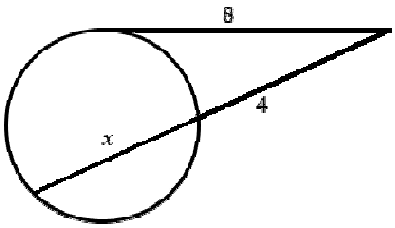
For all questions, E) NOTA means None Of The Above. Pictures are not necessarily to scale.

1) Sergey the cosmonaut draws this picture from space



Find x.

A) 2 **B) 4** **C) 8** **D) 12** **E) NOTA**

2) *SOPHIE* is a regular hexagon. What is the sum of the interior angles?

A) 720 **B) 860** **C) 1024** **D) 5040** **E) NOTA**

3) Nathan loves swimming. And boxes. In a stroke of genius, he decides to combine the two. He begins by cutting out 1m squares from the corners of a 4m x 8m piece of cardboard, then folding up the newly created flaps to make an open box. Then he goes swimming and turns his box upside down then submerges it underwater. Assuming no leaks, what is the volume of the air trapped inside the box?

A) 32 m³ **B) 16 m³** **C) 12 m³** **D) 8 m³** **E) NOTA**

4) In a circle of radius π, the circumference is

A) 2π **B) π^2** **C) $2\pi^2$** **D) $4\pi^2$** **E) NOTA**

5) Your Geometry teacher would be shocked and appalled if you didn't know the author of *Elements*, who is commonly known as the father of geometry. He is

A) Descartes **B) Euclid** **C) Euler** **D) Pascal** **E) NOTA**

6) Sophie is from Belgium. The distance from her home town to Brussels is 195 km, and from her home town to Antwerp is 193 km. The distance from Brussels to Antwerp is 4 km. What is the area of the triangle whose vertices are the three aforementioned cities? (Note: Disputes claiming the distances are wrong will not be accepted.)

A) 336 km² **B) 392 km²** **C) 660 km²** **D) 1337 km²** **E) NOTA**

7) The graph of $y = x^2$ is

A) a parabola **B) defined only for values of $x > 0$**
C) not a function **D) concave down** **E) NOTA**

8) Caroline is traveling to the moon. She blasts off and flies to intercept the moon. If the radius of the moon is approximately 2222 miles, then half the circumference minus the number of angles in a heptagon equals

A) 2222π-7 B) 1111π-9 C) 4444π-11 D) 10110π E) NOTA

9) The geometric mean of 4 and 16 is A, and the geometric mean of 3 and 27 is B. Find B-A

A) -1 B) 1 C) 2 D) 4 E) NOTA

10) If you get a perfect score on this test, I'll go to Europe. Which of the following is logically equivalent to the previous statement?

A) I like Europe
B) Europe is a beautiful continent
C) If I go to Europe, then you got a perfect score on this test
D) If I were Europe, you would go to me
E) NOTA

11) Nicholas is a genius. His supercomputer of a mind quickly determines that the formula for the number of diagonals of an n-gon is $\frac{(n(n-3))}{x}$. Find x.

A) 0 B) 1 C) 2 D) 3 E) NOTA

12) Did you know that much of conventional mathematics was invented and developed by Europeans? If you did, you'd know that the Cartesian plane was developed by

A) Archimedes B) Descartes C) Lagrange
D) Poincaré E) NOTA

13) Mu Alpha Theta gets its name from the language of this European country. They also found accurate approximations for π.

A) Albania B) Estonia C) France D) Greece E) NOTA

14) Find the volume of the cube which is inscribed in a sphere which has radius $\sqrt{3}$

A) $4\pi\sqrt[3]{3}$ B) $2\sqrt{3}$ C) 8 D) $24\sqrt{3}$ E) NOTA

15) What is the area of a circle with radius $\frac{15}{\sqrt{\pi}}$

A) 15 B) 125 C) 15π D) 225π E) NOTA

16) Ken is standing on the shoulder of a giant. The giant is 1600 inches tall, and the giant's shadow is 1200 inches long. How long is it from the top of the giant's head to the end of the giant's shadow? Ken knows. Do you?

A) 900 in B) 1000 in C) 2000 m D) 2500 m E) NOTA

17) Isaac Newton, an Englishman, once said "If I have seen further it is by standing on the shoulders of giants" (He would be so proud of Ken). Newton liked finding the area under a function. So tell me, what is the area of the figure bounded by the line $y=2x+1$, the x axis and the line $x=5$?

A) 30 B) 30.25 C) 66 D) 72.75 E) NOTA

18) Much of Central Europe's current borders were drawn after World War II. Find the number of countries in Central Europe pre-WWII if the number is the number of sides in a polygon with interior angles measuring 140˚ each.

A) 6 B) 9 C) 10 D) 140 E) NOTA

19) Sophie is back, this time she wants to draw a perfect 30˚-60˚-90˚ triangle, using only her compass and ruler. Is it possible?

A) Yes B) No C) Only if you use magic
D) What's a triangle? E) NOTA

20) If a number is in the form of $2^{2^n}+1$, then it is constructible with a ruler and straight edge. These numbers end in 7 when

A) Always ends in 7 B) $n > 0$
C) $n \geq 1$ D) $n \geq 2$ E) NOTA

21) Which is <u>not</u> a way to prove triangles congruent?

A) ASA B) SAS C) SSS D) SSA E) NOTA

22) What is the volume of the frustrum with height 3, bottom radius 6, and top radius 3?

A) 27π B) 36π C) 63π D) 189π E) NOTA

23) A parallelogram has side lengths of 4 and 15, and an interior angle measure of 60°. What is the length of the longest diagonal?

A) $\sqrt{301}$ B) $\sqrt{289+4\sqrt{3}}$ C) 18 D) $\sqrt{401}$ E) NOTA

24) If the smallest angle in a right triangle is $\frac{a}{b}$ where a is the number of sides in a polygon with 36° exterior angles, and b is the area of a square with side length 0.5, then find the larger acute angle.

A) 30 **B) 40** **C) 45** **D) 60** **E) NOTA**

25) If the airspeed velocity of an unladed European swallow is v m/s, and $v^3 + 6 = 1337$, find $41v$

A) 133.7 **B) 369** **C) 410** **D) 451** **E) NOTA**

26) Nick and his friend Jimmy are in a department store, standing side by side. Jimmy wanders 173 feet due north to escape from Mr. Friedlander. Nick walks 33 feet due east, then 50 feet due north to get to the tuxedo section of the store. Then Nick walks 22 feet due east and 9 feet due south to reach the aviator section. Assuming Nick walks at 5.5 feet per second , how many minutes would it take him to walk to his elusive friend if he walks straight to him?

A) 26 **B)** $\frac{13}{30}$ **C)** $\frac{2}{5}$ **D)** $\frac{2}{11}$ **E) NOTA**

27) This recently deceased Frenchman boldly stated that the notion of the length of any given coastline is a fallacy. He is credited with the formalization of the concept of Fractals and is famous for the quote "The part looks like the whole."

A) Euler **B) Gauss**
C) Mandelbrot **D) Zeno** **E) NOTA**

28) If a = the arithmetic mean of x and y (for $x \geq y$), and g = the geometric mean of x and y (for $x \geq y$), then which inequality is true?

A) $x < y$ **B)** $g > a$ **C)** $a \leq g$ **D)** $g \leq a$ **E) NOTA**

29) I'm on the vertex of GLORY, a regular pentagon. If point O is not next to me, and neither is point L, which vertex am I on?

A) G **B) L** **C) R** **D) Y** **E) NOTA**

30)Find the mistake in this proof: $x=1-1+1-1+1-1+1-.....$

$$x=1-(-x)$$
$$x=1+x$$
$$x-x=1+x-x$$
$$0=1$$

A) No mistake **B) $-x= -1 + 1 - 1 + 1...$, not $1 + 1 - 1 + 1.,$,**
C) $1 - (-x) \neq 1 + x$ **D) $x - x \neq 0$** **E) NOTA**