OU Math Day 2014

Geometry Test

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1. A shadow in the sun cast by a tree is 48 feet. At the same time, a shadow cast by a nearby post is 15 feet. If the line of sight distance from the farthest end of the trees shadow to the top of the tree is 62 feet, what is the line of sight distance from the top of the post to the farthest end of the posts shadow? Round your answer to the nearest tenth of a foot.

   (A) 18.1 ft (B) 19.4 ft (C) 22.9 ft (D) 14.1 ft (E) None of the above.

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2. Three points P, Q and R lie on a line. Suppose that the distance between P and Q is $4d - 15$, between Q and R is $2d + 3$, and between P and R is 48. There is more than one possible value for d. What is the sum of all these possible values?

   (A) 10 (B) 28 (C) 17 (D) -5 (E) None of the above.

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3. The front of a box has area 12 square inches, the side has area 8 square inches, and the bottom has area 6 square inches. What is the volume of the box (in cubic inches)?

   (A) 576 (B) 109 (C) 24 (D) 9 (E) None of the above

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4. The minimum value of the parabola $y = x^2 - 6x + 8$ occurs at

   (A) $x = 2$ (B) $x = 3$ (C) $x = 4$ (D) $x = 5$ (E) None of the above

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5. A square piece of paper is folded in half twice: from top to bottom, then from top to bottom again. If the perimeter of the final rectangle is 10 centimeters, what was the perimeter of the original square (in centimeters)?

   (A) 14 (B) 15 (C) 16 (D) 20 (E) None of the above

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6. If each edge of a cube is increased by 30%, by what percentage does the surface area of the cube increase?

(A) 10% (B) 20% (C) 30% (D) 40% (E) None of the above

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7. The area enclosed by the graph of $y = 3|x| - 5$ and the x-axis is

(A) 25/6 (B) 25/9 (C) 25/18 (D) 25/12 (E) None of the above

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8. A circle of radius 1 is centered at $(3, 4)$. What is the distance from the origin $(0, 0)$ to the point on the circle closest to the origin?

(A) 3 (B) 4 (C) 5 (D) 6 (E) None of the above

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9. For what value of $k > 0$ will the circle $x^2 + y^2 = 3k$ and the line $y = x + k$ be tangent to each other?

(A) 8 (B) 6 (C) 4 (D) 2 (E) None of the above

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10. Find the radius of the circle inscribed in the triangle with sides 5, 12, and 13.

(A) 2 (B) 1.5 (C) 1 (D) 2.5 (E) None of the above

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11. A rectangle has a perimeter of 40 cm. If the length and width are each increased by 2 cm, by how much will the total area increase (in square centimeters)?

(A) 40 (B) 44 (C) 80 (D) 96 (E) None of the above

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12. The four corners of a square are cut off to form a regular octagon. If the resulting octagon has side length equal to 1, what is the length of a side in the original square?

(A) $\sqrt{2}/2$ (B) $1+\sqrt{2}/2$ (C) $1+\sqrt{2}$ (D) $\sqrt{2}$ (E) None of the above

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13. If an equilateral triangle and a regular hexagon have the same area, what is the ratio between their perimeters?

(A) $1:1$ (B) $\sqrt{3}:6$ (C) $6:1$ (D) $\sqrt{6}:1$ (E) None of the above

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14. The center of the circle represented by $x^2+y^2+10x-14y=-38$ is

(A) $(-5,7)$ (B) $(5,-7)$ (C) $(-5,-7)$ (D) $(-7,5)$ (E) None of the above

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15. If $(2,8)$, $(8,15)$ and $(6,k)$ are collinear points, then the value of k is

(A) 13.5 (B) 14.2 (C) 18.4 (D) 17.2 (E) None of the above

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16. A parallelogram has 3 of its vertices at $(1, 2)$, $(3, 8)$, and $(4, 1)$. What is the sum of all of the possible first coordinates for the other vertex?

(A) 6 (B) 9 (C) 8 (D) 7 (E) None of the above

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17. The distance between the points $(2, 7)$ and $(5, 3)$ is

(A) 3 (B) 4 (C) 5 (D) 6 (E) None of the above

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18. If the radius of a circle is increased by 100%, the area of the circle will increase by

(A) 100% (B) 200% (C) 300% (D) 400% (E) None of the above

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19. What is the maximum number of times a circle and a square might intersect?

(A) 4 (B) 8 (C) 10 (D) 12 (E) None of the above

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20. A right triangle with integer side lengths a, b, and c satisfies $a < b < c$ and $c - a = 9$. What is the area of the right triangle?

(A) 30 (B) 72 (C) 76 (D) 84 (E) None of the above

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21. The edge of a cube has length 2 in. What is the distance from the center point on one face to a vertex on the opposite face?

(A) $\sqrt{8}$ (B) $\sqrt{7}$ (C) $\sqrt{6}$ (D) $\sqrt{5}$ (E) None of the above

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