Northern Virginia Community College Fourth Annual NOVA Mathematic Competition April 8, 2016
Competition Questions
Round 1
Question 1 to 10

## Question 1

## Team Number:

$\qquad$
A natural number is said to be perfect if it is equal to the sum of its proper divisors. Example 6 has divisors, are 1, 2, 3, and $1+2+3=6$, so 6 is a perfect number. What is the next perfect natural number?

The solution $=$

## Question 2

Team Number:
Find a number 373982 base 10 convert to a number base 16

The solution $=$

## Question 3

Team Number: $\qquad$
My son's piggy bank has 42 coins worth exactly $\$ 1.00$. If it has at least one quarter, dime, nickel, and penny, find the total number of dimes and nickels.

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

## Question 4

Team Number: $\qquad$
Tom spends $\$ 25$ on 3 CD's, each costing a whole number of dollars. The first CD costs more than twice the second, but less than three times the third; the second CD cost more than the third. Find the cost of the third CD.

The solution $=$

## Question 5

Team Number: $\qquad$
Find the two complex roots of $x^{3}+1=0$.

The solution $=$
$\qquad$
The first two terms of are 10 and 20 . The rest of the terms are the average of the preceding terms. Find the $2016^{\text {th }}$ term

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

Question 7
Team Number:
Solve $\sqrt{x+7}=2+\sqrt{x}$ (must be in simplified fraction)

The solution $=$

## Question 8

## Team Number:

$\qquad$
Given: Julia's age is a 2 digit number. The remainder is 1 when her age is divided by $2,3,4,6$ or 8 . Julia is 5 times Bart's age.
Find Bart's age

| The solution $=$ |  |  |
| :--- | :--- | :--- |
|  |  |  |
| Official Use Only : Is answer is correct? | Yes | No |

## Question 9

Team Number: $\qquad$
Find the last two digits of $2^{1000}$

The solution $=$

Question 10
Team Number:
Given $x+\frac{1}{x}=3$, find the $x^{4}+\frac{1}{x^{4}}$

| The solution $=$ |  |  |
| :--- | :--- | :--- |
|  |  |  |
| Official Use Only : Is answer is correct? | Yes | No |

# Northern Virginia Community College Fourth Annual NOVA Mathematic Competition 

## Competition Questions <br> Round 2 <br> Question 11 to 20

## Question 11

## Team Number:

$\qquad$
A store sells 10 apples for $\$ 6$ or 20 apples for $\$ 10$. How much would you save by buying 25 apple at the 20 apple rate instead of 10 apple rate?

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

Question 12
Team Number:
In right triangle $A B C$ ( right angle at $C$ ), points $D$ and $E$ lie on hypothenuse so that $A D=D E=B E$.
If $C D=10 \sin (x)$ and $C E=10 \cos (x)$ for some value $x$, find $A B$

The solution $=$

## Question 13

## Team Number:

$\qquad$
In a hand of 5 card poker, 5 cards of consecutive denominations, all in the same suit (excluding Royal Flush) are called Straight Flush. How many possible way to have a Straight Flush from a standard deck of 52 cards?

The solution $=$

## Question 14

Team Number: $\qquad$
Convert Roman number to our Natural number: MMDCXIV

The solution $=$

## Question 15

Team Number: $\qquad$
Find all $x$ in degree such that $\cos ^{2}(x)+\cos (x)=\sin ^{2}(x)$ on the domain $0 \leq x \leq 360^{\circ}$

The solution $=$

## Question 16

Team Number: $\qquad$
Counting possibilities on a combination lock. How many different three number combination are possible in a combination lock having 62 numbers on its dailed?

[^0]Question 17
Team Number:
One way of find the next number of the sequence, mathematician uses a method called successive difference. Use this method to find the next number of the following sequence.
$6,20,50,102,182,296$, $\qquad$

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

## Question 18

Team Number: $\qquad$
Find a domain of $f(x)=\ln \left(\frac{x^{2}-1}{x}\right)$ using interval notation.

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

## Question 19

Team Number:
Let $r_{1}$ be the remainder of $x^{6}-x^{4}-3 x^{3}-2 x+5$ divides by $x-1$.
Let $r_{2}$ be the remainder of $x^{6}-x^{4}-3 x^{3}-2 x+5$ divides by $x+2$
Find the $3 r_{1}+r_{2}$

The solution $=$

Official Use Only : Is answer is correct?
Yes
No

## Question 20

## Team Number:

Circle $S$ has equation $x^{2}+y^{2}=16$. If $P(1,0), Q(-1,0)$, and $R$ is a point on a circle $S$. What is the largest possible value of $P R+Q R$ ? ( must be exact value)

The solution $=$

# Northern Virginia Community College Fourth Annual NOVA Mathematic Competition 

## Competition Questions <br> Tie Breaker

## Question Tie-Breaker 1

Team Number:
How many non repeating four-digit numbers have the sum of their digits equal to 30 ?

| The solution $=$ |  |  |
| :--- | :--- | :--- |
|  |  |  |
| Official Use Only : Is answer is correct? | Yes | No |

## Question Tie-Breaker 2

Team Number: $\qquad$
Let $x$ be a rational number. If $x=0.1563156315631563 \ldots \ldots .$.
What is the simplified fraction of this repeating decimal number?

| The solution $=$ |  |  |
| :--- | :--- | :--- |
|  |  |  |
| Official Use Only : Is answer is correct? | Yes | No |

## Question Tie-Breaker 3

Team Number: $\qquad$
The students in Mrs. N class can be seated in rows of 4 or 5 each time with exactly the same number of seats in each row, but when seated in rows of 6 , one row has exactly 2 fewer students than all other rows. If 4 new students join the class, in how many equal rows could her students now be seated?

```
The solution =
```


## Solutions to Round1

1. Answer: 28
2. Answer : 5B4DE
3. Answer : 6
4. Answer : \$ 5
5. Answer : $\frac{1+\sqrt{3} i}{2}$ and $\frac{1-\sqrt{3} i}{2}$
6. Answer : 15
7. Answer : $\frac{9}{16}$
8. Answer : 5
9. Answer : 76
10. Answer : 47

## Solutions to Round 2

11. Answer : \$ 2.50
12. Answer : $6 \sqrt{5}$ OR $\sqrt{180}$
13. Answer : 36
14. Answer : 2614
15. Answer : $60^{\circ}, 180^{\circ}, 300^{\circ}$
16. Answer : 226,920
17. Answer : 450
18. Answer : $(-\infty,-1) \cup(-1,0) \cup(0,1) \cup(1, \infty)$
19. Answer : 81
20. Answer: $2 \sqrt{17}$ OR $\sqrt{68}$

## Solutions to Tie Breaker

Answer : 24

Answer : $\frac{521}{3333}$
Answer : 11


[^0]:    The solution $=$

    Official Use Only : Is answer is correct?
    Yes
    No

