

**February Regional 2005****Pre-Calc Team: Question # 1**

1. If  $\triangle ABC = \triangle DEF$ ,  $AB = 29$ ,  $DF = 19$ , and  $\angle C = 30^\circ$ , find  $\angle D$  to the nearest tenth of a Radian.

**February Regional****Pre-Calc Team: Question # 2**

2. How many values of  $x$  satisfy the equation  $2 \sin x + 4 \cos^2 x - 4 \sin^2 x = 4$  if  $0^\circ \leq x \leq 720^\circ$ ?

**February Regional****Pre-Calc Team: Question # 3**

3. Let  $A$  and  $B$  be vectors such that :

$$A = (4a, -2b, ab)$$

$$B = (b, a + b, -2a)$$

$$\text{Find: } \frac{A \cdot B}{a^2 - a + b}$$

**February Regional****Pre-Calc Team: Question # 4**

4. If  $M = \begin{bmatrix} 1 & -72 \\ 8 & 3 \end{bmatrix}$ , what is  $\det(3M^{-1})$ ?

**February Regional****Pre-Calc Team: Question # 5**

5. Find the area of the triangle whose vertices are given by the three points:  $(1,6)$ ,  $(5,3)$ ,  $(0,-3)$ ?

**February Regional****Pre-Calc Team: Question # 6**

6. Find  $x$  if  $x = \sqrt{3 - \sqrt{3 - \dots}}$

**February Regional****Pre-Calc Team: Question # 7**

7. In 1980, a 2000g substance was found in Florida. Ten years later only 50g of the substance remained. To the nearest year, how many years after there was only 50g of substance left was there 4g of substance remaining?

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8. If the statement below is true add the number next to it, if the statement is false subtract the number, What is the total of the statements?
- 1  $r = 2 \cos \theta$  is a circle.
  - 2  $r = 2 - \cos \theta$  is a circle.
  - 3  $r = \cos 3\theta$  is a rose with 6 petals.
  - 4  $2x^2 + 8x = -y^2 - 4y - 12$  is an equation for an ellipsoid.
  - 5  $\text{cis } 180^\circ$  is a real number.
  - 6  $y = \sin x$  is an even function.

$$7 \sum_{n=0}^{\infty} \left(\frac{1}{3}\right)^n = 2/3 .$$

$$8 \ i^{2004} = 1$$

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**Pre-Calc Team: Question # 9**

9.  $A = \sum_{n=2}^{\infty} 2^n \left(\frac{1}{3}\right)^{n-1}$

$B = 3 e^{\ln 7}$

C = number of prime factors of 2004 which are greater than 1

D = x coordinate of the center of  $3x^2 + 12x + y^2 + 2y = 6$

Find  $\frac{C+B}{AD}$

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**Pre-Calc Team: Question # 10**

10. A 2 g rock is thrown from a 200m building with a velocity of 100 m/s, at an angle of  $30^{\circ}$  above the horizon. How far away will the rock land to the nearest tenth of a meter? Use  $9.8 \text{ m/s}^2$  for gravity.

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**Pre-Calc Team: Question # 11**

11. What is the maximum area of a right triangle if the sum of the lengths of its legs is equal to the area of a circle with diameter 8?

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**Pre-Calc Team: Question # 12**

12. Let A be an integer between 1000 and 3000. Only two of the digits are the same. The sum of the digits is 6. The thousands digit is half the units digit and the thousands digit plus the tens digit is 2.

Let B equal the number of questions answered wrong on a test with 50 questions, if all questions are answered, a correct answer is worth 5 points and an incorrect answer is worth  $-1$  points, and the final score is 172.

Find  $A + B$ .

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**Pre-Calc Team: Question # 13**

13. How many complete revolutions does a car wheel with radius 13 in travel in 3000 miles?

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**Pre-Calc Team: Question # 14**

14. Convert  $x^2 + y - 2x + 2$  from rectangular to polar coordinates.

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**Pre-Calc Team: Question # 15**

15. If an isotope has a half life of 2000 years. To the nearest year, how long would you have to wait for one-fifth to disappear?