

FAMAT

Rules:

Use state FAMAT state ID#s only.
Calculators are NOT allowed.

The abbreviation NOTA denotes
"None Of These Answers."

Diagrams are not necessarily drawn
to scale.

Scoring is 4 points for a correct answer,
and -1 point for a wrong answer. An
unanswered question is not considered
wrong.

1. Which is equivalent to $\frac{2^{x+1} - 2^{x+2}}{4^x}$, for
real values of x ?

A. $\frac{-1}{2^{1-x}}$

B. $\frac{1}{2^{x+1}}$

C. 2^{-x}

D. $\frac{-1}{2^{x-1}}$

E. NOTA

2. Given that $f(x) = \sqrt{12 - \sqrt{x}}$ for $x \geq 0$
how many values of x give an
integral value of f ?

A. 1

B. 2

C. 3

D. 4

E. NOTA

3. If $|2x+6|$ is greater than 8, and
 $x+3 < 0$ then which is the set of
all possible values of x ?

A. $x > 1$

B. $x < -1$

C. $x > 1$ or $x < -7$

D. $x < -7$

E. NOTA

4. In $\triangle ABC$, $AB=6$ and $BC=8$. Which
statement(s) must be true?

i. If $\triangle ABC$ is a right triangle
then $AC=10$.

ii. $2 \leq AC \leq 14$.

iii. If the area of $\triangle ABC$ is less than
24, then $\triangle ABC$ is an acute
triangle.

A. ii only

B. ii and iii only

C. i and ii only

D. iii only

E. NOTA

5. In a survey of grocery shoppers, 30
shopped on Saturday, 10 shopped on
Monday, and 20 shopped on Tuesday.
10 shopped only on a weekday, and 5
shopped only on a Tuesday. What is the
minimum number of grocery shoppers
which could have been surveyed
for this survey?

A. 60

B. 45

C. 40

D. 30

E. NOTA

6. How many positive integer factors does the number 200 have?

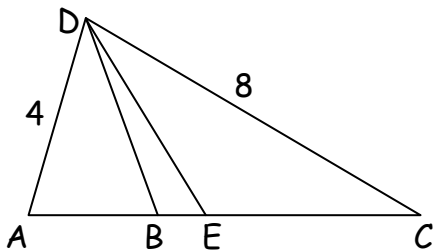
- A. 2 B. 4
C. 8 D. 12 E. NOTA

7. For $[x]$ defined as the greatest integer of x , or the greatest integer less than or equal to x , find

$$\left[\frac{-1 \cdot 2003! \cdot 2003!}{2002! \cdot 2004!} \right].$$

- A. -1 B. 0
C. 1 D. 2003 E. NOTA

8.



Points B and E lie on \overline{AC} . In $\triangle ADC$ $AD=4$, $DC=8$ and $AB=6$. \overline{DB} is the bisector of $\angle ADC$ and \overline{DE} is the median to side \overline{AC} . Find the length BE.

- A. 12 B. 6
C. 3 D. 2 E. NOTA

9. $\sum_{x=2}^{20} (2x-12) =$

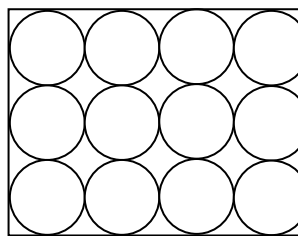
- A. 28 B. 162
C. 190 D. 380 E. NOTA

10. For the system
$$\begin{aligned} 2x - y + z &= 12 \\ 3x + 6y - z &= 2 \\ x + y + 6z &= 1 \end{aligned}$$

give the value of $x + y + z$.

- A. $\frac{3}{2}$ B. $\frac{5}{2}$
C. $\frac{7}{2}$ D. $\frac{15}{2}$ E. NOTA

11.



Each of the congruent circles shown is externally tangent to other circles and/or to the side(s) of the rectangle as shown. If each circle has circumference 16π , find the length of a diagonal of the rectangle.

- A. 80 B. 40
C. 20 D. 15 E. NOTA

12. If $\log\left(\frac{x}{10}\right) - \log 2 = \log 5$ then $x =$

- A. 100 B. 50
C. 10 D. $\sqrt{10}$ E. NOTA

13. If a and b are Real, and $i = \sqrt{-1}$ then $a + bi$ must be ____.

- A. Real B. Complex C. Nonzero
D. Not enough information E. NOTA

14. For $f(x) = \frac{1}{x}$ find $f(1.5) \cdot f(1+i) \cdot 3$

if $i = \sqrt{-1}$.

- A. $\frac{9}{4}(1-i)$ B. $\frac{1+i}{3}$
 C. $2+2i$ D. $1-i$
 E. NOTA

15. The graph of $y = 4x - x^2 + 1$ is graphed over the domain $0 \leq x \leq 3$. What is the range for this graph?

- A. $1 \leq y \leq 5$
 B. $1 \leq y \leq 4$
 C. $0 \leq y \leq 5$
 D. $0 \leq y \leq 4$
 E. NOTA

16. The graph of the function

$f(x) = x^3 + 4x^2 - kx + 1$ for a positive integer k , passes through the x-axis at $x = 3$. If the graph also has x-intercepts m and n , neither of which is equal to 3, then give the value of $m + n$.

- A. 12 B. $\frac{4}{3}$
 C. 1 D. -7 E. NOTA

17. The number 25_n is a number written in base n , for $n > 5$. If this number is rewritten in base n^2 then it would be

- A. 7_{n^2} B. $(2n+5)_{n^2}$
 C. $(2+5n)_{n^2}$ D. $(2^n \cdot 5)_{n^2}$
 E. NOTA

18. Set A consists of the even integers between 1 and 9. Set B consists of the odd integers between 0 and 10. If a digit is chosen at random from each set (one digit from each) and the two digits are written in any order, then what is the probability that the resulting number is an even number less than 50?

- A. $\frac{1}{5}$ B. $\frac{1}{10}$
 C. $\frac{1}{20}$ D. $\frac{1}{24}$ E. NOTA

19. A right triangle has angles which measure 30, 60 and 90 degrees. If the perimeter of this triangle is $15 + 5\sqrt{3}$ then give the length of the hypotenuse of this triangle.

- A. 5 B. 7.5
 C. 10 D. 12.5 E. NOTA

20. For $0 < x < \frac{\pi}{2}$ it is given that $\sin(2x) = \frac{1}{3}$.

If $\cos x = a$ then $\sin x =$

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

21. Which is/are true?

- i. $(\log 3)^2 = 2 \log 3$
 ii. $\log 5 + \log 2 = 1$
 iii. $\log_4 3 = \frac{1}{\log_3 4}$
 iv. $\log_e 4 = 2 \ln 2$

- A. all are true B. i, iii only
 C. ii, iv only D. ii, iii, iv only E. NOTA

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22. An isosceles triangle RST has $RS=RT$. If $m\angle R = 30^\circ$ and $m\angle S = (2x-3)^\circ$ then give the value of x .

- A. 20 B. 39
C. 42 D. 77.5 E. NOTA

23. For $0 < x < \frac{\pi}{2}$, $\cos(2x) + \sin^2 x = \frac{1}{4}$.

Give the value of $\cos x$.

- A. $\frac{1}{2}$ B. $\frac{\sqrt{2}}{2}$ C. $\frac{3}{5}$ D. $\frac{3}{4}$ E. NOTA

24. A key to room C3 is dropped into a jar with five other keys, and the jar is thoroughly mixed. If keys are randomly drawn from the jar without replacement until the key to room C3 is chosen, then what are the odds that the key to room C3 will be obtained on the 2nd try?

- A. 1:4 B. 1:5
C. 1:6 D. 5:6 E. NOTA

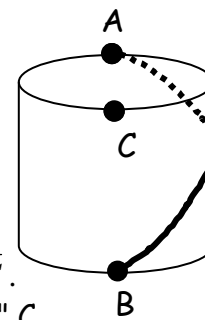
25. A solution has 50 mL of solution which is 10% acid. How much pure acid must be mixed with the original solution in order to obtain a solution which is 20% acid?

- A. 10 mL B. $\frac{25}{4}$ mL
C. 5 mL D. 1 mL E. NOTA

26. The line with equation $y = mx + 2$ is perpendicular to the line through the origin which has slope 3. Give the abscissa of the intersection of the two lines.

- A. $\frac{1}{5}$ B. $\frac{2}{5}$
C. $\frac{3}{5}$ D. $\frac{4}{5}$ E. NOTA

27. In the right circular cylinder shown, the radius is $\frac{6}{\pi}$ cm and the height is 8 cm.



Diameter \overline{AC} is on one base of the cylinder and \overline{BC} is perpendicular to \overline{AC} .

That is, B is "directly below" C, on the opposite base. A string is tightly wrapped around the cylinder from A to B. How long is the string, in cm?

- A. 5 B. $\sqrt{73}$
C. 10 D. $2\sqrt{73}$ E. NOTA

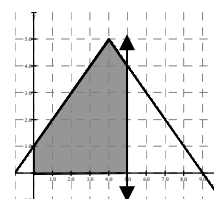
28. Triangle ABC has an obtuse angle A. If $AB=4$ and $AC=3$ and $|\cos A| = \frac{11}{24}$ then find the length BC.

- A. 5 B. 5.5
C. 6 D. 6.5 E. NOTA

29. In the expansion of $\left(2x^2 + \frac{1}{x}\right)^5$, one term is kx . Find the value of k .

- A. 8 B. 24
C. 40 D. 80 E. NOTA

30. The graph of $y = -|x - 4| + 5$, the x-axis, the y-axis and the line $x = 5$ bounds a region in the first quadrant. Find the area of the region.



- A. 12.5
B. 16.5
C. 17.0
D. 17.5
E. NOTA