

2D GEOMETRY NEED FORMULA

- 2012A 21. Let points $A = (0, 0, 0)$, $B = (1, 0, 0)$, $C = (0, 2, 0)$, and $D = (0, 0, 3)$. Points E , F , G , and H are midpoints of line segments \overline{BD} , \overline{AB} , \overline{AC} , and \overline{DC} respectively. What is the area of $EFGH$?

(A) $\sqrt{2}$ (B) $\frac{2\sqrt{5}}{3}$ (C) $\frac{3\sqrt{5}}{4}$ (D) $\sqrt{3}$ (E) $\frac{2\sqrt{7}}{3}$

- 2014A 21. Positive integers a and b are such that the graphs of $y = ax + 5$ and $y = 3x + b$ intersect the x -axis at the same point. What is the sum of all possible x -coordinates of these points of intersection?
- (A) -20 (B) -18 (C) -15 (D) -12 (E) -8
- 2014B 21. Trapezoid $ABCD$ has parallel sides \overline{AB} of length 33 and \overline{CD} of length 21. The other two sides are of lengths 10 and 14. The angles at A and B are acute. What is the length of the shorter diagonal of $ABCD$?
- (A) $10\sqrt{6}$ (B) 25 (C) $8\sqrt{10}$ (D) $18\sqrt{2}$ (E) 26
- 2016A 21. Circles with centers P , Q , and R , having radii 1, 2, and 3, respectively, lie on the same side of line l and are tangent to l at P' , Q' , and R' , respectively, with Q' between P' and R' . The circle with center Q is externally tangent to each of the other two circles. What is the area of $\triangle PQR$?
- (A) 0 (B) $\sqrt{\frac{2}{3}}$ (C) 1 (D) $\sqrt{6} - \sqrt{2}$ (E) $\sqrt{\frac{3}{2}}$

- 2016B 21. What is the area of the region enclosed by the graph of the equation $x^2 + y^2 = |x| + |y|$?
- (A) $\pi + \sqrt{2}$ (B) $\pi + 2$ (C) $\pi + 2\sqrt{2}$ (D) $2\pi + \sqrt{2}$ (E) $2\pi + 2\sqrt{2}$

- 2017A 21. A square with side length x is inscribed in a right triangle with sides of length 3, 4, and 5 so that one vertex of the square coincides with the right-angle vertex of the triangle. A square with side length y is inscribed in another right triangle with sides of length 3, 4, and 5 so that one side of the square lies on the hypotenuse of the triangle. What is $\frac{x}{y}$?

- (A) $\frac{12}{13}$ (B) $\frac{35}{37}$ (C) 1 (D) $\frac{37}{35}$ (E) $\frac{13}{12}$

- 2017B 22. The diameter \overline{AB} of a circle of radius 2 is extended to a point D outside the circle so that $BD = 3$. Point E is chosen so that $ED = 5$ and line ED is perpendicular to line AD . Segment \overline{AE} intersects the circle at a point C between A and E . What is the area of $\triangle ABC$?

- (A) $\frac{120}{37}$ (B) $\frac{140}{39}$ (C) $\frac{145}{39}$ (D) $\frac{140}{37}$ (E) $\frac{120}{31}$

- 2005B 23. In trapezoid $ABCD$ we have \overline{AB} parallel to \overline{DC} , E as the midpoint of \overline{BC} , and F as the midpoint of \overline{DA} . The area of $ABEF$ is twice the area of $FECD$. What is AB/DC ?
- (A) 2 (B) 3 (C) 5 (D) 6 (E) 8
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- 2001 24. In trapezoid $ABCD$, \overline{AB} and \overline{CD} are perpendicular to \overline{AD} , with $AB + CD = BC$, $AB < CD$, and $AD = 7$. What is $AB \cdot CD$?
- (A) 12 (B) 12.25 (C) 12.5 (D) 12.75 (E) 13
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- 2008B 24. Quadrilateral $ABCD$ has $AB = BC = CD$, $\angle ABC = 70^\circ$, and $\angle BCD = 170^\circ$. What is the degree measure of $\angle BAD$?
- (A) 75 (B) 80 (C) 85 (D) 90 (E) 95

- 2011B
24. A lattice point in an xy -coordinate system is any point (x, y) where both x and y are integers. The graph of $y = mx + 2$ passes through no lattice point with $0 < x \leq 100$ for all m such that $\frac{1}{2} < m < a$. What is the maximum possible value of a ?
- (A) $\frac{51}{101}$ (B) $\frac{50}{99}$ (C) $\frac{51}{100}$ (D) $\frac{52}{101}$ (E) $\frac{13}{25}$
- 2016A
24. A quadrilateral is inscribed in a circle of radius $200\sqrt{2}$. Three of the sides of this quadrilateral have length 200. What is the length of its fourth side?
- (A) 200 (B) $200\sqrt{2}$ (C) $200\sqrt{3}$ (D) $300\sqrt{2}$ (E) 500
- 2018B
24. Let $ABCDEF$ be a regular hexagon with side length 1. Denote by X , Y , and Z the midpoints of sides \overline{AB} , \overline{CD} , and \overline{EF} , respectively. What is the area of the convex hexagon whose interior is the intersection of the interiors of $\triangle ACE$ and $\triangle XYZ$?
- (A) $\frac{3}{8}\sqrt{3}$ (B) $\frac{7}{16}\sqrt{3}$ (C) $\frac{15}{32}\sqrt{3}$ (D) $\frac{1}{2}\sqrt{3}$ (E) $\frac{9}{16}\sqrt{3}$