Drill Problems: Week 2.3

Author: Jaehoon Song (Lecturer) *Release: 2025-06-20 00:34:11-04:00*

Purpose and Usage:

This material has been developed for internal training and educational purposes at Hans edu LLC. It is intended for use within our organization and should not be distributed, sold, or used for commercial purposes outside of our educational programs.

For Our Community:

Students and staff are welcome to use this material in their studies and teaching at Hans edu LLC. While we encourage active engagement with the content, please respect that this is proprietary material. Any reproduction or distribution outside of our organization's educational activities is not permitted.

Content and Attribution:

This material represents our adaptation of various established mathematics textbooks, reorganized and enhanced for our teaching context. While we've added our own pedagogical improvements, we maintain proper attribution to original sources. This work is shared under the Creative Commons Attribution-NonCommercial-ShareAlike (CC BY-NC-SA) license, allowing internal use and adaptation while respecting the original creators' rights.

Quality Assurance:

We have carefully reviewed this material for accuracy and clarity. However, as with any educational resource, we encourage critical engagement and verification of concepts. If you notice any issues or have suggestions for improvement, please bring them to our attention.

COLUMBIA ACADEMY

enrichment beyond the classroom

Written by Jaehoon Song (Lecturer)

1. **Arc Length Calculation** (10 points)

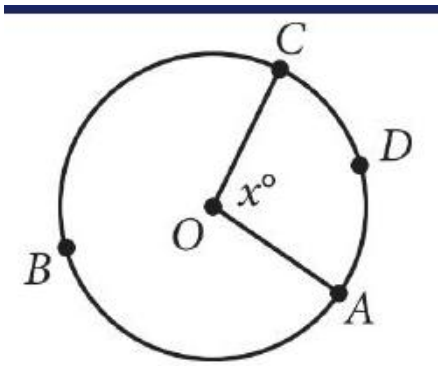

Figure 1: Circle with center O and arcs

The circle above has center O, the length of arc $\overline{ADC}$ is 5π, and $x = 100$. What is the length of arc $\overline{ABC}$?

(A) 9π

(B) 13π

(C) 18π

(D) $\frac{13}{2}\pi$

Answer:

2. **Circle Radius from Equation** (10 points)
The graph of $x^2 + x + y^2 + y = \frac{199}{2}$ in the xy-plane is a circle. What is the length of the circle's radius?

Answer:

3. **Circle Center Coordinates** (10 points)
The equation above defines a circle in the xy-plane. What are the coordinates of the center of the circle?

(A) $(-20, -16)$

(B) $(-10, -8)$

(C) $(10, 8)$

(D) $(20, 16)$

Answer:

4. **Arc Length with Angle** (10 points)

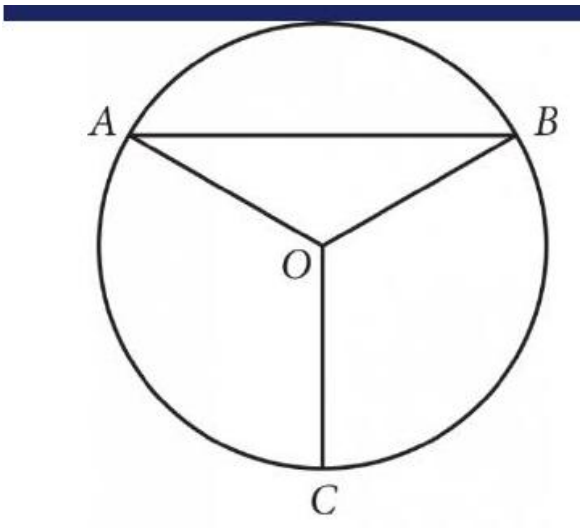

Figure 2: reference attached

Point O is the center of the circle above, and the measure of $\angle OAB$ is $30°$. If the length of $\overline{OC}$ is 18, what is the length of arc $\overline{AB}$?

(A) 9π

(B) 12π

(C) 15π

(D) 18π

Answer:

□

5. **Circle Radius from Diameter** (10 points)
A circle in the xy-plane has a diameter with endpoints $(2, 4)$ and $(2, 14)$. An equation of this circle is $(x-2)^2 + (y-9)^2 = r^2$, where r is a positive constant. What is the value of r?

Answer:

□

6. **Angle Calculation in Triangle** (10 points)

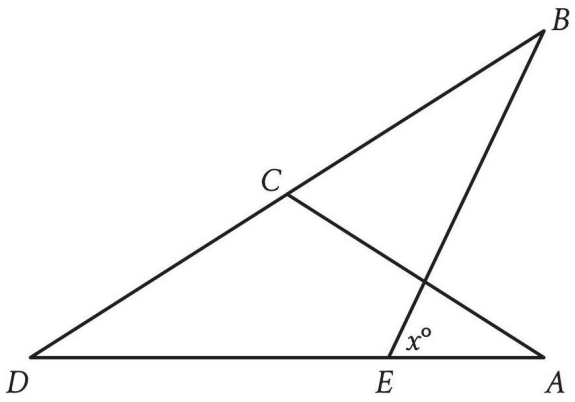

Figure 3: reference attached

In the figure, $AC = CD$. The measure of angle EBC is 45°, and the measure of angle ACD is 104°. What is the value of x?

Answer:

□

7. **Complex Angle Calculation** (10 points)

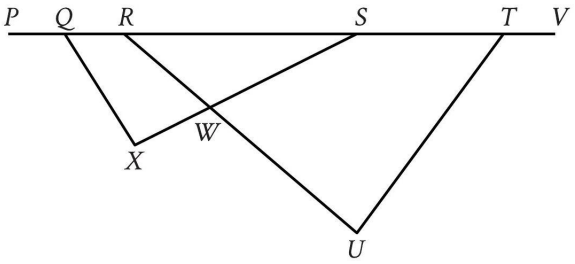

Figure 4: reference attached

In the figure shown, points Q, R, S, and T lie on line segment PV, and line segment RU intersects line segment SX at point W. The measure of $\angle SQX$ is 48°, the measure of $\angle SXQ$ is 86°, the measure of $\angle SWU$ is 85°, and the measure of $\angle VTU$ is 162°. What is the measure, in degrees, of $\angle TUR$?

Answer:

□

8. **Intersecting Lines Angle** (10 points)
Intersecting lines r, s, and t are shown below.

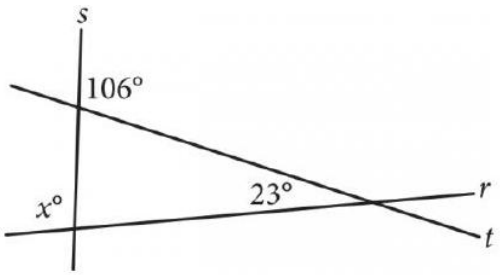

Figure 5: reference attached

What is the value of x?

Answer:

9. **Parallel Lines Angle** (10 points)

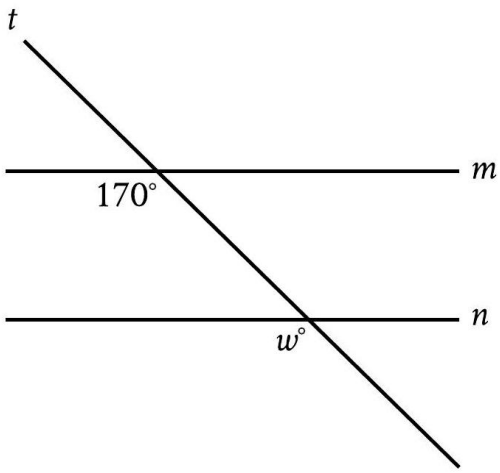

Figure 6: reference attached

In the figure, line m is parallel to line n. What is the value of w?

(A) 17
(B) 30
(C) 70
(D) 170

Answer:

10. **Isosceles Triangle Angle** (10 points)

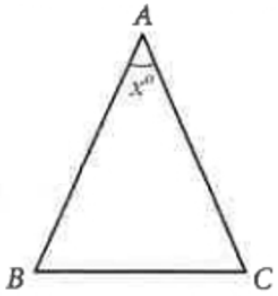

Figure 7: reference attached

In the given triangle, $AB = AC$ and $\angle ABC$ has a measure of 67°. What is the value of x?

(A) 36
(B) 46
(C) 58
(D) 70

Answer:

11. **Intersecting Segments Angle** (10 points)

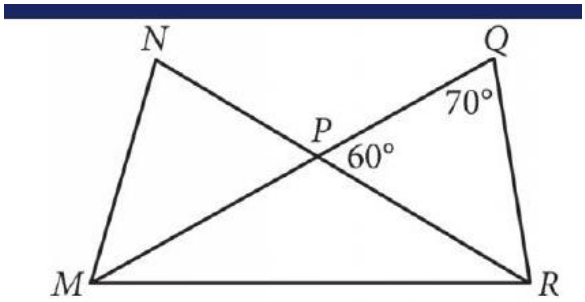

Figure 8: reference attached

In the figure above, $\overline{MQ}$ and $\overline{NR}$ intersect at point P, $NP = QP$, and $MP = PR$. What is the measure, in degrees, of $\angle QMR$? (Disregard the degree symbol when gridding your answer.)

Answer:

12. **Similar Triangles Angle** (10 points)

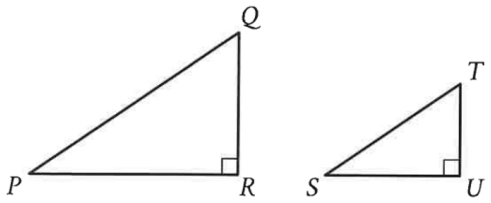

Figure 9: reference attached

Right triangles PQR and STU are similar, where P corresponds to S. If the measure of angle Q is 18°, what is the measure of angle S?

(A) 18°
(B) 72°
(C) 82°
(D) 162°

Answer:

□

13. **Parallel Lines with Transversal** (10 points)

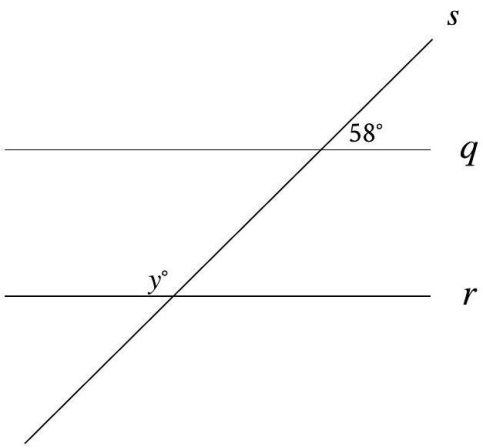

Figure 10: reference attached

In the figure, line q is parallel to line r, and both lines are intersected by line s. If $y = 2x + 8$, what is the value of x?

Answer:

□

14. **Parallel Lines Angle Relationship** (10 points)

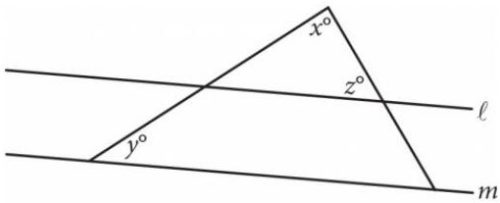

Figure 11: reference attached

In the figure above, lines ℓ and m are parallel, $y = 20$, and $z = 60$. What is the value of x?

(A) 120
(B) 100
(C) 90
(D) 80

Answer:

□

15. **Parallel Lines Proportionality** (10 points)

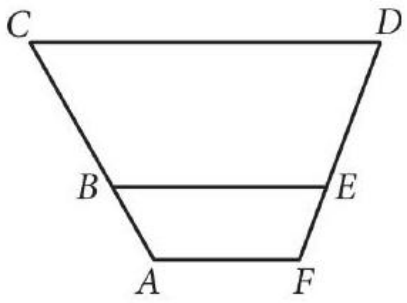

Figure 12: reference attached

In the figure above, $\overline{AF}$, $\overline{BE}$, and $\overline{CD}$ are parallel. Points B and E lie on $\overline{AC}$ and $\overline{FD}$, respectively. If $AB = 9$, $BC = 18.5$, and $FE = 8.5$, what is the length of $\overline{ED}$, to the nearest tenth?

(A) 16.8
(B) 17.5
(C) 18.4
(D) 19.6

Answer:

□

16. **Similar Triangles Sine Value** (10 points)
Triangle FGH is similar to triangle JKL, where angle F corresponds to angle J and angles G and K are right angles. If $\sin(F) = \frac{308}{317}$, what is the value of $\sin(J)$?

(A) $\frac{75}{317}$
(B) $\frac{308}{317}$
(C) $\frac{317}{308}$
(D) $\frac{317}{75}$

Answer:

□

17. **Right Triangle Trigonometric Relationship** (10 points)
In right triangle RST, the sum of the measures of angle R and angle S is 90 degrees. The value of $\sin(R)$ is $\frac{\sqrt{15}}{4}$. What is the value of $\cos(S)$?

(A) $\frac{\sqrt{15}}{15}$
(B) $\frac{\sqrt{15}}{4}$
(C) $\frac{4\sqrt{15}}{15}$
(D) $\sqrt{15}$

Answer:

□

18. **Tangent Value Calculation** (10 points)

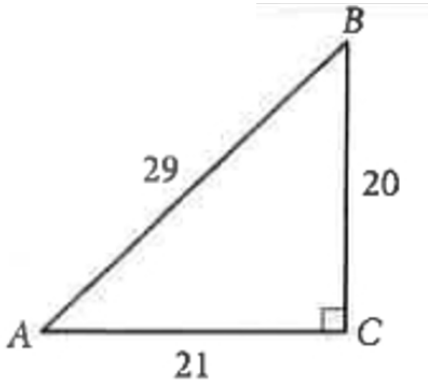

Figure 13: reference attached

In the figure above, what is the value of $\tan(A)$?

(A) $\frac{20}{29}$
(B) $\frac{21}{29}$
(C) $\frac{20}{21}$
(D) $\frac{21}{20}$

Answer:

19. **Right Triangle Side Length** (10 points)

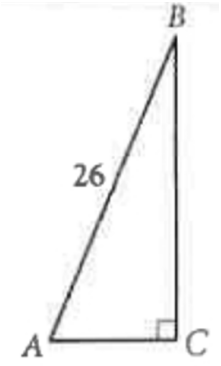

Figure 14: reference attached

Triangle ABC above is a right triangle, and $\sin(B) = \frac{5}{13}$. What is the length of side $\overline{BC}$?

Answer:

20. **Pythagorean Theorem Application** (10 points)

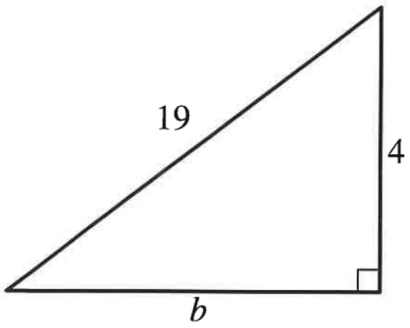

Figure 15: reference attached

Which equation shows the relationship between the side lengths of the given triangle?

(A) $4b = 19$
(B) $4 + b = 19$
(C) $4^2 + b^2 = 19^2$
(D) $4^2 - b^2 = 19^2$

Answer: