2013 WMI Competition
Grade 8 Part 1 Logical Reasoning Test

Problems 1–30: 5 points each for a total of 150 points.

1. Compute $500\times499\times(\frac{499}{500}-\frac{500}{499})$.

   (A) -1999 (B) -1111 (C) -1001 (D) -999

2. If $kx^3+kx^2+k+5x^3+2x^2+4$ is a second degree polynomial of x, then what must it be?

   (A) $7x^2-1$ (B) $-3x^2-1$ (C) $2x^2-3$ (D) x^2+2

3. Which one of the following is an arithmetic (equal difference) series (progression)?

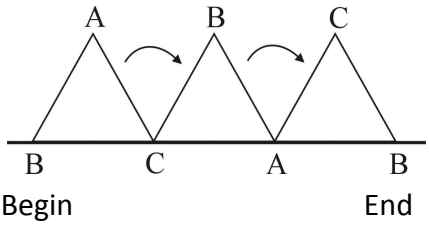
   (A) 1，2，3，4，5 (B) $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\frac{1}{7}$

   (C) 1，0，1，0，1 (D) $\frac{13}{8}+\frac{5}{4}+\frac{7}{8}+\frac{1}{2}+\frac{1}{8}$

4. Compute $\sqrt{23\frac{1}{25}}-\sqrt{\frac{147}{75}}-\sqrt{19.36}=?$

   (A) -1 (B) -1.2 (C) -2 (D) -2.4

5. Roll triangle with length 6 to the right along a straight line as shown in the right figure until vertex B lands on the line again. From the beginning to the end, how far has vertex B traveled?



   (A) 4π (B) 8π (C) 9π (D) $4\pi+12$

6. Suppose $(1+\sqrt{3}-\sqrt{5})(1-\sqrt{3}+\sqrt{5})=a+b\sqrt{c}$ with integer a, even number b, and two–digit positive integer c. Then $a+b+c=?$

   (A) 6 (B) 10 (C) 24 (D) 54

7. It is given that the three heights of a right triangle are x, 7, and 24 with heights 7 and 24 perpendicular to each other. Which one of the following choices is correct?

(A) $6<x<7$ (B) $7<x<8$ (C) $8<x<9$ (D) $9<x<10$

8. If $x=\frac{1}{\sqrt{2}+1}$, then $x^4+2x^3-x^2+x+1=?$

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

9. Let a and b be the roots of equation $x^2+2x-1699$. Then $\left|\frac{2}{5}a-\frac{2}{5}b\right| = ?$

(A) $8\sqrt{13}$ (B) $10\sqrt{7}$ (C) $8\sqrt{17}$ (D) $9\sqrt{14}$

10. Suppose $x^2+mx+n=(x-a)(x-b)$. If $m>0$ and $n>0$, then which one of the following is correct?

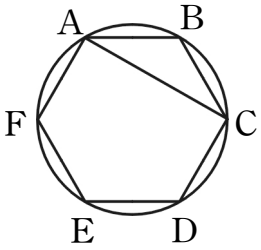
(A) $a>0$、$b>0$ (B) $a>0$、$b<0$ (C) $a<0$、$b>0$ (D) $a<0$、$b<0$

11. If each term in a sequence a_1, a_2, ……, a_9 can only take on a value of either 1 or -1, then how many possible value can S_9 take on if S_9 represents the sum of these 9 terms?

(A) 5 (B) 9 (C) 10 (D) 19

12. If *ABCDEF* is an inscribed regular hexagon as shown in the figure on the right, then which one of the following figures is NOT a symmetric image of $\triangle ABC$?

(A) $\triangle DEF$ (B) $\triangle AFE$ (C) $\triangle CDE$ (D) $\triangle ACD$



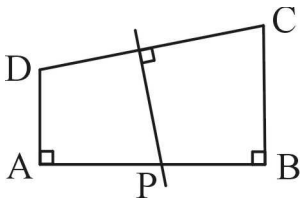
13. If P(x, y) is the symmetric image of Q(3, 3) using the y-axis as axis of symmetry on the xy-coordinate plane, then $2x-y = ?$

(A) -3 (B) -9 (C) 3 (D) 9

14. Given $\angle AOB=60°$, $\overline{AO}=8cm$, and $\overline{BO}=12cm$. Based on these conditions, which one of the following cannot be constructed using a ruler and compass.

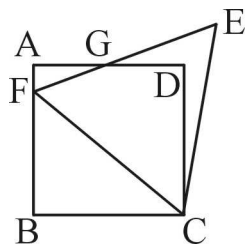
(A) 3*cm* line segment (B) 15° angle (C) 20° angle (D) 2*cm* line segment

15. Given a trapezoid *ABCD* where $\overline{DA}\perp\overline{AB}$, $\overline{CB}\perp\overline{AB}$, and a line perpendiculars to $\overline{CD}$ and intersects $\overline{AB}$ at *P*. If $\overline{AD}=20$, $\overline{BC}=30$, and $\overline{AB}=40$, then $\overline{AP}=?$



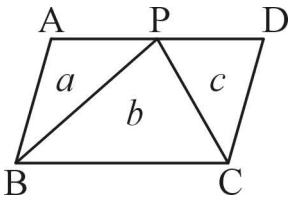
(A) 24.25 (B) 25.75 (C) 26.25 (D) 26.75

16. A square and an equilateral triangle are overlapped as shown in the right figure. If $\angle BCF = 40°$, then $\angle DGE = ?$



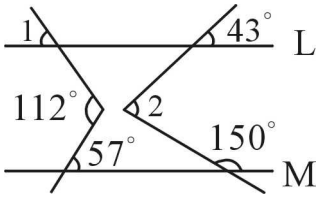
(A) 10° (B) 15° (C) 20° (D) 25°

17. Let *ABCD* be a parallelogram as shown in the figure and let *P* be a point on $\overline{AD}$. If the area of $\triangle ABP$ is *a*, area of $\triangle BCP$ is *b*, and area of $\triangle CDP$ is *c*, which one of the following choices is correct?



(A) $a = 2c$ (B) $b - a = c$ (C) $a + c > b$ (D) $a + c < b$

18. Consider the figure on the right. If L // M, then $\angle 1 + \angle 2 = ?$

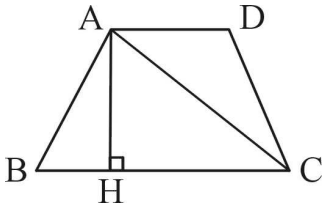


(A) 126° (B) 128° (C) 130° (D) 132°

19. Let point *O* be an interior point, not on the diagonals, of quadrilateral *ABCD*. If the Areas of $\triangle OAB$, $\triangle OBC$, and $\triangle OCD$ are 23, 21, and 27, respectively, what is the area of $\triangle OAD$?

(A) 25 (B) 27 (C) 28 (D) 29

20. Consider the isosceles trapezoid *ABCD* as shown on the right figure. If $\overline{AD} // \overline{BC}$, $\overline{AB} = \overline{CD}$, $\overline{AD} = 10$, $\overline{BC} = 22$, and the trapezoid's height $\overline{AH} = 12$, then the length of the diagonal $\overline{AC} = ?$

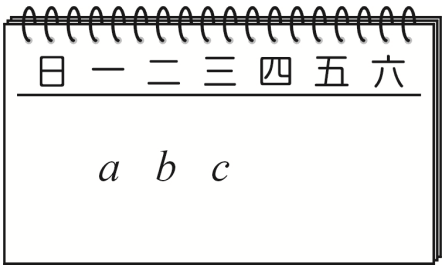


(A) 16 (B) 18 (C) 20 (D) 22

21. If $(p+q)^2 - (p-q)^2 > 37$ where *p* and *q* and $p > q$, what is the smallest possible value for *p*?

(A) 4 (B) 5 (C) 6 (D) 7

22. The figure on the right is a calendar that shows the month of September. Suppose *a*, *b*, and *c* are three consecutive dates for extra-curriculum activities. If $a^2 + b^2 + c^2 = 974$, then which date of the week it is on October 15?



(A) Sunday (B) Monday
(C) Tuesday (D) Wednesday

23. If $x - 2$ is a factor for both $5x^2 - 11x + a$ and $x^2 + bx - 2$, then $a - b = ?$

(A) 2 (B) 3 (C) 4 (D) 6

24. *Tom* and *Mary* are solving a quadratic equation with leading coefficient 1 together. *Tom* copied down the wrong coefficient for the x term, but with the correct constant term, and solved the equation with solutions of -5、3. *Mary* copied down the wrong constant term, but with the correct coefficient for the x term, and solved the equation with solutions of 4、-2. What are the correct solutions for the original equation?

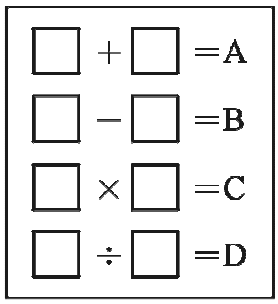
(A) 3、-5 (B) -5、-3 (C) -5、3 (D) 5、-3

25. If $x^2+5x-5=0$. then $\sqrt{(x+1)(x+2)(x+3)(x+4)+22}$ = ?

(A) 11 (B) 12 (C) 13 (D) 14

26. If ☐ in the figure on the right represents a positive integer and $A+B+C+D=49$, find how many positive factors does the positive integer represented by ☐ have?

(A) 2 (B) 3 (C) 4 (D) 6



27. Place nine hundred and ninety positive integers from 1 to 990 one after another in order to form the number 12345… 989990. How many digits does this number have?

(A) 2860 (B) 2862 (C) 2865 (D) 2872

28. Given that A and B are two positive integers with $A<B$. If $AB+A+B$ = 34, then $B-A$ = ?

(A) 1 (B) 2 (C) 3 (D) 5

29. If a, b, and c are the sides of $\triangle ABC$, then

$$\sqrt{(a+b-c)^2}+\sqrt{(c-a-b)^2}-\sqrt{(a-b-c)^2} = ?$$

(A) $a-b-c$ (B) $a+3b-c$ (C) $-a+b+c$ (D) $3a+b-3c$

30. Eight people with their last names started in “A, B, C, D, E, F, G, H” are lined up in a row in alphabetical order. A said, “I am 10 years old this year.” H said, “I am 52 years old this year.” The middle 6 people said, at the same time, “My age is 2 times the sum of the ages of the two persons next to me.” Four mathematical statements are made under these conditions.

1. The ages of these 8 people, in order, form an arithmetic (equal difference) sequence.
2. E's age is 34.
3. There are a total of 8 terms in this arithmetic sequence.
4. Since the ages of these 8 people form an arithmetic sequence, the sum of ages of A, C, E, and G is the same as the sum of ages of B, D, F, and H.

(A) Only Statements (1), (2), and (3) are correct.
(B) Only Statements (1), (3), and (4) are correct.
(C) All 4 Statements are correct.
(D) None of the Statements are correct.