

Mu Alpha Theta
Pre-Calculus Individual Test

Mark the best answer on your answer sheet. NOTA stands for None Of The Above.
Follow the order of operations. $i = \sqrt{-1}$. Good luck!

1. What type of conic section does the graph of the given equation form?

$$4x^2 + 9y^2 + 12xy + 87x + 23y = 0$$

- A. circle B. ellipse C. hyperbola
D. parabola E. NOTA

2. Find the foci of the ellipse:

$$25x^2 + 169y^2 + 100x - 1352y - 1421 = 0$$

- A. (2,16) (2,-8) B. (-14,4) (10,4) C. (-2,16) (-2,-8)
D. $(-2 \pm 2\sqrt{3}, 4)$ E. NOTA

3. Find the domain of the function:

$$f(x) = 3 + 4 \operatorname{Arccos} \left(\frac{2x+6}{3} \right)$$

- A. [-4.5, -1.5] B. [-7, 1] C. [-6, 2]
D. [-3.5, -0.5] E. NOTA

4. Given: $3x - 4y = 7$

$$(\cos \Phi)x + (\sin \Phi)y - p = 0$$

$$0^\circ \leq \Phi \leq 180^\circ$$

What is the exact value of p ?

- A. -3.5 B. -1.4 C. 1.4
D. 3.5 E. NOTA

5. Simplify for all x in the domain:

$$\frac{\cos x + \cos x \tan^2 x}{\csc x \sin^2 x + \cot x \cos x}$$

- A. $\sin x$ B. $\cos x$ C. $\tan x$
D. $\csc x$ E. NOTA

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6. Express the following complex number in polar form:
 $6i - 2\sqrt{3}$
- A. $2\sqrt{3} \text{ cis } 330^\circ$ B. $4\sqrt{3} \text{ cis } 300^\circ$ C. $2\sqrt{3} \text{ cis } 300^\circ$
D. $4\sqrt{3} \text{ cis } 150^\circ$ E. NOTA
7. Simplify:
 $(1 - i)^{14}$
- A. -128 B. $128i$ C. $-16384i$
D. 16384 E. NOTA
8. Christian gets on a raft and aims for a port 90 miles away. It is at a bearing of 32° and he consistently paddles 8 mph at a bearing of 32° . Unfortunately, an 11 mph current with a bearing of 279° pushes him off course. Sixteen hours after his departure when he realizes what has happened, how far is he from his original destination? Round to the nearest mile.
- A. 85 B. 123 C. 143
D. 165 E. NOTA
9. How many factors does 6048 have?
- A. 15 B. 42 C. 48
D. 62 E. NOTA
10. What is the distance (to the nearest hundredth) between the point (2,5,13) and the plane $4x - 3y + 8z = -17$
- A. 8.10 B. 9.67 C. 12.08
D. 14.31 E. NOTA
11. Let A be a 3×3 matrix and let $\det(A) = 17$. Find $\det(4A)$
- A. 68 B. 272 C. 1088
D. 1377 E. NOTA
12. If $x - y = 5$ and $x^3 + 3xy^2 = 1161$, what is the value of $x + y$?
- A. -4 B. 7 C. 13
D. 17 E. NOTA

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13. Simplify: $\sqrt{12 + \sqrt{12 + \sqrt{12 + \dots}}}$
- A. -3 B. 1 C. 2
D. 4 E. NOTA
14. A triangle has sides of lengths 6, 10, and 14. What is the hundredths digit of the area of this triangle?
- A. 2 B. 5 C. 8
D. 9 E. NOTA
15. Evaluate: $\ln(-5)$.
Round all numbers to the nearest hundredth.
- A. 15.71i B. 1.61+3.14i C. .70+3.14i
D. 5.06i E. NOTA
16. Which of the following graphs are even functions?
- i) $y = 3$ ii) $y = |x| + 3$ iii) $y = |x - 3|$
iv) $y = x^5 + x^2$ v) $2x^2 + y^2 = 1$
- A. i only B. i & ii only C. iii & iv only
D. i, ii, & v only E. NOTA
17. Which of the following is NOT a solution of $x^5 - 243 = 0$?
- A. -3 cis 324° B. -3 cis 144° C. 3 cis 216°
D. 3 cis 288° E. NOTA
18. Find the 4th term in the expansion of $(2x + 3y)^5$
- A. $810xy^4$ B. $944xy^4$ C. $1080x^2y^3$
D. $1360x^2y^3$ E. NOTA
19. What is the value of k, such that $f(x)$ is continuous for $x > -3$?
- $$f(x) = \begin{cases} \frac{x^2 - 3x}{x^2 - 9} & \text{for } x \neq 3 \\ k & \text{for } x = 3 \end{cases}$$
- A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. 3
D. 4 E. NOTA

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20. What is the sum of the following infinite series?
$$1 + \frac{1}{3} + \frac{1}{9} + \dots$$
- A. 1 B. $\frac{4}{3}$ C. $\frac{3}{2}$
D. 2 E. NOTA
21. Jeff & Vinnie put forces of 27 lbs. and 16 lbs. respectively upon their broken down school bus. The forces are applied at the same point and are at a 49° angle to each other. What is the hundredths digit of Jeff and Vinnie's combined force?
- A. 1 B. 4 C. 7
D. 9 E. NOTA
22. How many petals does the graph of $r = 5 \cos 4\theta$ have?
- A. 4 B. 5 C. 8
D. 10 E. NOTA
23. In order for $y = \text{Arccsc } x$ to be a function, the range is usually bounded by which of the following?
- A. $-\pi \leq y \leq \pi$ B. $-\pi \leq y \leq \pi/2$ C. $0 \leq y \leq \pi$
D. $0 \leq y \leq 2\pi$ E. NOTA
24. In square GOAT, G, O, A, and T are consecutive vertices. V and P are midpoints of \overline{OA} and \overline{AT} respectively. What is the cosine of $\angle VGP$?
- A. $\frac{2}{5}$ B. $\frac{3}{5}$ C. $\frac{7}{10}$
D. $\frac{4}{5}$ E. NOTA
25. A square matrix has a trace of 4. What is the trace of A^T ?
- A. 4 B. 5 C. 8
D. Can't be determined E. NOTA

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26. Given $\triangle ABC$ and $\triangle DEF$, $\overline{AC} \parallel \overline{DF}$, and E and B are midpoints of segments \overline{AC} and \overline{DF} respectively, if $m\angle A = 30^\circ$ and $AC = DF = 24$, find the area of $\triangle ABC \cap \triangle DEF$.

A. $6\sqrt{3}$ B. $12\sqrt{3}$ C. $24\sqrt{3}$
D. $36\sqrt{3}$ E. NOTA

27. If $M = A(eB)^x$, solve for x

A. $\frac{\ln M - \ln A}{1 + \ln B}$ B. $\frac{\ln M}{\ln(ABe)}$ C. $\frac{\ln M - \ln A}{B}$
D. $\frac{\ln(M - A)}{\ln B + 1}$ E. NOTA

28. The following transformations are applied to the graph of $y = \sqrt{x}$: a horizontal stretch by a factor of 3, a vertical shift up by 5 units, and a horizontal shift right of 2 units. An equation for the graph produced is

A. $y = 5 + 3\sqrt{x-2}$ B. $y = 5 + \sqrt{\frac{x+2}{3}}$ C. $y = 5 + \sqrt{\frac{x}{3} - 2}$
D. $y = 5 + \frac{\sqrt{x+2}}{3}$ E. NOTA

29. Brandee is eating a slice of a perfectly circular pizza with a radius of ten inches. The slice forms an angle of 35° . How many square inches of pizza will she eat? Round to the nearest tenth.

A. 2.3 B. 3.1 C. 23.4
D. 30.5 E. NOTA

30.
$$\begin{bmatrix} a & -1 \\ 3 & 5 \end{bmatrix} \begin{bmatrix} 2 & 6 \\ -2 & b \end{bmatrix} = \begin{bmatrix} 16 & x \\ -4 & -2 \end{bmatrix}$$

Find x.

A. 28 B. 46 C. 52
D. 61 E. NOTA