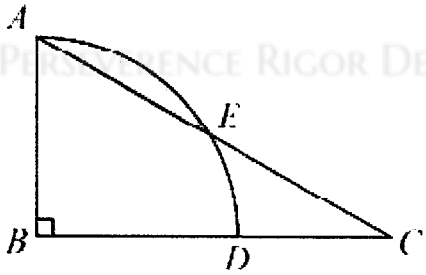
Mathlete Training Centre
WMI 2022 GRADE 9A

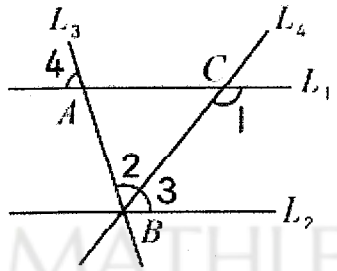
1. In the right triangle, $\angle B + 90°$, $\angle C + 30°$, $\overline{AB} = 4$. Set point B as the center of the circle and $\overline{AB}$ as the radius to draw an arc which intersects $\overline{BC}$ and $\overline{AC}$ at points D and E, respectively. Find the area of the shaded region.



(A) $\frac{4}{3}\pi - \sqrt{3}$ **(B)** $\frac{4}{3}\pi - 2\sqrt{3}$ **(C)** $\frac{8}{3}\pi - 4\sqrt{3}$ **(D)** $\frac{8}{3}\pi - 2\sqrt{3}$

2. If m and n are the two roots of the quadratic equation $x^2 - 5x + 3 = 0$, find $mn^2 + m^2n$.
(A) -30 **(B)** 30 **(C)** -15 **(D)** 15

3. As shown in the picture, $L_1 \parallel L_2, L_3$ intersects L_1 at point A and L_2 at point B, respectively. L_4 passes through B and intersects L_1 at point C. If $\angle 3 = 55°, \angle 1 + \angle 2 + \angle 3 = 240°$,find $\angle 4$.



(A) 60° **(B)** 65° **(C)** 70° **(D)** 75°

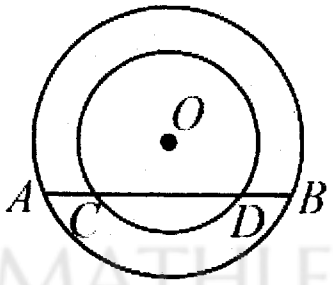
4. $x = \sqrt{27} + |-2|$ - $4tan60°$, $(\frac{x^2-1}{x^2-2x+1} - \frac{1}{x-1}) \div \frac{x-2}{x-1} = ?$

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

5. In order to maintain teaching quality, the language center accepts no more than 20 students, and the tuition fee is \$100 per student per month. When the number of students is lower than 20, the tuition fee for each student will be \$10 more for each insufficient student. How much tuition fee can the language center receive at most each month?

   (A) \$2100 **(B)** \$2250 **(C)** \$2400 **(D)** \$2500

6. In two concentric circles, $\overline{AB} = 10$, $\overline{CD} = 6$. Find the area of the shaded region between the two concentric circles.



   (A) 21π **(B)** 20π **(C)** 18π **(D)** 16π

7. Put one No.1 ball, two No.2 balls, three No.3 balls, and four No.4 balls in a bag. Given that the median of these 10 numbers is M, and the probability for each ball to be taken is the same. If a ball is taken from the bag at will, what is the probability that the number on this ball is smaller than M?

(A) $\frac{5}{10}$ **(B)** $\frac{4}{10}$ **(C)** $\frac{3}{10}$ **(D)** $\frac{2}{10}$

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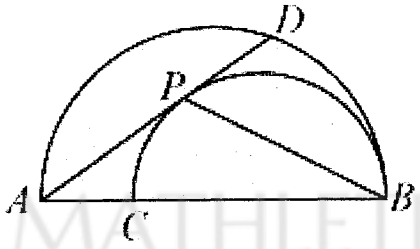
8. In the picture, $\overline{AB}$ and $\overline{BC}$ are the diameters of two semicircles, respectively; and $\overline{AD}$ is tangent to the small semicircle at point P. If $\angle PAC = 38°$, find $\angle PBC$



(A) 32° **(B)** 26° **(C)** 22° **(D)** 19°

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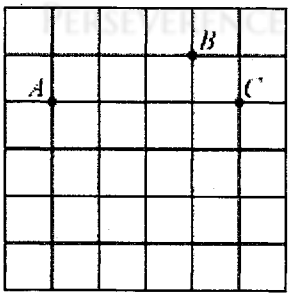
9. Set the coordinates for four points O, A, B and C on the number line to be x, -3, 3 and 6 repectively. Find the minimum value of $\overline{OA^2} + \overline{OB^2} + \overline{OC^2}$

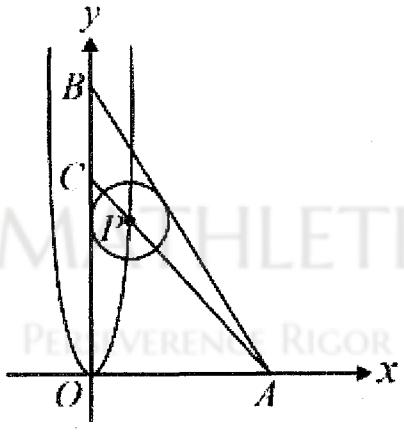
(A) 14 **(B)** 38 **(C)** 42 **(D)** 54

10. Three grid points A, B and C are on a piece of 6×6 square paper. Given that points A, B, and C are on a circumscribed circle, how many more grid points are on this circle?



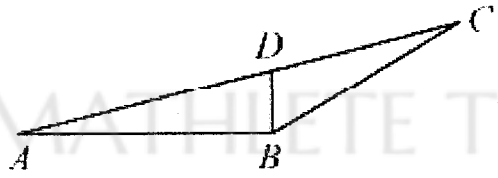
(A) 1 **(B)** 3 **(C)** 4 **(D)** 5

11. In the picture, $\overline{OA} = 6$, $\overline{OB} = 8$, $\overline{BC} = 2$, $\overline{OB}$ and $\overline{AB}$ are tangent to circle P, and point P is the intersection point of segment $\overline{AC}$ and parabola $y = ax^2$. Find a.



(A) 4 **(B)** 4.5 **(C)** 5 **(D)** 5.5

12. In $\triangle ABC$, $\overline{BD} \perp \overline{AB}$, $\overline{BD}$ intersects $\overline{AC}$ at point D, $\overline{AD} = \frac{4}{7}\overline{AC}$, $\overline{AB} = 2$, $\angle ABC = 150°$. Find the area of $\triangle DBC$

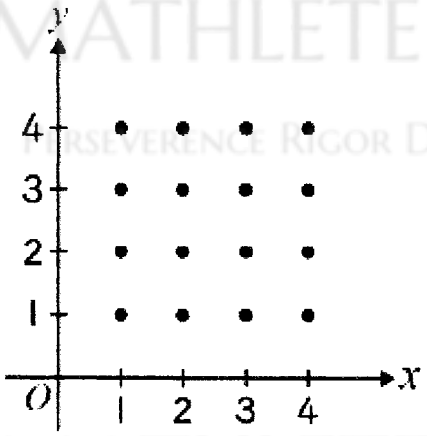


(A) $\frac{2\sqrt{3}}{7}$ **(B)** $\frac{3\sqrt{3}}{7}$ **(C)** $\frac{3\sqrt{3}}{14}$ **(D)** $\frac{9\sqrt{3}}{14}$

13. $|\frac{1}{x-y}-\frac{1}{x+y}-\frac{1}{3}|+|\frac{2}{x-y}+\frac{3}{x+y}-\frac{3}{2}|=0$, $x+3y=?$

(A) 10 **(B)** 8 **(C)** 7 **(D)** 6

14. On the rectangular coordinate plane are 16 points with ordered pairs of integers. Suppose the probability for each point to be picked is the same, find the probability that this point happens to be on $y=-2x^2+12x-14$



(A) $\frac{1}{8}$ **(B)** $\frac{3}{16}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{1}{16}$

15. Among positive integers which are not larger than 2022, how many of them are divisible by 2 or 3?

(A) 1348 **(B)** 1456 **(C)** 1658 **(D)** 1685