1}{x-3} - \frac{2}{x} = \frac{1}{x}$, then find the value of $9x$.

- A. 4
B. 9
C. 18
D. 40.5
E. NOTA

10. For an integer n , and $0 < n < 10$, if $i = \sqrt{-1}$ and $i^n = -1$, $i^{0.5n} = -i$ then $n =$

- A. 2
B. 4
C. 6
D. 7
E. NOTA

11. Let Sunday be day 1, Monday day 2, and so on, with Saturday day 7. Joe gives Dave \$5 on each even day, and takes from Dave three dollars more than the day number, on each odd day. If they begin the first of 7 exchanges on Sunday, and end on Saturday, and each begin with \$100 (before any exchanges), then how much money will Dave have at the end of day 7?

- A. \$87
B. \$92
C. \$143
D. \$148
E. NOTA

12. The average (mean) of five numbers is 60. Three of the numbers have sum 40. What is the average (mean) of the remaining two numbers?

- A. 120
B. 130
C. 20
D. $6\bar{3}$
E. NOTA

13. If $\log_2(x) = \log y$ for $x > 1, y > 1$. Which is an expression for $\log_y x$?

- A. $-\log 2$
B. 2
C. $1 - \log 5$
D. $1 - \log 2$
E. NOTA

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14. For $x \neq 1$, $f(x) = \frac{1}{1-x}$. Find the value of $f\left(f\left(f\left(1\frac{3}{4}\right)\right)\right)$.

- A. $\frac{3}{7}$ B. $\frac{7}{4}$
 C. $\frac{1}{4}$ D. $\frac{5}{4}$
 E. NOTA

15. If $x > 1$ then $|4-8x|$ is equal to

- A. $8x+4$
 B. $8x+4.5$
 C. $-|4-8x|$
 D. $8x-4$
 E. NOTA

16. If R is decreased by 10%, and the result is increased by 20%, the value of S is obtained. Give the value of $(9R)$ in terms of S .

- A. $\frac{25}{3}S$
 B. $\frac{25}{2}S$
 C. $50S$
 D. $450S$
 E. NOTA

17. The relation f has inverse, $g(x) = 3x^3 - 22$.

The graph of g crosses the line $y = x$ at the point $(2, 2)$. Where does the graph of f cross the line $y = x$?

- A. $(-2, -2)$ B. $\left(\frac{1}{2}, \frac{1}{2}\right)$
 C. $(2, 2)$ D. $\left(-\frac{1}{2}, -\frac{1}{2}\right)$
 E. NOTA

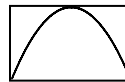
18. A sector of a circle is bounded by two radii and a 120° arc. If the area of this sector is 300π then find the circumference of the circle.

- A. 10π
 B. 20π
 C. 30π
 D. 60π
 E. NOTA

19. A rhombus has one side 20 and one interior angle 30° . A square has the same area as the rhombus. What is the length of the square's diagonal?

- A. 40
 B. $20\sqrt{2}$
 C. 20
 D. $10\sqrt{6}$
 E. NOTA

20. A square, which is certainly not drawn to scale, has a parabolic arch inside of it, so that the vertex is at the midpoint of one side of the square and the graph intersects the square's vertices, as shown. If the square has one side of length 10 then find the length of the latus rectum of the parabola.



- A. 10
 B. 5
 C. $2\sqrt{2}$
 D. 2.5
 E. NOTA

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21. If $x + y = 8$ and $4x + 4y + 3z = 47$ then what is the value of z ?

- A. 32
- B. 15
- C. 5
- D. 3
- E. NOTA

22. If $a \# b = b^2 - a$ and $a @ b = 2ab$ then find the value of $(1 \# 2) @ 3$.

- A. -11
- B. -5.5
- C. 9
- D. 18
- E. NOTA

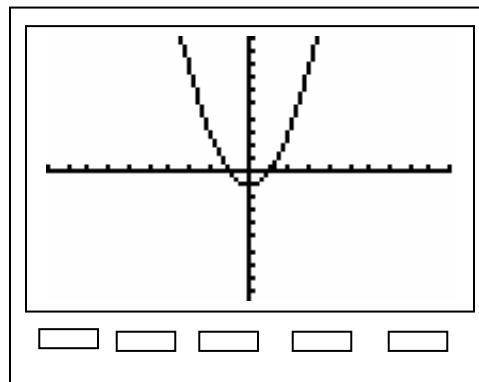
23. If $\log a + \log b = c$ for positive integers a , b and c , then which statement is true?

- A. ab cannot be divisible by 3.
- B. ab cannot be even.
- C. a or b must be divisible by 10.
- D. $a + b$ must be divisible by 6.
- E. NOTA

24. A 50-mililiter water glass (glass A) contains 20 mililiters of pure water. A second 50-mililiter glass (glass B) has 20 mililiters of pure acid. If half of the acid is poured into glass A, creating an acid/water mixture, and half of the new (thoroughly mixed) contents of glass A are poured into glass B then what percent of glass B is acid?

- A. 50%
- B. 60%
- C. $66\frac{2}{3}\%$
- D. 75%
- E. NOTA

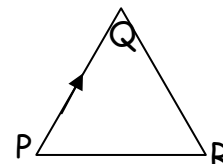
25. Toni graphed the equation $f(x) = x^2 - 1$ on her graphing calculator and saw the picture shown below.



Toni then rotated her calculator so that the top of the screen shown above became the left side (90 degree counterclockwise rotation). Which graph below would most closely resemble the new graph seen ? (Note: the notation $f^{-1}(x)$ is used here to denote the inverse relation of f , which is not a function.)

- A. $f^{-1}(x)$
- B. $-f(x)$
- C. $f^{-1}(|x|)$
- D. $-f^{-1}(x)$
- E. NOTA

26. A man walks around an equilateral triangle PQR of side length 20 feet. He starts to walk the perimeter starting at a vertex P, walking toward Q. After walking 45 feet, he then heads straight toward point Q again. After finally reaching Q How far has he walked totally, to the nearest tenth of a foot?



- A. 62.3
- B. 63.0
- C. 64.5
- D. 67.9
- E. NOTA

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27. A polynomial function with equation

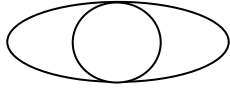
$$f(x) = x^2 + ax + b \text{ has a root } 1 - i.$$

What is the value of b ?

- A. 2 B. 3
C. 4 D. 6 E. NOTA

28. A circle and an ellipse have the same center and the minor axis of the ellipse is the diameter of the circle, as shown.

If the equation of the ellipse is

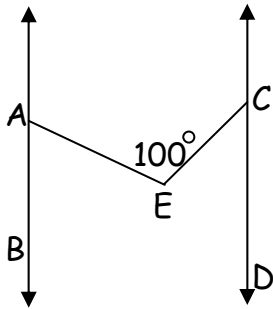


$$4x^2 + 9y^2 = 36 \text{ then}$$

the area of the circle is ___.

- A. 2π B. 3π
C. 4π D. 9π E. NOTA

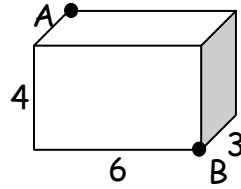
29.



Lines \overline{AB} and \overline{CD} are parallel, and $m\angle AEC = 100^\circ$ as shown. If $m\angle ECD = 20^\circ$ then find $m\angle BAE$ (in degrees).

- A. 20 B. 60
C. 80 D. 120
E. NOTA

30.



A spider will crawl along the walls of the room shown above. The floor of the room is 6 by 3, and the height is 4. The shortest distance from A to B, along the walls, is \sqrt{r} and the shortest distance from A to B through the room (the diagonal of the room) is \sqrt{s} . Give the value of $|r - s|$.

- A. 48 B. 45
C. 24 D. 1.4 E. NOTA