

**2015**

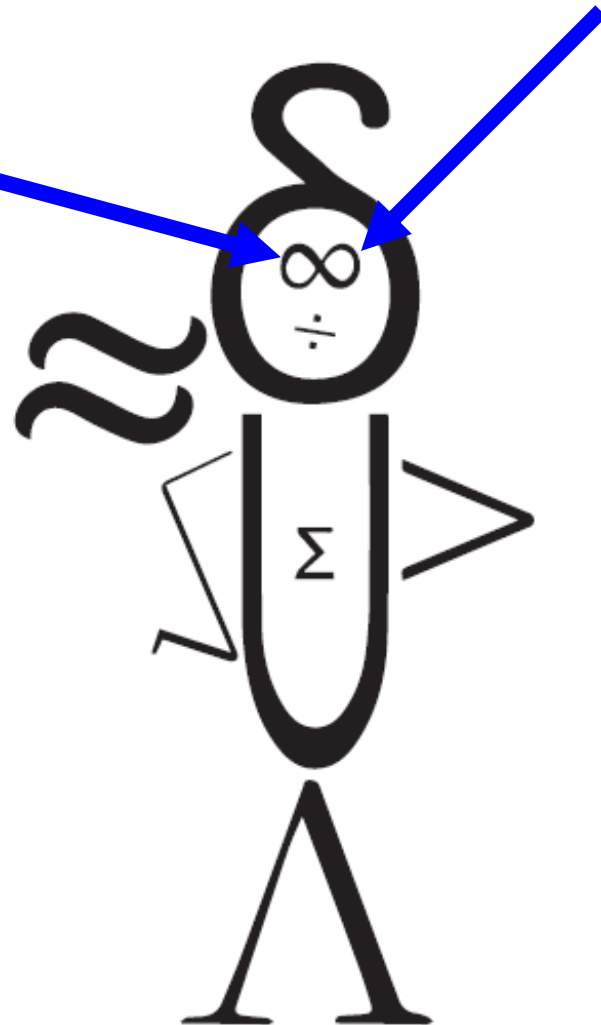
**Calhoun Community College  
Mathematics Tournament**

**CIPHERING**

1

# PRACTICE Question 1

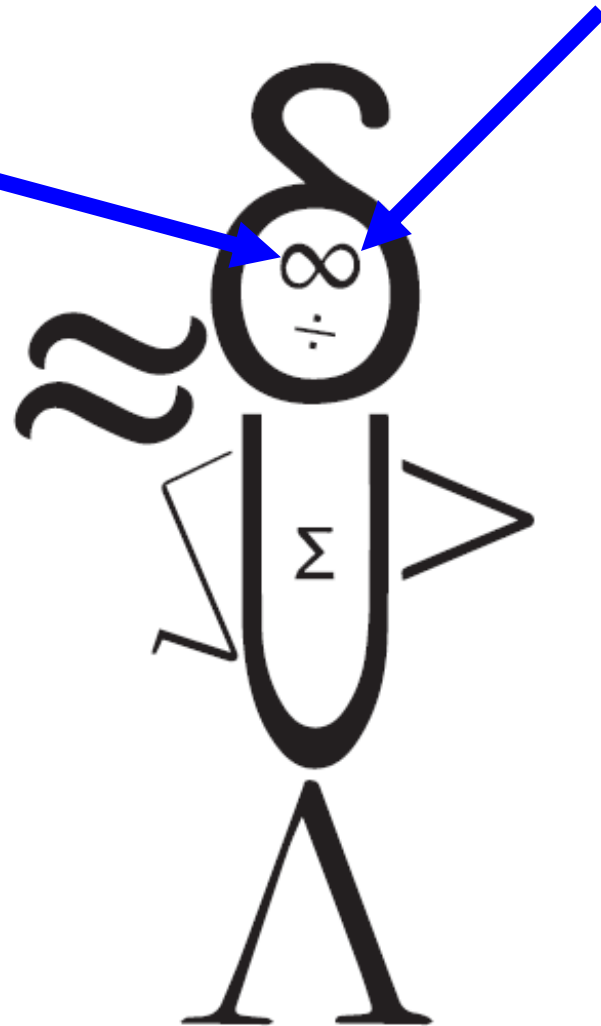
Write the word for the mathematical symbol shown [here](#) on this character:



2

# PRACTICE Question 1

Write the word for the mathematical symbol shown here on this character:



# Answer to PRACTICE Question 1

**INFINITY**

# 1

## PRACTICE Question 2

If  $x$  and  $y$  are non-zero and  $x^2 + y^2 = 4xy$ ,

what is the value of  $\frac{x}{y} + \frac{y}{x}$ ?

# 2

## PRACTICE Question 2

If  $x$  and  $y$  are non-zero and  $x^2 + y^2 = 4xy$ ,

what is the value of  $\frac{x}{y} + \frac{y}{x}$ ?

# Answer to PRACTICE Question 2

4

**1**

# Question 1

Find  $\frac{1}{2}$  of the constant term in the expansion of

$$\left( \frac{1}{3x^3} + 2x^4 \right)^7$$



**2**

# Question 1

Find  $\frac{1}{2}$  of the constant term in the expansion of

$$\left( \frac{1}{3x^3} + 2x^4 \right)^7$$

# Answer to Question 1

$$\frac{140}{81}$$

1

## Question 2

Evaluate the following limit:  $\lim_{x \rightarrow 0} \frac{1 - \sec^2 x}{x^2}$

2

## Question 2

Evaluate the following limit:  $\lim_{x \rightarrow 0} \frac{1 - \sec^2 x}{x^2}$

# Answer to Question 2

**-1**

1

## Question 3

Out of the top 10 ciphering students last year, 4 were female. What is the probability that 3 of them were in the top 5? Express your answer as a proper fraction.

2

## Question 3

Out of the top 10 ciphering students last year, 4 were female. What is the probability that 3 of them were in the top 5? Express your answer as a proper fraction.

# Answer to Question 3

$$\frac{5}{21}$$



**1**

## Question 4

$$\frac{5x + 1}{x^2 - 1} = \frac{A}{x + 1} + \frac{B}{x - 1}$$

If  $A$  and  $B$  are real numbers find  $B$ .

**2**

## Question 4

$$\frac{5x + 1}{x^2 - 1} = \frac{A}{x + 1} + \frac{B}{x - 1}$$

If  $A$  and  $B$  are real numbers find  $B$ .

# Answer to Question 4

3

1

## Question 5

Two concentric circles have radii of 9m and 16m. What is the length of a chord of the larger circle that is tangent to the smaller circle?

2

## Question 5

Two concentric circles have radii of 9m and 16m. What is the length of a chord of the larger circle that is tangent to the smaller circle?

# Answer to Question 5

$$10\sqrt{7}$$

**1**

## Question 6

Find the sum of the infinite geometric series:

$$\frac{\sqrt{2}}{2} + \frac{1}{2} + \frac{\sqrt{2}}{4} + \frac{1}{4} + \dots$$

# 2

## Question 6

Find the sum of the infinite geometric series:

$$\frac{\sqrt{2}}{2} + \frac{1}{2} + \frac{\sqrt{2}}{4} + \frac{1}{4} + \dots$$



# Answer to Question 6

$$1 + \sqrt{2}$$

1

## Question 7

*Find the smallest positive integer  $x$*

*such that*

$$\left(\sin(x^\circ) + \cos(x^\circ)\right)^2 = \frac{1}{2}$$

2

## Question 7

*Find the smallest positive integer  $x$*

*such that*

$$\left(\sin(x^\circ) + \cos(x^\circ)\right)^2 = \frac{1}{2}$$

# Answer to Question 7

105°

1

## Question 8

A round table with 5 place settings is to be decorated. Each place setting may be decorated in one of 5 ways. How many distinct table settings are there?

# 2

## Question 8

A round table with 5 place settings is to be decorated. Each place setting may be decorated in one of 5 ways. How many distinct table settings are there?

# Answer to Question 8

629

1

## Question 9

*What is the average value of*

*$f(x) = \cos^2 x$  on the interval  $[0, 3\pi]$  ?*



2

## Question 9

*What is the average value of*

*$f(x) = \cos^2 x$  on the interval  $[0, 3\pi]$  ?*

# Answer to Question 9

$$\frac{1}{2}$$

1

## Question 10

Consider a convex  $N$ -gon whose interior angles are integers when measured in degrees. What is the maximum possible value of  $N$ ?

2

## Question 10

Consider a convex  $N$ -gon whose interior angles are integers when measured in degrees. What is the maximum possible value of  $N$ ?

# Answer to Question 10

360