# Geometry
PSU Math Relays 2016

- For each problem choose the correct answer and shade the corresponding letter completely on the answer sheet. Choose "(E) none" if no correct answer is given as a choice in (A), (B), (C), or (D).
- You may write on the test but only the answer sheet will be graded.

1. In the figure below, $ABCD$ is a rectangle and $EBFD$ is a rhombus. Let $AE = 1$ and $EB = 2$. Find the area of the rectangle.

    (A) $2\sqrt{3}$ (B) $3\sqrt{3}$

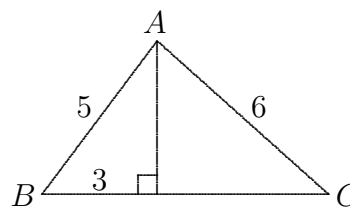   (C) $3\sqrt{2}$ (D) $4\sqrt{2}$ (E) none
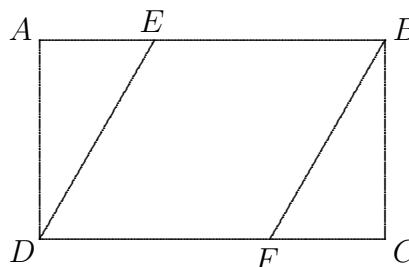
2. The diagonal of a square is 4 in. Find the area of the square.

    (A) $2\sqrt{2}$ in^2 (B) 8 in^2 (C) $4\sqrt{2}$ in^2 (D) 16 in^2 (E) none
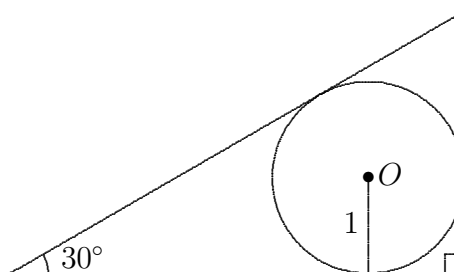
3. In the figure shown below, find the area of the triangle ABC.

    (A) $6 + 4\sqrt{5}$ (B) $6 + 2\sqrt{5}$

   (C) $6 + 4\sqrt{13}$ (D) $12 + 2\sqrt{13}$ (E) none

4. A circle of radius 1 is inscribed in a right triangle with a 30° angle, as shown in the following figure. Find the hypotenuse of the triangle to three decimal places.

    (A) 4.732   (B) 5.124

    (C) 5.464   (D) 5.732   (E) none

5. Shown in the following figure, two concentric circles have radii of 2 and 3 respectively. AB is a chord of the outer circle and is tangent to the inner circle. Find the length of AB.

   (A) $\sqrt{5}$ (B) $\sqrt{11}$
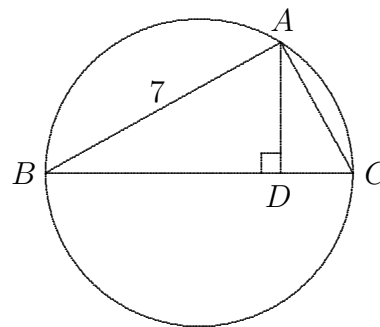
   (C) $\sqrt{13}$ (D) $\sqrt{17}$ (E) none
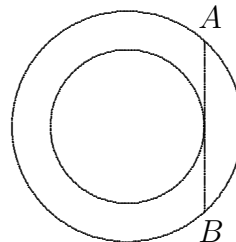
6. A square is inscribed in a circle of radius 1 cm. Find the area of the square.

   (A) $\sqrt{2}$ cm^2 (B) 2 cm^2 (C) $2\sqrt{2}$ cm^2 (D) $\sqrt{3}$ cm^2 (E) none

7. Shown in the accompanying figure is a circle with diameter $BC = 8$. Given $AB = 7$, find AD to two decimal places.

   (A) 3.39   (B) 3.48

   (C) 3.62   (D) 4.10   (E) none

8. A circle of radius 1 is inscribed in an equilateral triangle. Find the area of the triangle.

   (A) $2\sqrt{3}$ (B) 4.5   (C) $3\sqrt{3}$ (D) $6\sqrt{3}$ (E) none

9. In the figure below four congruent circles are contained in a large circle. Each small circle is tangent to the large circle and to two other small circles. If the small circles have radius 1, what is the area of the large circle?

   (A) $\pi(3 + \sqrt{2})$ (B) 8π

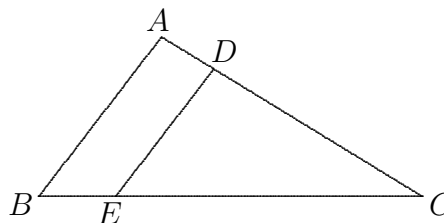   (C) $\pi(3 + 2\sqrt{2})$ (D) $\pi(5 + 2\sqrt{2})$ (E) none
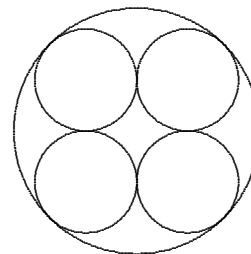
10. An annulus has inner radius 4 and outer radius 5. Find the area of the annulus.

   (A) π (B) 2π (C) 8π (D) 11π (E) none

11. In the triangles shown in the figure below, $\angle ABC = \angle DEC$, $AC = EC = 100$, and $DC = 80$. Find BE.

    (A) 22   (B) 24

    (C) 26   (D) 28   (E) none
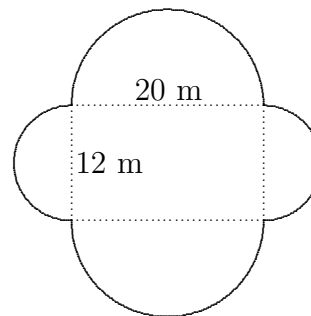
12. A circular cone has a height of 4 ft. Its base has a diameter of 6 ft. Find the volume of the cone to 2 decimal places.

    (A) 37.70 ft^3 (B) 28.27 ft^3 (C) 25.13 ft^3 (D) 18.85 ft^3 (E) none

13. A playground in the shape of a rectangle with a semicircle attached on each side is shown in the figure below. Find its area to the nearest square meter.

    (A) 427 m^2 (B) 667 m^2

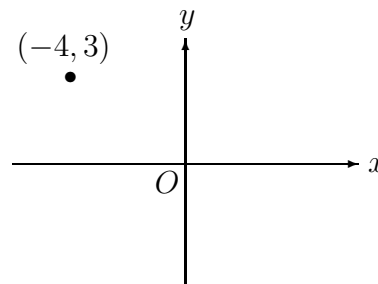   (C) 855 m^2 (D) 1095 m^2 (E) none

    20 m

    12 m

14. A can has the shape of a cylinder. Both the height and the diameter of the base are 4 in. Find the surface area of the can.

    (A) 12π in^2 (B) 16π in^2 (C) 20π in^2 (D) 24π in^2 (E) none

15. The point $(-4, 3)$ is rotated $90°$ counterclockwise about the origin O and then is reflected about the y-axis. Find the coordinates of the image.

    (A) $(-3, -4)$ (B) $(4, -3)$ $(-4, 3)$
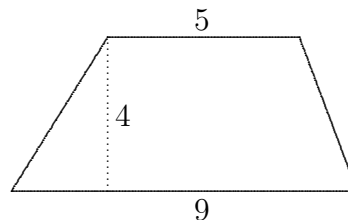
    (C) $(-3, 4)$ (D) $(3, -4)$ (E) none

16. A circle has a circumference of 6π ft. What is its area?

    (A) 3π ft^2 (B) 6π ft^2 (C) 9π ft^2 (D) 12π ft^2 (E) none

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17. The figure below shows a trapezoid. Find its area.
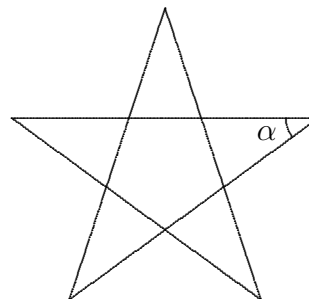
(A) 28   (B) 26

(C) 24   (D) 22   (E) none

18. A man stands 20 ft away from a lamp post. The man is 6 ft tall and his shadow cast by the light on top of the lamp post is 10 ft long. Find the height of the lamp post.

(A) 12 ft   (B) 16 ft   (C) 20 ft   (D) 24 ft   (E) none

19. The following figure shows a symmetrical star. Find the angle α.

(A) 30°   (B) 32°

(C) 34°   (D) 36°   (E) none

20. In the circle centered at O shown in the figure below, $\alpha = 58°$ and $\beta = 66°$. Find the angle γ.

(A) 114°   (B) 116°

(C) 118°   (D) 120°   (E) none