1. Let $a$, $b$, $c$ be real numbers such that

$$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=2 \quad \text{and} \quad \frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=1.$$

Find the value of $\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ac}$.

(A) $\frac{3}{2}$ (B) $-\frac{3}{2}$ (C) $-3$ (D) $3$ (E) $1$

2. Find the number of diagonals that can be drawn in a convex polygon of $n\,(n \geq 4)$ sides.

(A) $\frac{n\,(n-1)}{2}$ (B) $\frac{n(n-2)}{2}$ (C) $\frac{n(n-3)}{2}$ (D) $\frac{n(n+1)}{2}$ (E) $\frac{n(n+2)}{2}$

3. In a triangle ΔABC, $AB = 41$, $AC = 9$, $BC = 40$. Find the radius of the inscribed circle of ABC.

(A) 2 (B) 3 (C) 4 (D) 4.5 (E) 5

4. How many integers from 1 to 2007 have the sum of their digits divisible by 5 ?

(A) 399 (B) 400 (C) 401 (D) 402 (E) 403

5. 20 football teams take part in a tournament. $M$ matches have been played and it is found that
a) between any two teams at most one match has been played and,
b) among any three teams at least one match has been played between two of them
What is the smallest possible value of $M$?

(A) 20 (B) 40 (C) 60 (D) 80 (E) 90

6. Points $D$ and $E$ are points inside an equilateral triangle ABC such that $DE = 1$, $AD = EA = \sqrt{7}$, $BD = EC = 2$.
Find the length of $AB$.

(A) $\frac{5+\sqrt{13}}{2}$ (B) $\frac{5+\sqrt{14}}{2}$ (C) $\frac{5+\sqrt{15}}{2}$ (D) 4.5 (E) $\frac{5+\sqrt{17}}{2}$

7. A book has 30 chapters. The length of the each chapter are 1, 2, …,30 pages respectively. Chapter one starts from page 1 of the book and each chapter starts from a new page.
At most how many chapters can start from an odd-numbered page?

(A) 22 (B) 23 (C) 24 (D) 15 (E) 1

8. The length of the three medians AD, BE and CF of a triangle ΔABC are 9, 12 and 15 respectively. Find the area of ΔABC

(A) 68 (B) 70 (C) 72 (D) 74 (E) 90

9. An $m \times n \times p$ rectangular box has half the volume of an $(m+2)\times(n+2)\times(p+2)$ rectangular box, where *m , n, p* are integers and $m \le n \le p$ .
What is the largest possible value of *p* ?

(A) 110 (B) 120 (C) 130 (D) 140 (E) 150

10. Determine the number of acute-angled triangles with consecutive integer sides and of perimeter not exceeding 100.

(A) 26 (B) 27 (C) 28 (D) 29 (E) 30

11. What is the largest positive integer *n* for which there is a unique integer *k* such that

$$\frac{8}{15} < \frac{n}{n+k} < \frac{7}{13}?$$

(A) 108 (B) 109 (C) 110 (D) 111 (E) 112

12. Four consecutive even integers are removed from the sequence of integers $1,2,...,n,$ and the average of the remaining number is 51.5625.
Determine the largest integer removed.

(A) 28 (B) 30 (C) 32 (D) 34 (E) 36

13. Let ABCD be rhombus with AB=5. Suppose $AC \ge 6 \ge BD$, determine the maximum value of AC+BD.

(A) 13 (B) 14 (C) 15 (D) 16 (E) 17

14. Find the coefficient of $x^{17}$ in the expansion of $(1+x^5+x^7)^{20}$.

(A) 3400 (B) 3410 (C) 3420 (D) 3430 (E) 3440

15. For how many real numbers *a* do the quadratic equations

$$x^2 + ax + 8a = 0$$

have only integral roots?

(A) 1 (B) 3 (C) 5 (D) 8 (E) 10

16. If $x$, $y$ are non-zero numbers satisfying $x^2 + xy + y^2 = 0$, find the value of

$$\left(\frac{x}{x+y}\right)^{2007} + \left(\frac{y}{x+y}\right)^{2007}$$

(A) 2 (B) 1 (C) 0 (D) $-1$ (E) $-2$

17. Let $b$ a positive number. It is known that the equation $x^6 - 2bx^3 + b^2 - 100 = 0$ has exactly two real roots whose difference is 2.
Find the value of $b$.

(A) $6\sqrt{3}$ (B) $5\sqrt{3}$ (C) $4\sqrt{3}$ (D) $6\sqrt{2}$ (E) $5\sqrt{2}$

18. In ΔABC, $\angle BAC = 40^\circ$ and $\angle ABC = 60^\circ$.

D and E are points on sides AC and AB respectively such that $\angle CBD = 40^\circ$ and $\angle BCE = 70^\circ$.

Let DB intersect CE at F and AF intersect BC at G.
Find $\angle GFC$.

(A) $15^\circ$ (B) $20^\circ$ (C) $25^\circ$ (D) $30^\circ$ (E) $45^\circ$

19. Compute $1+3+5+...+2005+2007$

(A) 1008160 (B) 1008106 (C) 1008016 (D) 1006018 (E) 1006081

20. Let $a$ and $b$ are positive integers $10 < a < 1001 < b < 2007$.

Then $\frac{a}{b}$ is largest if

(A) $a$=11, $b$=2006 (B) $a$=1000, $b$=2006 (C) $a$=11, $b$=1002 (D) $a$=1000, $b$=1002 (E) $a$=500, $b$=1504

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