# Msgr. Gray's 25th Anniversary Trivia Night

Round 1:

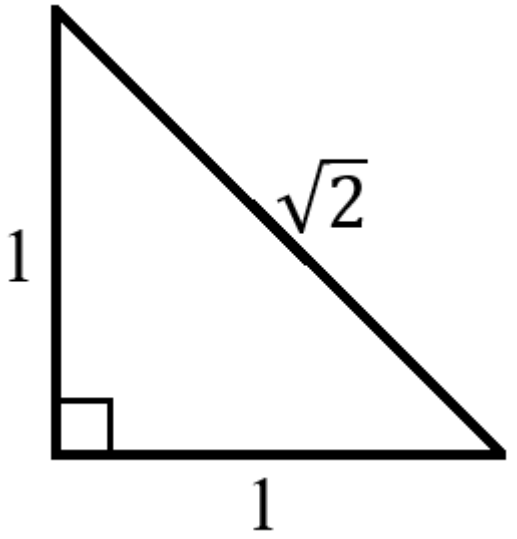
Mathematics

# Mathematics Question 1

- A common theorem about right triangles is known in China as the Gougu Theorem.  However, you probably know this theorem based on the name of the Greek Mathematician who also developed a proof for it.
- What is the name of the theorem?

# Mathematics Question 2

- The triangle on the right is properly described by two terms.
- The first term indicates that the triangle has two sides of equal length.
- The second term indicates that one angle is 90 degrees.
- What are the two terms?



# Mathematics Question 3

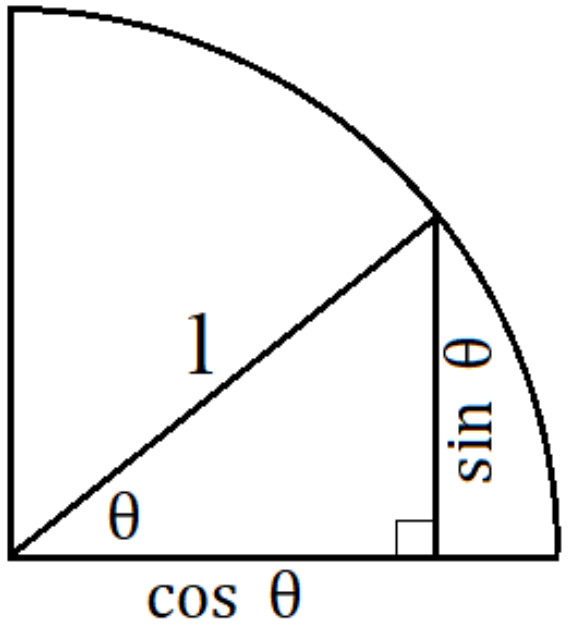
- When writing out a transcendental number, the digits go on forever and never repeat. They are not integers (like 2), nor rational numbers (like $\frac{2}{3}$).
- Transcendental numbers are irrational, but they are not the solution to an algebraic equation (such as $\sqrt{2}$).
- Instead, transcendental numbers can be used in trigonometric and logarithmic functions.
- Give any one example of a constant that is a real transcendental number.

# Mathematics Question 4

- The picture shows a right triangle inside a unit circle. The six trigonometric functions are the quotients of two of the sides of the right triangle, namely

$$sin\theta, cos\theta, tan\theta, cot\theta, sec\theta, csc\theta.$$

- Trig identities express the relationships between the various trig functions. In particular, the quotient $\frac{sin\theta}{cos\theta}$ is equal to which of these six trig functions?



# Mathematics Question 5

- Let a function, $s(t)$, describe the **position** of a vehicle as it travels with respect to time.
- In calculus, the first derivative of the position function gives the rate of change of the vehicle's position over time: $\frac{ds(t)}{dt} = v(t)$.
- This is known as the **velocity** function, $v(t)$.
- The second derivative of the position function gives the rate of change of the vehicle's velocity over time: $\frac{d^2s(t)}{dt^2} = a(t)$.
- What is the common name of this function, $a(t)$?

# Mathematics Question 6

- Computers use binary notation, also called base 2, to represent numbers using the digits 0 and 1.
- Computers also use hexadecimal notation (base 16), with the 16 digits composed of the numbers 0 to 9 followed by the "numbers" A to F.
- In base 10 notation, What number is indicated by the hexadecimal number FF?

| Base 2 | Base 10 |
|---|---|
| 10 | 2 |
| 11 | 3 |
| 100 | 4 |
| 111 | 7 |
| 1000 | 8 |
| **Base 16** | **Base 10** |
| FF | ? |

# Mathematics Question 7

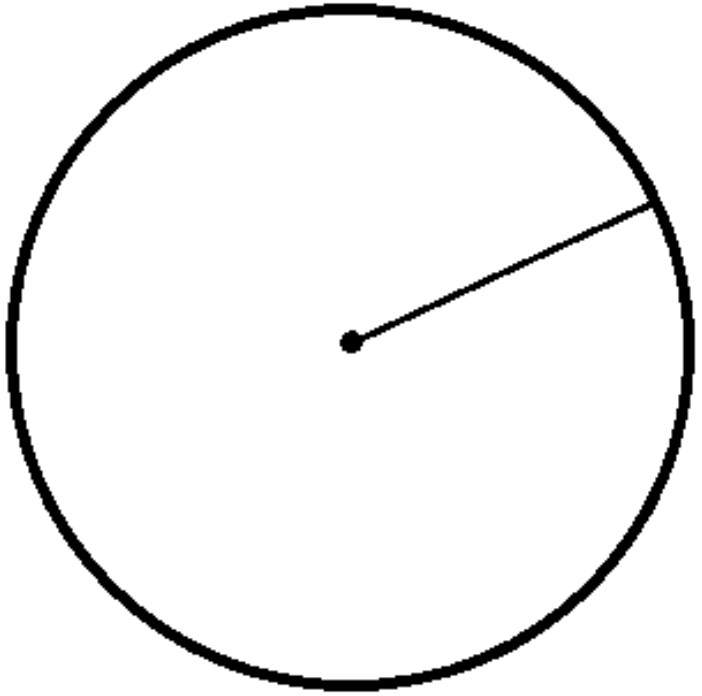
- Before it became the name of an Internet search engine, the extremely large number 1 followed by 100 zeros (i.e. $10^{100}$) was called by what name?

# Mathematics Question 8

- Beyond real numbers, mathematicians also work with imaginary numbers, represented by $i$.
- While $i$ is an imaginary number, $i^2$ is a real number.
- What is the value of $i^2$?

# Mathematics Question 9

- In geometry, the set of points that are a fixed distance from a single focus point is called a circle.
- What is the name of the shape formed by the points such that the sum of its distances from two foci points is constant?



# Mathematics Question 10

- In the 17th Century, this French philosopher and mathematician revolutionized mathematics by combining Euclidian geometry and algebra to develop this coordinate system represented in two dimensions by an x-axis to describe the horizontal position and the y-axis to describe the vertical position of a point.
- What is the mathematician whose name was also used to describe this coordinate system?

# Mathematics Trivia Answers

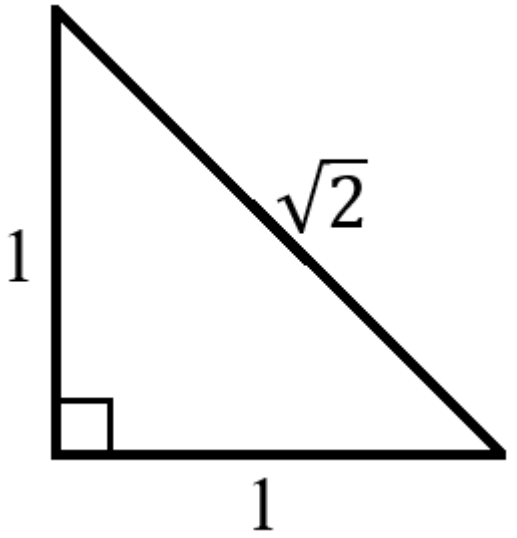
# Mathematics Answer 1

- The Gougu Theorem demonstrates that the sum of the square of the sides of a right triangle equals the square of the hypotenuse: $a^2 + b^2 = c^2$
- This theorem was also proven by Pythagoras and is known as the **Pythagorean Theorem**.

# Mathematics Answer 2

- A triangle with two equal sides is an isosceles triangle.
- A triangle with a 90-degree angle is a right triangle.

**Isosceles right triangle**.



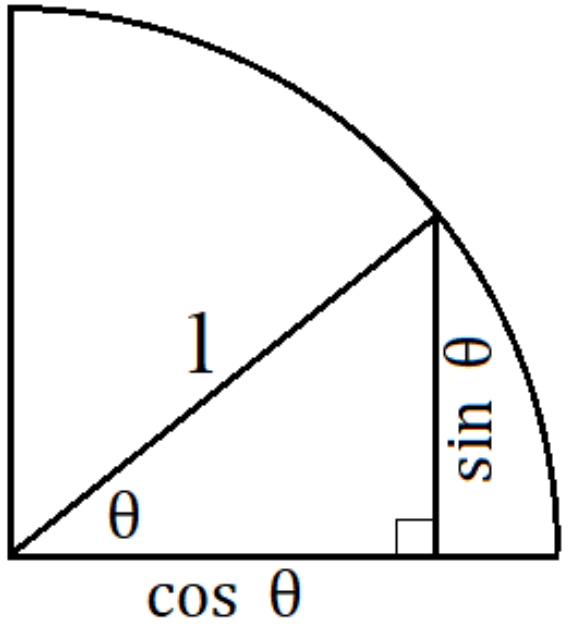
# Mathematics Answer 3

- Transcendental numbers include the following acceptable answers:
- $\boldsymbol{\pi}$
- $\boldsymbol{sin1}$ computed in radians
- $\boldsymbol{e}$
- $\boldsymbol{ln2}$
- Other similar variations on these numbers are also transcendental.

# Mathematics Answer 4

$\frac{sin\theta}{cos\theta}$ is the quotient dividing the "opposite" side of the triangle by the "adjacent" side. This is also called the **tangent**.

$$\boldsymbol{tan\theta}$$



# Mathematics Answer 5

- $s(t)$ is the *position* function.
- $\frac{ds(t)}{dt} = v(t)$ or the *velocity* function.
- $\frac{d^2s(t)}{dt^2} = a(t)$ or the **acceleration** function.

# Mathematics Answer 6

- In base 10, the number just before 10 is 9, and the number just before 100 is 99, etc.
- In hexadecimal notation, the digits are 1 2 3 4 5 6 7 8 9 A B C D E F.
- The number just before 10 is F, and the number just before 100 is FF.
- Therefore FF is the number before 256 in base ten or **255**.

| Base 16 | Base 10 |
|---|---|
| 1 | 1 |
| A | 10 |
| F | 15 |
| 10 | 16 |
| FF | 255 |
| 100 | 256 |
| FFF | 4095 |
| 1000 | 4096 |

# Mathematics Answer 7

- The number $\mathbf{10^{100}}$ is also called a

**Google**

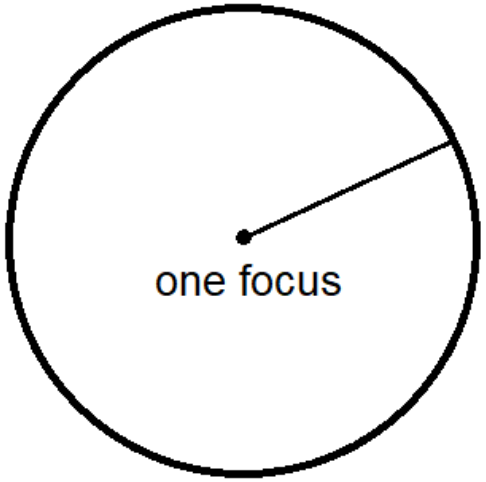
# Mathematics Answer 8

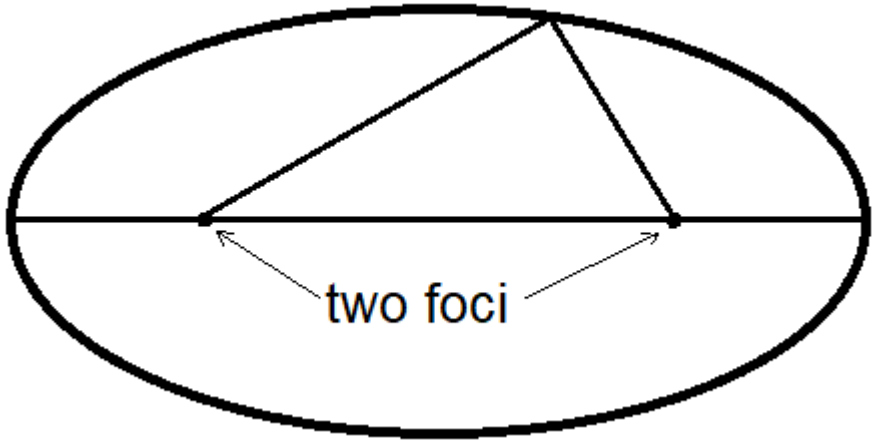
- The imaginary number $i = \sqrt{-1}$
- Therefore, $i^2 = \left(\sqrt{-1}\right)^2 = -1$

$$\mathbf{-1}$$

# Mathematics Answer 9

- A shape composed of the points such that the sum of its distances from two foci is constant is called an **ellipse**.



# Mathematics Answer 10

- The 17th Century French philosopher and mathematician **René Descartes** not only announced, "I think, therefore I am," but he also developed the **Cartesian** coordinate plane.