

### Question #0

Theta Ciphering

MAΘ National Convention 2010

Factor  $20x^2 + 33x - 36$  into  $(ax + b)(cx + d)$ , such that  $a, b, c$  and  $d$  are integers, and  $a > 0$ . Then, find the value of  $a + b + c + d$ .

### Question #1

Theta Ciphering

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Wayne's pool is now empty, so he wants to fill it. He opens both faucets. Faucet A, by itself, can fill the pool in 4 hours and faucet B, by itself, can fill the pool in 6 hours. However, ever the lame brain, Wayne forgets to close the drain. This drain can empty the pool in 8 hours. How many hours will it take to completely fill Wayne's pool if both faucets are on (full) and the drain is completely open? Express your answer as a mixed number with the fractional part in lowest terms.

### Question #2

Theta Ciphering

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Determine the minimum number of games necessary in a 251 team tournament in order to determine a champion if the format of the tournament is

S = single elimination (a team is eliminated after one loss)

D = double elimination (a team is eliminated after losing two games).

Find the value of  $S \bullet D$ .

### Question #3

Theta Ciphering

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Express in simplest rational form.

$$\frac{\frac{1}{5} + \frac{1}{6}}{\frac{1}{6} + \frac{1}{10}} + \frac{\frac{1}{4} + \frac{1}{8}}{\frac{1}{16} + \frac{1}{4}}$$

### Question #4

Theta Ciphering

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Part I. Let  $w$  = the radius of a circle with a central angle having measure of  $60^\circ$  and its intercepted arc length is  $3\pi$

Part II. Find the values of  $x$  and  $y$ , where in

$$\square ABC, m\angle B = 90^\circ, m\angle A = (x + 2y)^\circ,$$

$$m\angle ACB = (2x + y)^\circ,$$

and the measure of the exterior angle at  $\angle BCA = 125^\circ$ .

Find the value of  $x + y + w$ .

### Question #5

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Factor  $x^4 - 39x^2 + 49$  into two trinomials with positive leading coefficients.

### Question #6

Theta Ciphering

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If  $f(x) = x^2 - 2x$ , find the sum of all real values for  $x$  so that  $f(x) = f \circ f(x)$ .

### Question #7

Theta Ciphering

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Find all ordered pairs,  $(a, b)$ , that solve the system of equations over the real numbers.

$$\log_{10} \left( \frac{a^5}{b^3} \right) = 5$$

$$\log_{10}(a^3 b^4) = 3$$

### Question #8

Theta Ciphering

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Find the distance, in simplest radical form, between the center of

$$36x^2 + 16y^2 - 216x + 160y = -148$$
 and the

$$2x - y = 0$$
 and

$$x - y = -4.$$

### Question #9

Theta Ciphering

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Find the length of  $\overline{AB}$  when in right

$\triangle ABC$  with  $BD$  the altitude to the

hypotenuse with  $D$  on hypotenuse

$$\overline{AC}, BD = 10, CD = 4.$$

### Question #10

Theta Ciphering

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A giant watermelon weighed 100 pounds and was 99% water by weight in pounds. While standing in the sun, some water evaporated, so that the watermelon was only 98% water by weight in pounds. How many pounds did the watermelon then weigh?