



Miscellaneous Concepts in GMAT Quant

Concept # 1: Overlapping Sets – 2 variables (2 way matrix approach)

1. How many attendees are at a convention if 150 of the attendees are neither female nor students, one-sixth of the attendees are female students, two-thirds of the attendees are female, and one-third of the attendees are students?
300 450 600 800 900
2. Of the 645 speckled trout in a certain fishery that contains only speckled and rainbow trout, the number of males is 45 more than twice the number of females. If the ratio of female speckled trout to male rainbow trout is 4:3 and the ratio of male rainbow trout to all trout is 3:20, how many female rainbow trout are there?
192 195 200 205 208

Concept # 2: Overlapping Sets – 3 variables (3 circles approach)

3. In a group of 68 students, each student is registered for at least one of three classes – History, Math and English. Twenty-five students are registered for History, twenty-five students are registered for Math, and thirty-four students are registered for English. If only three students are registered for all three classes, how many students are registered for exactly two classes?
13 10 9 8 7
4. Each of the 59 members in a high school class is required to sign up for a minimum of one and a maximum of three academic clubs. The three clubs to choose from are the poetry club, the history club, and the writing club. A total of 22 students sign up for the poetry club, 27 students for the history club, and 28 students for the writing club. If 6 students sign up for exactly two clubs, how many students sign up for all three clubs?
2 5 6 8 9

Concept # 3: Percentages – (MIND THE LANGUAGE) – these questions test more of reading ability and less of math – read very carefully in such questions:

1. Before being simplified, the instructions for computing income tax in Country R were to add 2 percent of one's annual income to the average (arithmetic mean) of 100 units of Country R's currency and 1 percent of one's annual income. Which of the following represents the simplified formula for computing the income tax, in Country R's currency, for a person in that country whose annual income is A?
50+A/200 50+3A/100 50+A/40 100+A/50 100+3A/100
2. A certain city with population of 132,000 is to be divided into 11 voting districts, and no district is to have population that is more than 10 percent greater than the population of any other district. What is the minimum possible population that the least population district could have?
10700 10800 10900 11000 11100
3. In May Mr. Lee's earnings were 60 percent of the Lee family's total income. In June Mr. Lee earned 20 percent more than in May. If the rest of the family's income was the same both months, then, in June, Mr. Lee's earnings were approximately what percent of the Lee Family's total income?
4. Three grades of milk are 1 percent, 2 percent, and 3 percent by volume. If x gallons of 1 percent grade, y gallons of 2 percent grade, z gallons of 3 percent grade are mixed to give x + y + z gallons of a 1.5 percent grade, what is x in terms of y and z?

5. Whenever Martin has a restaurant bill with an amount between \$10 and \$99, he calculates the dollar amount of the tip as 2 times the tens digit of the amount of his bill. If the amount of Martin's most recent restaurant bill was between \$10 and \$99, was the tip calculated by Martin on this bill greater than 15 percent of the amount of the bill?
- (1) The amount of the bill was between \$15 and \$30 (2) The tip calculated by Martin was \$8
6. A school's annual budget for the purchase of student computers increased by 60% this year over last year. If the price of student computers increased by 20% this year, then the number of computers it can purchase this year is what percent greater than the number of computers it purchased last year?
- 33.33% 40% 42% 48% 60%

Concept # 4: Average Speed: No formula here:

Average Speed = Total Distance / Total Time

1. Lexy walks 5 miles from point A to point B in one hour, then bicycles back to point A along the same route at 15 miles per hour. Ben makes the same round trip, but does so at half of Lexy's average speed. How many minutes does Ben spend on his round trip?
- 40 80 120 160 180
2. Triathlete Dan runs along a 2-mile stretch of river and then swims back along the same route. If Dan runs at a rate of 10 miles per hour and swims at a rate of 6 miles per hour, what is his average rate for the entire trip in miles per minute?
- 1/8 2/15 3/15 1/4 3/8

Concept # 5: Speed and Distance: Speed = Distance / Time

3. What is the distance between Harry's home and his office?
- (1) Harry's average speed on his commute to work this Monday was 30 miles per hour.
(2) If Harry's average speed on his commute to work this Monday had been twice as fast, his trip would have been 15 minutes shorter.
4. The 'moving walkway' is a 300-foot long conveyor belt that moves continuously at 3 feet per second. When Bill steps on the walkway, a group of people that are also on the walkway stands 120 feet in front of him. He walks toward the group at a combined rate (including both walkway and foot speed) of 6 feet per second, reaches the group of people, and then remains stationary until the walkway ends. What is Bill's average rate of movement for his trip along the moving walkway?
- 2 feet per second 2.5 feet per second 3 feet per second
4 feet per second 5 feet per second

Concept # 6: Relative Speed:

Time to overtake (same directions) = Gap distance / difference of speeds

Time to meet (opposite directions: towards each other) = Gap distance / sum of speeds

5. John and Jacob set out together on bicycle traveling at 15 and 12 miles per hour, respectively. After 40 minutes, John stops to fix a flat tire. If it takes John one hour to fix the flat tire and Jacob continues to ride during this time, how many hours will it take John to catch up to Jacob assuming he resumes his ride at 15 miles per hour? (Consider John's deceleration/acceleration before/after the flat to be negligible)
- 3 3.33 3 1/2 4 4 1/2

Concept # 7: Work:

If A alone takes X hours and B alone takes Y hours to do a piece of work, and if Z is the total time taken when they work together, then we have: $1/X + 1/Y = 1/Z$ or $Z = XY/(X + Y)$

A's contribution = $Y/(X + Y)$

B's contribution = $X/(X + Y)$

It is best to take the LCM of times taken to avoid using fractions in such questions.

- Machine A and Machine B can produce 1 widget in 3 hours working together at their respective constant rates. If Machine A's speed were doubled, the two machines could produce 1 widget in 2 hours working together at their respective rates. How many hours does it currently take Machine A to produce 1 widget on its own?
 $\frac{1}{2}$ 2 3 5 6
- Tom, working alone, can paint a room in 6 hours. Peter and John, working independently, can paint the same room in 3 hours and 2 hours, respectively. Tom starts painting the room and works on his own for one hour. He is then joined by Peter and they work together for an hour. Finally, John joins them and the three of them work together to finish the room, each one working at his respective rate. What fraction of the whole job was done by Peter?
 $\frac{1}{9}$ $\frac{1}{6}$ $\frac{1}{3}$ $\frac{7}{18}$ $\frac{4}{9}$
- Machine A can fill an order of widgets in a hours. Machine B can fill the same order of widgets in b hours. Machines A and B begin to fill an order of widgets at noon, working together at their respective rates. If a and b are even integers, is Machine A's rate the same as that of Machine B?
(1) Machines A and B finish the order at exactly 4:48 p.m.
(2) $(a + b)^2 = 400$

Concept # 8: Compound Interest formula: $A = P \left(1 + \frac{R}{100}\right)^n$ $CI = A - P$.

For half yearly calculation of the interest: $A = P \left(1 + \frac{R}{200}\right)^{2n}$

For quarterly calculation of the interest: $A = P \left(1 + \frac{R}{400}\right)^{4n}$

In all these results: A = Final Amount, P = Principal (Initial Amount), R = Rate per annum, n = number of years.

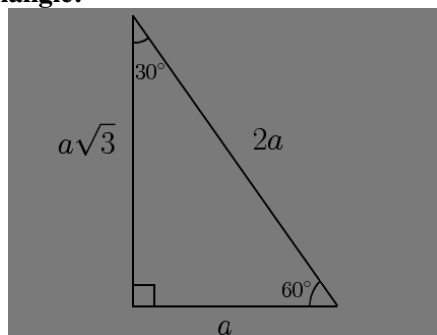
- A certain investment grows at an annual interest rate of 8%, compounded quarterly. Which of the following equations can be solved to find the number of years, x , that it would take for the investment to increase by a factor of 16?
 $16 = (1.02)^{x/4}$ $2 = (1.02)^x$ $16 = (1.08)^{4x}$ $2 = (1.02)^{x/4}$ $1/16 = (1.02)^{4x}$
- An investor purchased a share of non-dividend-paying stock for p dollars on Monday. For a certain number of days, the value of the share increased by r percent per day. After this period of constant increase, the value of the share decreased the next day by q dollars and the investor decided to sell the share at the end of that day for v dollars, which was the value of the share at that time. How many working days after the investor bought the share was the share sold, if $r = 100 \left(\sqrt{\frac{v+q}{p}} - 1 \right)$?
2 3 4 5 6

Concept # 9: Population Growth:

$$Final = Initial \left[\text{Factor of Multiplication} \right]^{\frac{\text{Total Time Available}}{\text{Time interval required for one Multiplication}}}$$

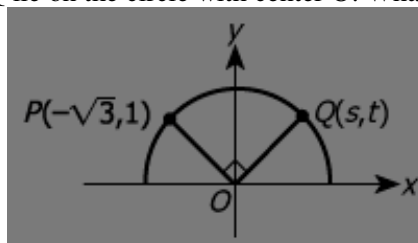
- The number of antelope in a certain herd increases every year at a constant rate. If there are 500 antelope in the herd today, how many years will it take for the number of antelope to double?
 - Ten years from now, there will be more than ten times the current number of antelope in the herd.
 - If the herd were to grow in number at twice its current rate, there would be 980 antelope in the group in two years.
- If a certain culture of bacteria increases by a factor of x every y minutes, how long will it take for the culture to increase to ten-thousand times its original amount?
 - $\sqrt[10]{x} = 10$
 - In two minutes, the culture will increase to one-hundred times its original amount.

Concept # 10: 30-60-90 Right angled triangle:

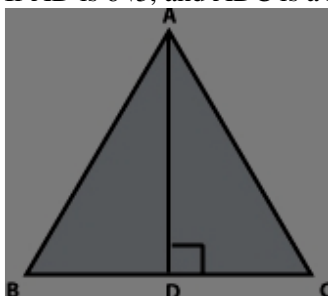


Side opposite the angle 30° is the smallest (say a), so the side opposite the angle 60° will be $a\sqrt{3}$ and the side the angle 90° will be $2a$.

- In the given figure, points P and Q lie on the circle with center O. What is the value of s ?



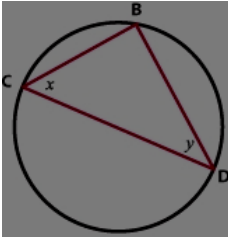
- If AD is $6\sqrt{3}$, and ADC is a right angle, what is the area of triangular region ABC?



(1) Angle ABD = 60°

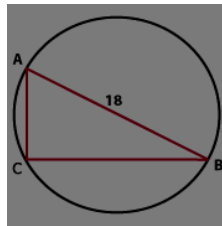
(2) AC = 12

3. If CD is the diameter of the circle, does x equal 30?



- (1) The length of CD is twice the length of BD . (2) $y = 60$

4. For the triangle shown, where A, B and C are all points on a circle, and line segment AB has length 18, what is the area of triangle ABC?

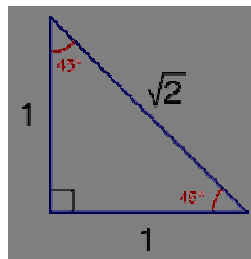


- (1) Angle ABC measures 30° . (2) The circumference of the circle is 18π .

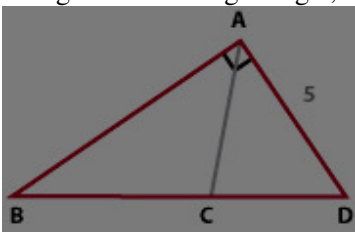
5. For a circle with center point P, cord XY is the perpendicular bisector of radius AP (A is a point on the edge of the circle). What is the length of cord XY?

- (1) The circumference of circle P is twice the area of circle P. (2) The length of Arc XAY = $2\pi/3$.

Concept # 11: 45-45-90 Right angled triangle (isosceles right triangle):

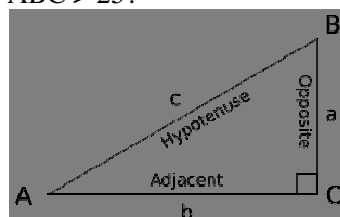


1. If angle BAD is a right angle, what is the length of side BD ?



- (1) AC is perpendicular to BD (2) $BC = CD$

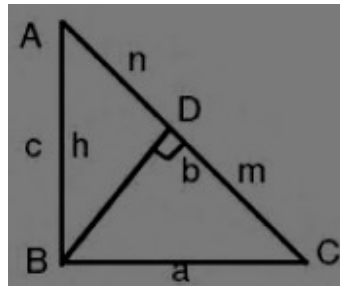
2. Is the area of the right angled triangle $ABC > 25$?



- (1) $AC = 6$ (2) $AB = 10$

3. The perimeter of a certain isosceles right triangle is $16 + 16\sqrt{2}$, what is the length of the hypotenuse of the triangle?

Concept # 12: Right angled triangle



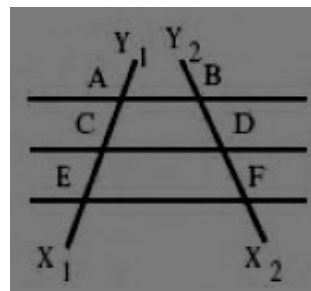
A triangle whose one angle is 90° is called a right (angled) Triangle. In the figure, b is the hypotenuse, and a & c the legs, called base and height resp.

- (1) $h^2 = mn$
- (2) $AC^2 = AB^2 + BC^2$ (Pythagoras theorem)
- (3) $h = ac/b$
- (4) $\text{Area} = ac / 2$

Concept # 13: Similar Triangles:

1. Proportionality Theorem:

Intercepts made by two transversal lines (cutting lines) on three or more parallel lines are proportional. In the figure, lines X_1Y_1 & X_2Y_2 are transversals cutting the three parallel lines AB , CD , EF . Then AC , CE , BD , DF are intercepts Also,



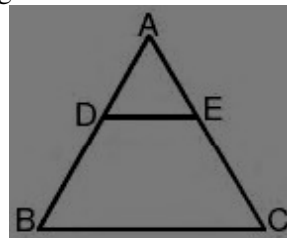
$$AC/BD = CE/DF$$

2. Midpoint Theorem:

A triangle, the line joining the mid points of two sides is parallel to the third side and half of it.

3. Basic Proportionality Theorem:

A line parallel to any one side of a triangle divides the other two sides proportionally. If DE is parallel to BC , then



- (a) $AD/BD = AE/EC$
- (b) $AB/AD = AC/AE$
- (c) $AD/DE = AB/BC$ and so on.

4. PROPERTIES OF SIMILAR TRIANGLES:

In SIMILAR FIGURES, the RATIO OF AREAS is (RATIO OF LENGTHS)²

If length ratio = $a : b$ area ratio = $a^2 : b^2$

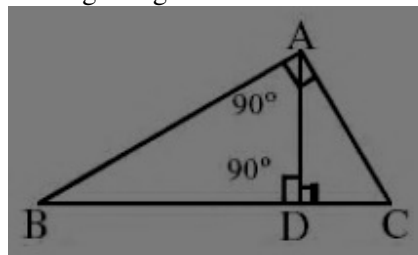
In SIMILAR SOLIDS, the RATIO OF VOLUMES is (RATIO OF LENGTHS)³

In SIMILAR SOLIDS, the RATIO OF SURFACE AREAS is (RATIO OF LENGTHS)²

Length ratio = $a : b$ surface area ratio = $a^2 : b^2$ volume ratio = $a^3 : b^3$

5. RIGHT TRIANGLE (similarity):

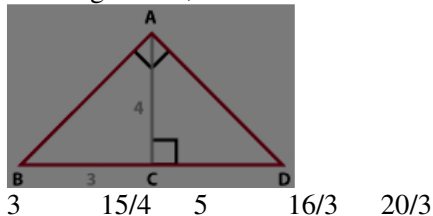
ABC is a Right Triangle with A as the Right angle.



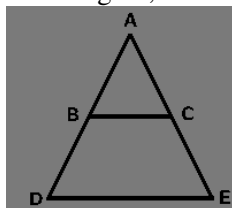
AD is perpendicular to BC then

- (a) Triangle ABD ~ Triangle CBA & $BA^2 = BC \times BD$
- (b) Triangle ACD ~ Triangle BCA & $CA^2 = CB \times CD$
- (c) Triangle ABD ~ Triangle CAD & $DA^2 = DB \times DC$.

1. In triangle ABC, if $BC = 3$ and $AC = 4$, then what is the length of segment CD ?

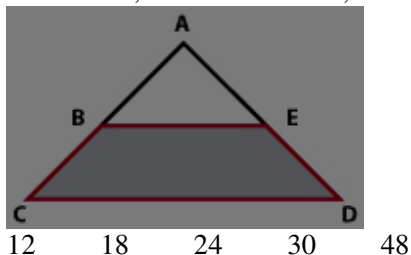


2. In the figure, $AC = 3$, $CE = x$, and BC is parallel to DE . If the area of

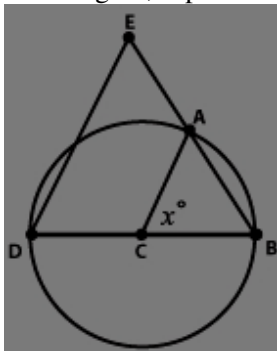


triangle ABC is $1/12$ of the area of triangle ADE, then $x = ?$

3. If $BE \parallel CD$, and $BC = AB = 3$, $AE = 4$ and $CD = 10$, what is the area of trapezoid $BEDC$?

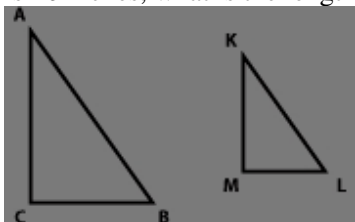


4. In the figure, if point C is the center of the circle and $DB = 7$, what is the length of DE ?



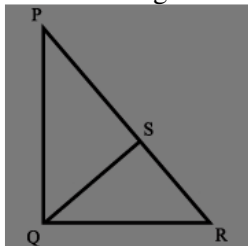
- (1) $x = 60^\circ$ (2) $DE \parallel CA$

5. The area of the right triangle ABC is 4 times greater than the area of the right triangle KLM . If the hypotenuse KL is 10 inches, what is the length of the hypotenuse AB ?



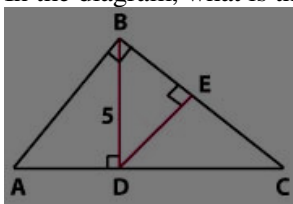
- (1) Angles ABC and KLM are each equal to 55° . (2) LM is 6 inches.

6. In the diagram, triangle PQR has a right angle at Q and a perimeter of 60. Line segment QS is perpendicular to PR and has a length of 12. $PQ > QR$. What is the ratio of the area of triangle PQS to the area of triangle RQS ?



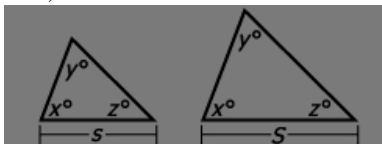
- $\frac{3}{2}$ $\frac{7}{4}$ $\frac{15}{8}$ $\frac{16}{9}$ 2

7. In the diagram, what is the length of AB ?



- (1) $BE = 3$ (2) $DE = 4$

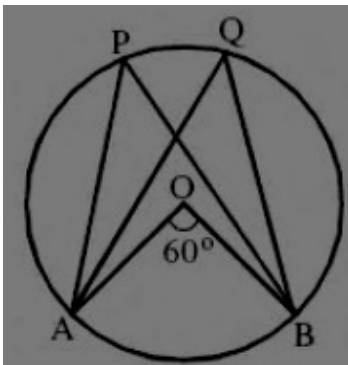
8. In the given figure, if the area of the triangle on the right is twice the area of the triangle on the left, then in terms of s , $S = ?$



- $s\sqrt{2}$ $s\sqrt{3}/2$ $s\sqrt{2}$ $s\sqrt{3}$ $2s$

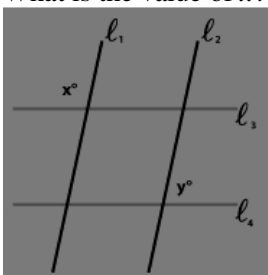
Concept # 14: Lines and Angles:

- Two angles whose sum is 90° are complementary. Each one is the complement of the other.
- Two angles whose sum is 180° are supplementary. Each one is the supplement of the other.
- Sum of the three interior angles of a triangle is 180°
- In a triangle, an exterior angle = Sum of the other two interior angles not adjacent to it
- In a triangle, sum of any two sides is greater than the third side and the difference of any two sides is less than the third side.
- In a triangle, the side opposite to the greatest angle will be the greatest and vice versa.
- If a, b, c denote the sides of a triangle then
 - if $c^2 < a^2 + b^2$, Triangle is acute angled
 - if $c^2 = a^2 + b^2$, Triangle is right angled
 - if $c^2 > a^2 + b^2$, Triangle is obtuse angled
- Sum of the four interior angles of a quadrilateral = 360°
- If a quadrilateral can be inscribed in a circle, it is called a cyclic quadrilateral. Here opposite angles are supplementary.
- In any polygon, the sum of exterior angles = 360°
- In any polygon, the sum of Interior angles = $(2n - 4) 90^\circ$
- Angle in a semicircle is a right angle.
- In a circle, angle at the centre made by an arc = twice the angle made by the arc at any point on the remaining part of the circumference.



We have $\angle APB = \frac{1}{2} \angle AOB = 30^\circ = \angle AQB$

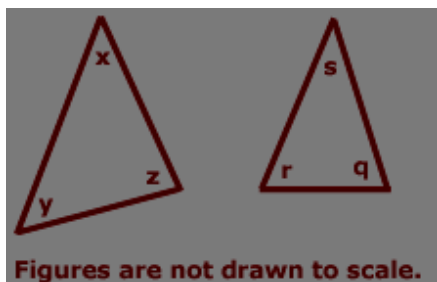
1. What is the value of x ?



(1) l_1 is parallel to l_2

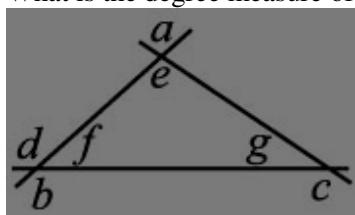
(2) $y = 70$

2. If $x - q = s - y$, what is the value of z ?



- 1) $xq + sy + sx + yq = zr$ 2) $zq - ry = rx - zs$

3. What is the degree measure of angle a ?

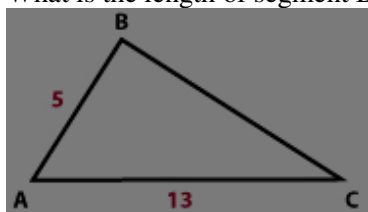


- (1) $b + c = 287$ degrees (2) $d + e = 269$ degrees

4. What is the perimeter of isosceles triangle ABC?

- (1) The length of side AB is 9 (2) The length of side BC is 4

5. What is the length of segment BC?



- (1) Angle ABC is 90 degrees. (2) The area of the triangle is 30.

6. Triangle A has one side of length x . If $\sqrt{x^8} = 81$, what is the perimeter of Triangle A?

- (1) Triangle A has sides whose lengths are consecutive integers
(2) Triangle A is NOT a right triangle

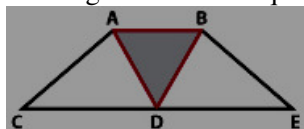
7. If the length of side AB is 17, is triangle ABC a right triangle?

- (1) The length of side BC is 144. (2) The length of side AC is 145.

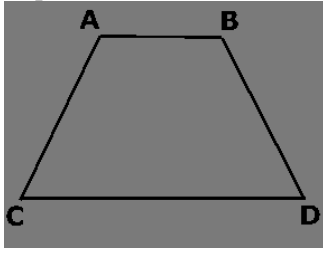
8. Which of the following is a possible length for side AB of triangle ABC if $AC = 6$ and $BC = 9$?

- I. 3 II. $9\sqrt{3}$ III. 13.5
I only II only III only II and III I, II and III

9. If triangle ABD is an equilateral triangle and $AB = 6$ and $CE = 18$, what fraction of the trapezoid BACE is shaded?



10. The height of isosceles trapezoid $ABDC$ is 12 units. The length of diagonal AD is 15 units. What is the area of trapezoid $ABDC$?

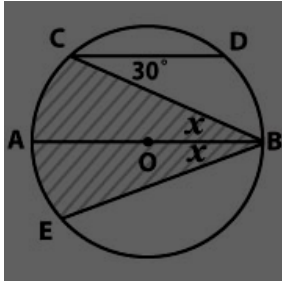


- (A) 72 (B) 90 (C) 96 (D) 108 (E) 180

11. Is the measure of one of the interior angles of quadrilateral $ABCD$ equal to 60 degrees?

- 1). two of the interior angles of $ABCD$ are right angles
2). the degree measure of angle ABC is twice the degree measure of angle BCD

12. In the figure, circle O has center O , diameter AB and a radius of 5. Line CD is parallel to the diameter. What is the perimeter of the shaded region?

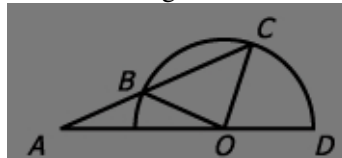


- $(\frac{5}{3})\pi + 5\sqrt{3}$ $(\frac{5}{3})\pi + 10\sqrt{3}$ $(\frac{10}{3})\pi + 5\sqrt{3}$
 $(\frac{10}{3})\pi + 10\sqrt{3}$ $(\frac{10}{3})\pi + 20\sqrt{3}$

13. In Quadrilateral $WXYZ$, is XY perpendicular to YZ ? (1) WXY is a right angle (2) WZY is a right angle

14. What is the maximum number of points at which a circle can intersect a triangle?

15. In the figure point O is the centre of the semicircle and Point B , C , and D lie on the semicircle. If the length of line segment AB is equal to the length of the line segment OC , what is the degree measure of angle BAO ?

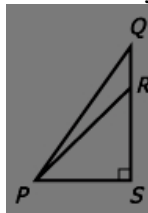


- (1) The degree measure of angle COD is 60° (2) The degree measure of angle BCO is 40°

16. In isosceles triangle RST what is the measure of angle R ?

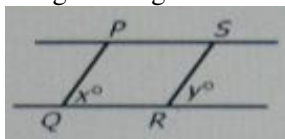
- (1) The measure of angle T is 100 degrees. (2) The measure of angle S is 40 degrees.

17. In the figure shown, the measure of angle PRS is how many degrees greater than the measure of angle PQR ?



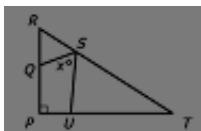
- (1) The measure of angle QPR is 30 degrees. (2) The sum of angles PQR and PRQ is 150 degrees.

18. In the figure, if x and y are each less than 90 degrees and $PS \parallel QR$, is the length of segment PQ less than the length of segment SR ?



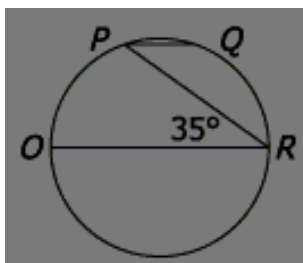
- (1) $x > y$ slanted line runs from p to q and s to r (2) $x + y > 90$

19. In the figure shown, what is the value of x ?



- (1) The length of line segment QR is equal to the length of line segment RS .
 (2) The length of line segment ST is equal to the length of line segment TU .

20. In the circle shown, PQ is parallel to diameter OR , and OR has length 18. What is the length of minor arc PQ ?



- (A) 2π (B) $9\pi/4$ (C) $7\pi/2$ (D) $9\pi/2$ (E) 3π