Oklahoma Math Day

November 10, 2022

Geometry

INSTRUCTIONS:

1. Do not begin the test until told to do so.
2. Calculators are not permitted.
3. Mark your answers on the separate sheet.
4. Please remain in your seat until time is called

OU Math Day 2022

Geometry Test

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1. Two of the interior angles of a triangle have degree measures $10°$ and $20°$. What is the measure of the third angle?

   (A) $30°$ (B) $330°$ (C) $150°$ (D) $60°$ (E) None of the above

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2. Which number is closest to the area of a triangle with side lengths of 150, 210, and 164?

   (A) $149,537,024$ (B) $12,229$ (C) $148,839$ (D) $201,644$ (E) 474

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3. The area of a circle is equal to five times the circumference. What is the area of the circle?

   (A) 4π (B) 4 (C) 100π (D) 10 (E) None of the above

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4. How many sides does a hexagon have?

   (A) 4 (B) 5 (C) 6 (D) 8 (E) None of the above

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5. Using degree measures, the sum of the interior angles in a hexagon equals

   (A) $1080°$ (B) $720°$ (C) $1440°$ (D) $360°$ (E) None of the above

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6. In a triangle PQR the interior angle at P is $59°$, and the interior angle at R is $60°$. Which side of the triangle is longest?

   (A) both QR and PQ (B) PR (C) QR (D) PQ (E) None of the above

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7. Points A, B and C form a triangle with $AB = 10$ and $BC = 3$. Which of the following is a possible value for AC?

   (A) 7 (B) 14 (C) 103 (D) 1 (E) None of the above

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8. A rectangle with width 32 and height 14 is inscribed in a circle. Find the area of the circle.

   (A) 305π (B) 1220π (C) 448π (D) 448 (E) None of the above

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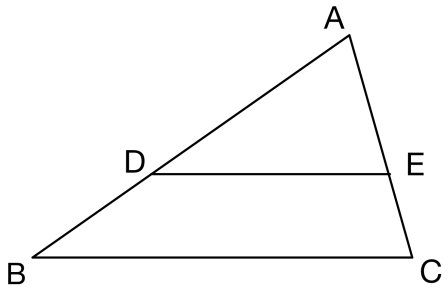
9. In the figure shown below, DE is parallel to BC, and the area of the triangle ADE equals the area of the trapezoid $BDEC$. If BC has length 100 what is the length of DE?

   (A) 60 (B) $25\sqrt{2}$ (C) 50 (D) $50\sqrt{2}$ (E) None of the above



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10. A rectangle has a diagonal $\sqrt{5}$ units long and a side $\sqrt{3}$ units long. Find its area.

(A) $\sqrt{6}$ (B) $2\sqrt{3}$ (C) 6 (D) $2\sqrt{2}+2\sqrt{3}$ (E) None of the above

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11. What is the surface area of a cube whose volume equals 27?

(A) 9 (B) 54 (C) $3\sqrt{3}$ (D) 36 (E) None of the above

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12. What is the area of an isoceles triangle whose side lengths are 15, 24 and 15?

(A) 90 (B) 54 (C) 180 (D) 108 (E) None of the above

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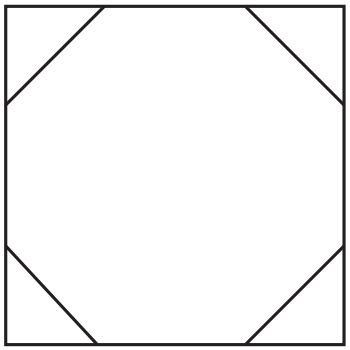
13. A regular octagon is constructed from a 6×6 square by removing four triangular corners, as shown below. What is the area of the octagon?

(A) $18\left(3-2\sqrt{2}\right)$ (B) 32 (C) $9(5-\sqrt{2})$ (D) $18(2\sqrt{2}-1)$ (E) None of the above



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14. Which of the following statements about two triangles ABC and PQR are true?

I. *If all three of the interior angles are the same then the triangles are congruent.*

II. *If all three side lengths of the triangles are equal then the triangles are congruent.*

III. *If $|AB| = |PQ|$, $|AC| = |PR|$ and the interior angles at A and P are equal then the triangles are congruent.*

(A) II only (B) I only (C) III (D) II and III only (E) None of the above

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15. Which configuration does NOT necessarily determine a unique plane in space containing it?

(A) two distinct parallel lines
(B) three distinct points
(C) a line and a point not on the line
(D) two lines which intersect in one point
(E) None of the above

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16. Among all triangles which have a base of length 10 and an altitude of height 5, what is the smallest possible area?

(A) 50 (B) $25\sqrt{2}$ (C) 25 (D) 20 (E) None of the above

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17. Among all triangles which have a base of length 10 and an altitude with height 5, what is the smallest possible perimeter?

(A) $10(1+\sqrt{2})$ (B) 20 (C) $5(3+\sqrt{5})$ (D) 15 (E) None of the above

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18. If a triangle is acute (and not a right triangle), which of the following conditions are satisfied?

I. *All internal angles are less than* $90°$.

II. *Exactly one internal angle is larger than* $90°$.

III. *The sum of all three internal angles is* $180°$.

(A) I only (B) II only (C) I and III only (D) III only (E) None of the above

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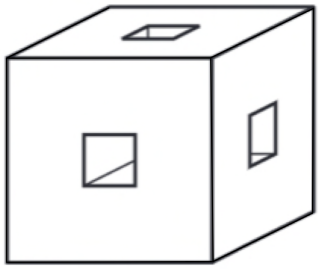
19. A cube with side length 4 has a square hole with side length 1 drilled all the way through the center of each face. (See figure below.) What is the volume of the resulting solid?

(A) 32 (B) 48 (C) 51 (D) 54 (E) None of the above



20. If the length of a rectangle is increased by 20% and its width is decreased by 25% then the area of the rectangle is

(A) increased by 10% (B) decreased by 10% (C) unchanged
(D) decreased by 5% (E) None of the above

21. As shown below, $ABCD$ is a rectangle with side lengths of 24 for AB, and 16 for BC. Also E is the midpoint of AB, and CF has length 7. Find the perimeter of the triangle DEF.

(A) 60 (B) 48 (C) 66 (D) $35 + \sqrt{527}$ (E) None of the above