1. Consider a parallelogram with one side of length 1 and another side of length 2. What is the largest possible value for the area of such a parallelogram?

   **A.** 1

   **B.** 2

   **C.** 3

   **D.** 4

   **E.** 5

2. All three vertices of triangle $ABC$ lie on a circle, and side $AB$ passes through the center of that circle. What is angle $C$?

   **A.** 30 degrees;

   **B.** 45 degrees;

   **C.** 60 degrees;

   **D.** 90 degrees;

   **E.** Cannot be determined from the given information.

3. Professors SMITH, JONES, BROWN and DAVIS are giving a student Ms. AGNESI a qualifying exam on combinatorics. The professors are sitting in a row of four chairs. As the co-chairs of the examination committee, professors SMITH and BROWN have to sit next to each other. Prof. DAVIS, as the adviser of Ms. AGNESI, is required to sit next to the exam co-chairs. In how many ways can the professors sit?

   **A.** 24

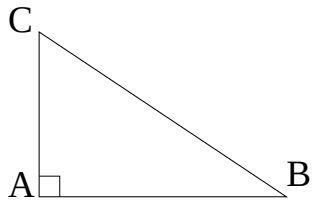
   **B.** 12

   **C.** 8

   **D.** 6

   **E.** 3

4. If $\Delta ABC$ is a right triangle as shown in the graph. What is $(\tan B) \times (\tan C)$?




**A.** 1

**B.** $\frac{\sqrt{2}}{2}$

**C.** $\frac{\sqrt{3}}{2}$

**D.** 0

**E.** There's not enough information to decide.

5. Suppose that $f(x) = x^3 + ax^2 + bx + c$, $p \neq q$, and $f(p) = f(q) = 0$. What is $f(0)$?

**A.** $p + q$

**B.** $-(p + q)$

**C.** $pq$

**D.** $-pq$

**E.** Cannot be determined from the given information.

6. A positive integer is said to be a prime number if the only positive integers which divide it are 1 and itself. For example, 7 is a prime number, but 15 is not. Which one of the following is a prime number:

**A.** 9999

**B.** $5^4 - 1$

**C.** $2^4 - 1$

**D.** $2^{2^3} + 1$

**E.** $7^5 + 1$

7. The slope of the line tangent to the circle $x^2 + y^2 = 1$ at the point $(3/5, 4/5)$ is:

   **A.** 0

   **B.** $3/4$

   **C.** $-3/4$

   **D.** $4/3$

   **E.** $-4/3$

8. The area of a triangle with side lengths 1, 2, and 4 is

   **A.** 1

   **B.** 2

   **C.** 3

   **D.** $2\sqrt{2}$

   **E.** There is no such triangle.

9. Two fair dice, with sides labeled $1, 2, 3, 4, 5$ and 6, are rolled. What is the probability that the difference of the two numbers rolled is even:

   **A.** 1

   **B.** $1/2$

   **C.** $1/3$

   **D.** $1/4$

   **E.** It is impossible to compute the probability.

10. How many integers between 1 and 100 are divisible by both 6 and 10?

    **A.** 0

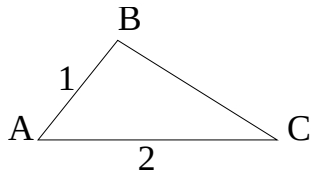
    **B.** 3

    **C.** 10

    **D.** 16

    **E.** 50

11. The area of triangle $\Delta ABC$ is $\sqrt{2}$. Side $AB$ has length 1 and side $AC$ has length 2. What is angle $A$?




**A.** $15^\circ$

**B.** $30^\circ$

**C.** $30^\circ$ or $60^\circ$

**D.** $45^\circ$ or $135^\circ$

**E.** $60^\circ$

**This problem is not correctly stated. Please ignore it.**

12. Six distinct points are marked on a circle. How many distinct convex polygons of three or more sides can be drawn using some or all of the six points as vertices.

**A.** 64

**B.** 52

**C.** 50

**D.** 44

**E.** 42

13. The equation $x^3 + \frac{1}{2}x^2 - \frac{1}{3}x - \frac{1}{6} = 0$ has three distinct solutions and one of them is $\frac{\sqrt{3}}{3}$. What is the sum of the other two solutions?

**A.** $-\dfrac{1}{2} - \dfrac{\sqrt{3}}{3}$

**B.** $-\dfrac{1}{2}$

**C.** $\dfrac{1}{2} - \dfrac{\sqrt{3}}{3}$

**D.** $\dfrac{1}{2}$

**E.** $-\dfrac{1}{6} - \dfrac{\sqrt{3}}{3}$

14. The radius of the circle $x^2 - 2x + y^2 - 4y = 4$ is:

**A.** 1

**B.** 2

**C.** 3

**D.** 4

**E.** That's not the equation of a circle.

15. For a positive integer $n$, we define $n$-factorial as $n! = 1 \cdot 2 \cdot 3 \cdots n$. For example, $4! = 24$. The last digit of $1! + 2! + 3! + \cdots + 50!$ is

**A.** 0

**B.** 1

**C.** 2

**D.** 3

**E.** 4

16. The area of an equilateral triangle with side length 1 is

**A.** $1/2$

**B.** 1

**C.** $\sqrt{2}$

**D.** $\sqrt{3}/2$

**E.** $\sqrt{3}/4$

17. If $\sin x - \cos x = 0.5$, then what is $\sin 2x$?

**A.** 0.5

**B.** 0.75

**C.** 0.25

**D.** $-0.5$

**E.** $-0.25$

18. In this problem, the angle in $\sin 1$, $\cos 1$, $\tan 1$ and $\cot 1$ is measured in radians. 1 rad $= 1 \cdot \frac{180^\circ}{\pi} \approx 57.2958^\circ$. Which of the following numbers is the largest? ($\cot 1 = \frac{\cos 1}{\sin 1}$)

**A.** $1$

**B.** $\sin 1$

**C.** $\cos 1$

**D.** $\tan 1$

**E.** $\cot 1$

19. Which of the following numbers is the smallest?

**A.** $\sqrt{7} - \sqrt{5}$

**B.** $\sqrt{5} - \sqrt{3}$

**C.** $\dfrac{2}{2+\sqrt{3}}$

**D.** $\dfrac{2}{2+\sqrt{5}}$

**E.** $\dfrac{2}{2+\sqrt{7}}$

20. Consider a regular polygon with 100,000 sides. If the sum of the lengths of the sides is 6.28, then the area is best approximated by

**A.** $1$

**B.** $2$

**C.** $3.14$

**D.** $6.28$

**E.** $12.56$