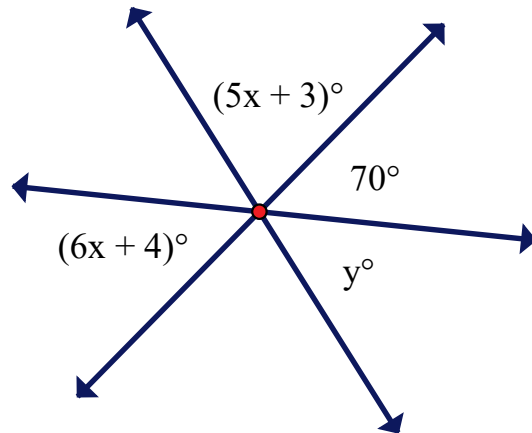


Geometry Exam

University of Houston Mathematics Contest 2025

Throughout the exam, diagrams may not be drawn to scale.

1. Find the value of y in the diagram below.



- A. 58
- B. 11
- C. 52
- D. 70
- E. 89
- F. None of the above

2. Suppose that $\triangle COU \sim \triangle GAR$ and that $m\angle A : m\angle U : m\angle G = 5 : 2 : 3$. Find $m\angle C$.

- A. 72°
- B. 36°
- C. 18°
- D. 54°
- E. 90°
- F. None of the above

3. $\triangle PQR$ is isosceles with vertex angle P . If $PQ = 12$ and the perimeter of $\triangle PQR$ is 43, find the length of QR .

- A. 19
- B. 15.5
- C. 27.5
- D. 12
- E. 10.5
- F. None of the above

4. Given the following conditional statement:

If a polygon is regular, then it is equilateral.

Determine the truth values of the inverse, the contrapositive, and the converse, respectively.

- A. True, True, False
- B. True, False, True
- C. False, True, False
- D. False, False, False
- E. True, True, True
- F. None of the above

5. Given the following information, find x .

$$\triangle CAT \sim \triangle DOG$$

$$DG = 2x + 3$$

$$AT = 4x - 9$$

$$AC = x + 1$$

$$TC = 3x - 3$$

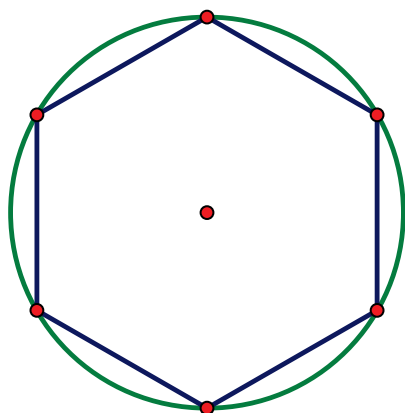
$$DO = x + 3$$

- A. 5 B. 2 C. 4 D. 6 E. 3 F. No solution

6. Five squares of the same size are placed side-by-side to form a single rectangle. The perimeter of this new rectangle is 60 cm. Find the area of the rectangle.

- A. 45
- B. 20
- C. 125
- D. 80
- E. 180
- F. None of the above

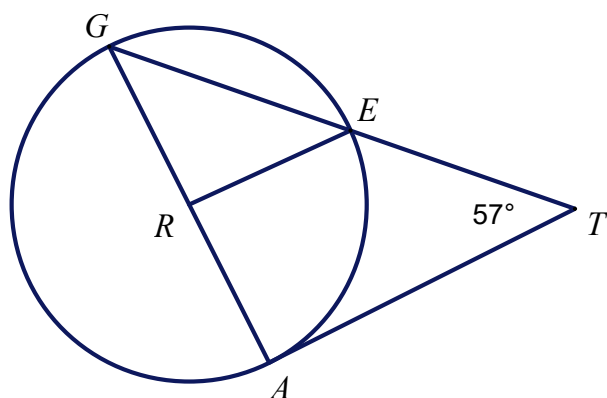
7. A regular hexagon is inscribed in a circle as shown below. If the circle has area 48π , find the area of the hexagon.



- A. $48\sqrt{3}$
B. 288
C. $72\sqrt{3}$
D. $96\sqrt{3}$
E. $36\sqrt{3}$
F. None of the above
8. Which of the following polyhedra have 8 faces?
- | | | |
|------------------------|----------------------|----------------------|
| I. Octagonal pyramid | II. Hexagonal prism | III. Octagonal prism |
| IV. Heptagonal pyramid | V. Hexagonal pyramid | |
- A. I and II only
B. III and IV only
C. I and III only
D. I and IV only
E. II and IV only
F. None of the above
9. Find the equation of a line that passes through the point $(-10, 4)$ and is perpendicular to the line $2x + 5y = 8$.
- A. $y = \frac{2}{5}x + 8$
B. $y = \frac{5}{2}x + 29$
C. $y = -\frac{2}{5}x$
D. $y = \frac{5}{2}x - 20$
E. $y = -\frac{5}{2}x - 21$
F. None of the above

10. A parallelogram has a diagonal that measures 8 cm, and all the side lengths of the parallelogram are whole numbers. Find the smallest possible perimeter of the parallelogram, in centimeters.
- A. 9
B. 17
C. 26
D. 18
E. 16
F. None of the above

11. Find the measure of $\angle GRE$, given that $\overline{AT}$ is tangent to circle R .



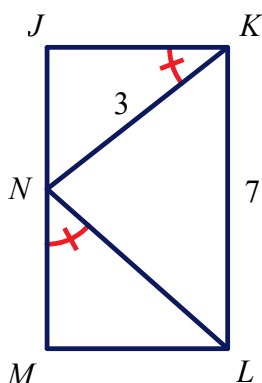
- A. 33°
B. 57°
C. 66°
D. 90°
E. 114°
F. Cannot be determined

12. The supplement of an angle is 24 degrees less than three times its complement. Find the measure of the angle.
- A. 33
B. 19
C. 23
D. 38
E. 22
F. None of the above

13. Draw trapezoid QUAD with base $\overline{AD}$, where the diagonals intersect at point P. Which of the following statements is true?
- A. $\triangle QUP \sim \triangle DAP$
B. $\triangle UPA \sim \triangle QPD$
C. $\triangle UPA \sim \triangle DPQ$
D. $\triangle UAD \sim \triangle QDA$
E. $\triangle QUP \sim \triangle ADP$
F. None of the above

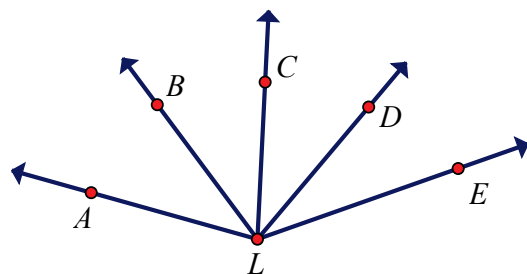
14. A kite is inscribed in a circle. If the longer diagonal of the kite measures 10 cm, and one side of the kite measures $2\sqrt{5}$ cm, find the area of the kite, in square centimeters.
- A. $20\sqrt{5}$
 B. 20
 C. $60\sqrt{2}$
 D. $10\sqrt{5}$
 E. $20\sqrt{15}$
 F. None of the above
15. Allen, Brayden, Carlos, and Duane decide that they want to share an orange at lunchtime. Allen slices the orange horizontally through its center to cut it in half, and holding both halves together in that same position, slices the orange vertically through the center – creating four orange slices of equal size and shape. If the total surface area of Brayden's orange slice is 36π cm², what is the volume of Brayden's orange slice, in cubic centimeters?
- A. 72π B. $54\pi\sqrt{2}$ C. $18\pi\sqrt{2}$ D. $36\pi\sqrt[3]{2}$ E. $72\pi\sqrt{2}$
 F. None of the above

16. Find the area of rectangle JKLM.



- A. $3\sqrt{10}$
 B. 10.5
 C. $6\sqrt{10}$
 D. $12\sqrt{10}$
 E. 21
 F. None of the above
17. Rose needs 1450 square inches of mosaic tile for a project. If the store will only sell the tile by the square foot (and will not sell any fractions of a square foot), how many square feet of tile should Rose purchase?
- A. 120 B. 11 C. 121 D. 10 E. 162
 F. None of the above

18. How many distinct angles can be named from the diagram below? (Assume that the diagram is drawn to scale, and do not count any angles greater than 180 degrees.)

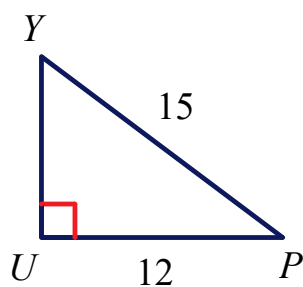


- A. 6
- B. 10
- C. 8
- D. 5
- E. 12
- F. None of the above

19. In a square pyramid, how many distinct pairs of edges are skew?

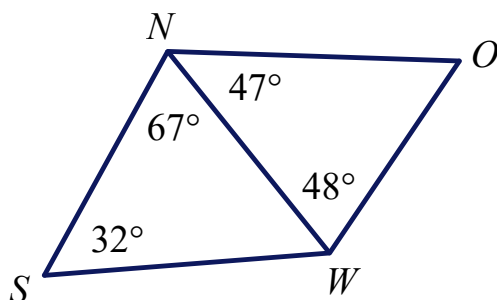
- A. 12
- B. 6
- C. 10
- D. 14
- E. 8
- F. 16

20. Using right triangle YUP, find $\tan(P) - \sin(Y)$.



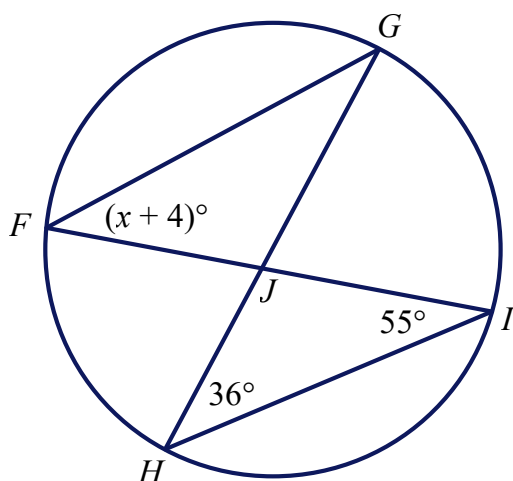
- A. $\frac{7}{12}$
- B. 0
- C. $-\frac{1}{20}$
- D. $\frac{8}{15}$
- E. $\frac{3}{20}$
- F. None of the above

21. Of the five segments drawn in the diagram below, which one has the largest measure?



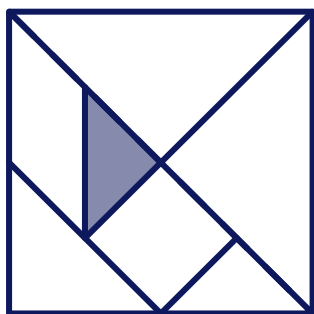
- A. $\overline{SW}$
- B. $\overline{NO}$
- C. $\overline{SN}$
- D. $\overline{NW}$
- E. $\overline{OW}$
- F. None of the above

22. Find the value of x in the circle below.



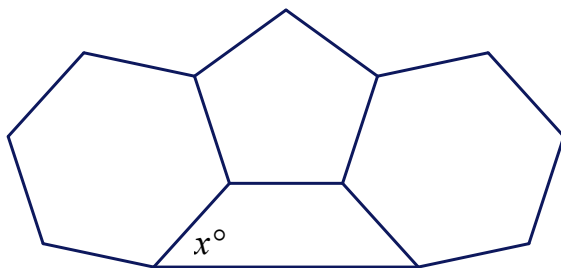
- A. 51
- B. 68
- C. 32
- D. 106
- E. 85
- F. None of the above

23. The following geometric puzzle is called a tangram. The seven polygonal pieces – a square, a parallelogram, and five triangles – are arranged to form a larger square. The interior angle measures of each of the seven pieces are multiples of 45° . Find the area of the shaded triangle, given that the outermost square has an area of 40 square units.



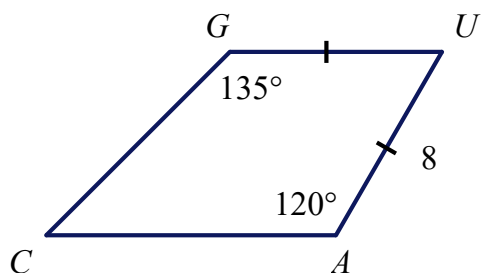
- A. 5
- B. $\frac{20}{9}$
- C. 4
- D. $\frac{20}{7}$
- E. $\frac{5}{2}$
- F. None of the above

24. The diagram below is made up of a trapezoid and three regular polygons, joined at their vertices as shown below. Find the value of x .



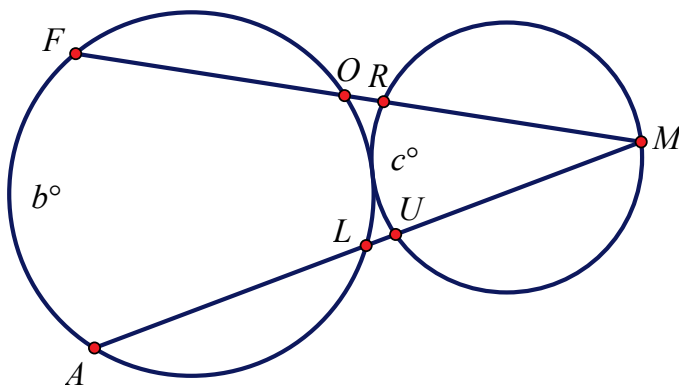
- A. 36
- B. 60
- C. 72
- D. 28
- E. 48
- F. None of the above

25. Trapezoid GUAC is shown below with bases $\overline{GU}$ and $\overline{AC}$. Find the length of the median of the trapezoid.



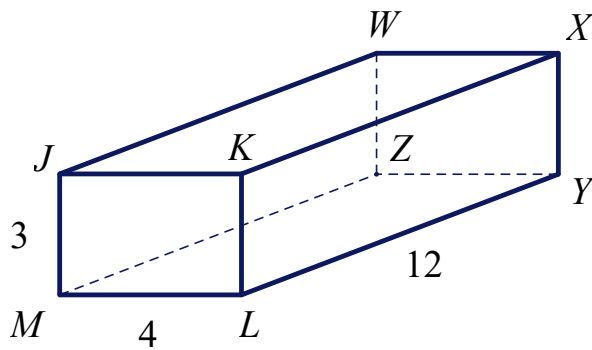
- A. $4 + 2\sqrt{2}$
- B. $8 + 2\sqrt{3}$
- C. $12 + 4\sqrt{2}$
- D. $6 + 2\sqrt{3}$
- E. $4 + 2\sqrt{6}$
- F. None of the above

26. The two circles below are externally tangent. Which expression below represents the degree measure of $\widehat{OL}$, given that $m\widehat{FA} = b^\circ$ and $m\widehat{RU} = c^\circ$?



- A. $(b - c)^\circ$
- B. $(c - b)^\circ$
- C. c°
- D. $(b - 2c)^\circ$
- E. $\left(\frac{b-c}{2}\right)^\circ$
- F. None of the above

27. A rectangular prism is shown below. Which expression represents $m\angle WLX$?



- A. $\sin^{-1}\left(\frac{4}{13}\right)$
- B. $\cos^{-1}\left(\frac{12}{13}\right)$
- C. $\tan^{-1}\left(\frac{4}{13}\right)$
- D. $\tan^{-1}\left(\frac{1}{4}\right)$
- E. $\cos^{-1}\left(\frac{4}{13}\right)$
- F. None of the above

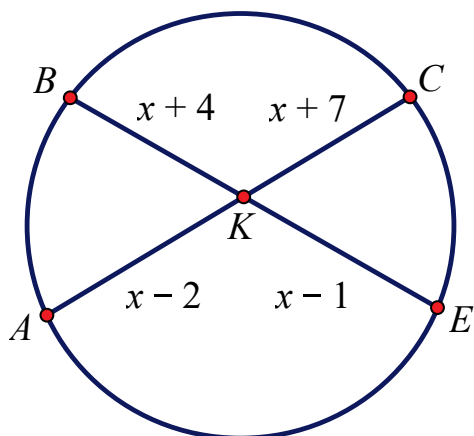
28. Polyhedron C is similar to Polyhedron D. If Polyhedron C has a surface area of 192 cm^2 , polyhedron D has a surface area of 300 cm^2 , and Polyhedron D has a volume of 500 cm^3 , find the volume of polyhedron C, in cm^3 .

- A. 2048
- B. 320
- C. 400
- D. 256
- E. 625
- F. None of the above

29. An isosceles triangle with side lengths 5, 5, and 8 is inscribed in a circle. Find the length of the circle's radius.

- A. $\frac{11}{6}$
- B. $\frac{37}{6}$
- C. 3
- D. $\frac{25}{6}$
- E. $\frac{73}{6}$
- F. None of the above

30. Find the length of the longer chord in the circle below, given that $BK = x + 4$, $KC = x + 7$, $AK = x - 2$, and $KE = x - 1$.



- A. 9
- B. 15
- C. 13
- D. 12
- E. 23
- F. None of the above

31. Find the area of the isosceles trapezoid below, given that its perimeter is 48 cm.



- A. 70
- B. $70 - 25\sqrt{3}$
- C. 140
- D. $70\sqrt{3}$
- E. $70 + 25\sqrt{3}$
- F. None of the above

32. The hour hand of a clock is 9 inches long. On any given day, how far (in inches) does the tip of the hour hand travel between 7:57 a.m. and 11:09 a.m.?

- A. $\frac{12\pi}{5}$
- B. $\frac{108\pi}{5}$
- C. $\frac{57\pi}{10}$
- D. $\frac{24\pi}{5}$
- E. $\frac{36\pi}{5}$

F. None of the above

33. Find the height, in centimeters, of a regular tetrahedron with base edge 12 cm. (A regular tetrahedron is a solid made up of four regular equilateral triangles.)

- A. $2\sqrt{33}$
- B. $4\sqrt{3}$
- C. $2\sqrt{30}$
- D. $6\sqrt{3}$
- E. $4\sqrt{6}$

F. None of the above

34. An equilateral triangle is divided into four smaller equilateral triangles of equal size and the center piece is removed (shown in black), as depicted in Figure 2. This process is repeated with each remaining triangle, resulting in Figure 3. The process is repeated, resulting in Figure 4 (not shown). If a dart is thrown randomly at Figure 4 and can land on any point within Figure 4 with equal probability, what is the probability that the dart will land on a black triangle?

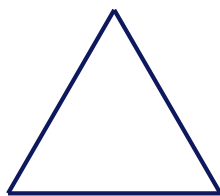


Figure 1

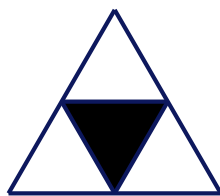


Figure 2

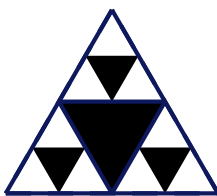


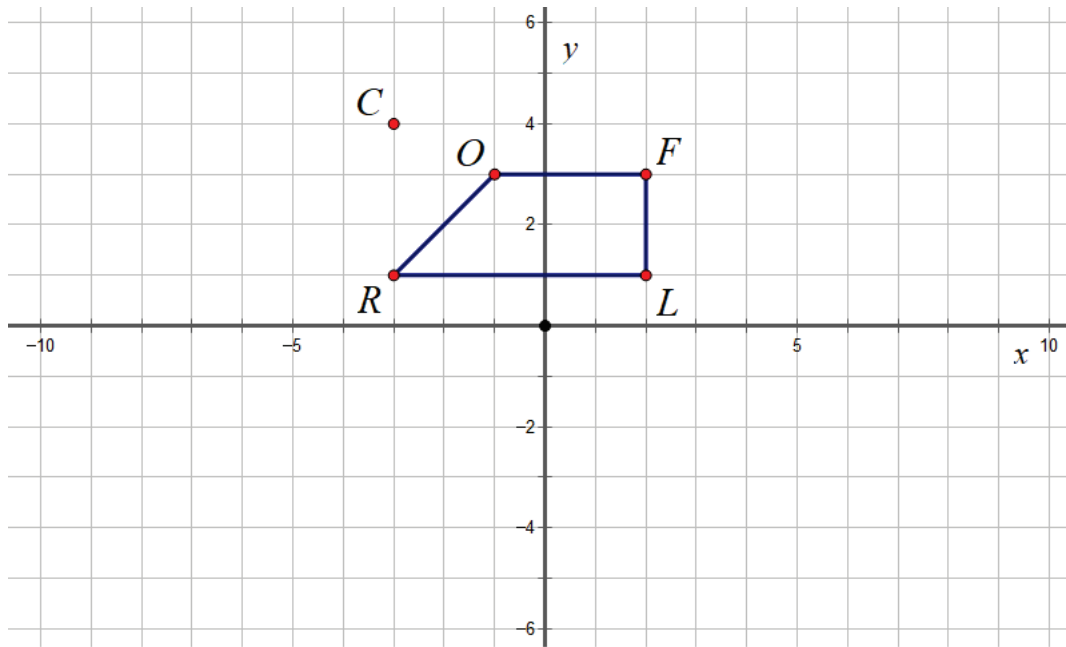
Figure 3

- A. $\frac{13}{40}$ B. $\frac{7}{16}$ C. $\frac{37}{64}$ D. $\frac{175}{256}$ E. $\frac{13}{64}$
- F. None of the above
35. $\triangle IDK$ has vertices $I(-4, 5)$, $D(5, 1)$, and $K(2, -8)$. Classify the triangle according to its sides and angles.
- A. scalene, right
 B. isosceles, acute
 C. isosceles, right
 D. scalene, acute
 E. isosceles, obtuse
 F. None of the above
36. A right cylinder with diameter 6 cm and height 10 cm is topped with a cone, where the base of the cone – also having diameter 6 cm – sits on the top base of the cylinder. If the cone's height is 4 cm, find the total surface area of this new solid, in square centimeters.
- A. 99π
 B. 84π
 C. 93π
 D. 81π
 E. 102π
 F. None of the above

37. Find the equation of a circle given that $(2, 6)$ and $(-10, -4)$ are endpoints of its longest chord.

A. $(x + 5)^2 + (y + 6)^2 = 2\sqrt{17}$
B. $(x + 4)^2 + (y - 1)^2 = 61$
C. $(x - 1)^2 + (y + 4)^2 = 2\sqrt{61}$
D. $(x - 4)^2 + (y + 1)^2 = 244$
E. $(x - 6)^2 + (y - 5)^2 = \sqrt{61}$
F. None of the above

38. If quadrilateral ROFL is dilated 200% about center $C(-3, 4)$ to produce quadrilateral $R'O'F'L'$, find the area of the portion of $R'O'F'L'$ which lies in the first quadrant.



A. 8 B. 14 C. 16 D. 13.5 E. 9.5
F. None of the above

END OF EXAM ☺