

Theta Ciphering  
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**#0 Theta Ciphering**  
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If the two lines below are parallel, what is the value of  $7n$ ?

$$\begin{aligned}4x + ny &= -2 \\ -3x + (n - 1)y &= 5\end{aligned}$$

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**#1 Theta Ciphering**  
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If the domain of the function

$f(x) = \sqrt{-3x^2 + 24x + 1}$  is  $[A, B]$  and the range is  $[C, D]$ , compute  $A + B + C + D$ .

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**#2 Theta Ciphering**  
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Let  $f(x) = x^3 - 6x^2 + Rx + S$  for real numbers  $R$  and  $S$ . If  $1 + 5i$  is a zero, what is the value of  $R + S$ ?

**#2 Theta Ciphering**  
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**#3 Theta CIPHERING**  
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A tunnel has a cross section that is semicircular in shape. A vertical 10-yard pole touches the top of the tunnel when the pole's foot is 4 yards from the side of the tunnel. What is the maximum height of the tunnel in yards?

**#3 Theta CIPHERING**  
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**#3 Theta CIPHERING**  
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**#4 Theta Ciphering**  
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Let  $k \in \mathbb{R}$ , compute the sum of the values of  $k$  that satisfy

$$k - 1 = \sqrt[4]{k^4 - 4k^3 + k + 5}$$

**#4 Theta Ciphering**  
**MAΘ National Convention 2024**

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**#5 Theta Cipheryng**  
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Let  $k \in \mathbb{R}$ , compute the sum of the values of  $k$  that satisfy

$$\sqrt{\log k} = \log \sqrt{k}$$

**#5 Theta Cipheryng**  
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**#6 Theta Ciphering**  
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The region bounded by the lines  $y = 2$ ,  $y = 0$ ,  $x = 2$ , and  $x = -2$  is rotated 360 degrees around the line  $x = 2$ . What is the total surface area of the resulting figure?

**#6 Theta Ciphering**  
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**#7 Theta Ciphering**  
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Find the sum of all integer values  $k$  that satisfy:

$$-5 \leq \frac{k}{\pi} \leq 10$$

**#7 Theta Ciphering**  
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**#8 Theta Ciphering**  
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What is the greatest integer value of  $k$  such that  $\frac{k^2+2k+5}{k-3}$  is an integer?

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**#9 Theta Ciphering**  
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Trapezoid  $WXYZ$  has  $\overline{WZ}$  parallel to  $\overline{XY}$ ,  
 $XZ = 15$ ,  $m\angle ZXW = 15^\circ$ , and  $m\angle XZY = 30^\circ$ .  
The ratio of  $XY:WZ$  is 9:5. What is  $YZ$ ?

**#9 Theta Ciphering**  
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**#10 Theta Ciphering**  
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Find the length (in inches) of the minor arc between the tips of the two 4-inch hands of a clock when the clock reads 2:45.

**#10 Theta Ciphering**  
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Find the length (in inches) of the minor arc between the tips of the two 4-inch hands of a clock when the clock reads 2:45.

**#10 Theta Ciphering**  
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Find the length (in inches) of the minor arc between the tips of the two 4-inch hands of a clock when the clock reads 2:45.

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**#11 Theta Ciphering**  
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An ellipse has foci (0,0) and (14,0) and passes through the vertex of the parabola with equation  $y = x^2 - 10x + 37$ . Find the length of the major axis of the ellipse.

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**#12 Theta Ciphering**  
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Let  $S$  be the set of positive integral factors of 2024. Compute the median of  $S$ .

**#12 Theta Ciphering**  
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