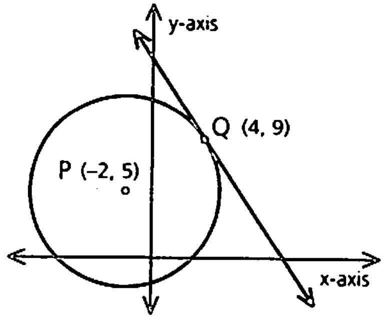
11 **a** Find the radius of ⊙P.

b Find the slope of the tangent to ⊙P at point Q.



12 Two concentric circles have radii 3 and 7. Find, to the nearest hundredth, the length of a chord of the larger circle that is tangent to the smaller circle. (See problem 2 for a diagram.)

13 The centers of two circles of radii 10 cm and 5 cm are 13 cm apart.

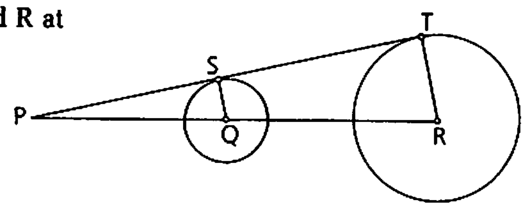
a Find the length of a common external tangent. (Hint: Use the common-tangent procedure.)

b Do the circles intersect?

14 The centers of two circles with radii 3 and 5 are 10 units apart. Find the length of a common internal tangent. (Hint: Use the common-tangent procedure.)

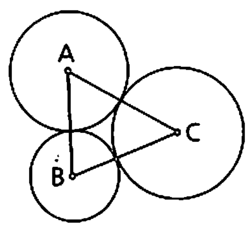
15 Given: $\overline{PT}$ is tangent to ⊚ Q and R at points S and T.

Conclusion: $\frac{PQ}{PR} = \frac{SQ}{TR}$



16 Given: Tangent ⊚ A, B, and C, AB = 8, BC = 13, AC = 11

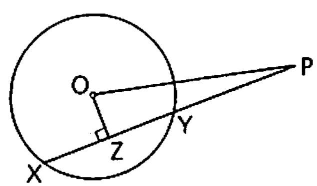
Find: The radii of the three ⊚ (Hint: This is a walk-around problem.)



17 The radius of ⊙O is 10. The secant segment $\overline{PX}$ measures 21 and is 8 units from the center of the ⊙.

a Find the external part (PY) of the secant segment.

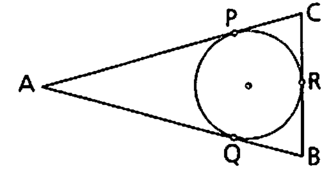
b Find OP.



Problem Set B, *continued*

18 Given: △ABC is isosceles, with base $\overline{BC}$.

Conclusion: $\overline{BR} \cong \overline{RC}$

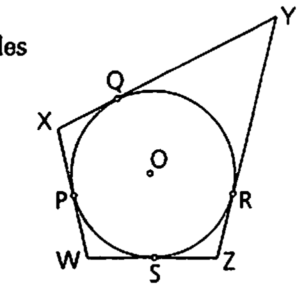


20 Find, to the nearest tenth, the distance between two circles if their radii are 1 and 4 and the length of a common external tangent is $7\frac{1}{2}$.

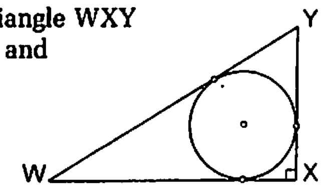
Problem Set C

21 Given: Quadrilateral WXYZ is *circumscribed about* ⊙O (that is, its sides are tangent to the ⊙).

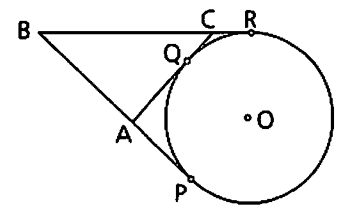
Prove: XY + WZ = WX + YZ



22 Find the perimeter of right triangle WXY if the radius of the circle is 4 and WY = 20.

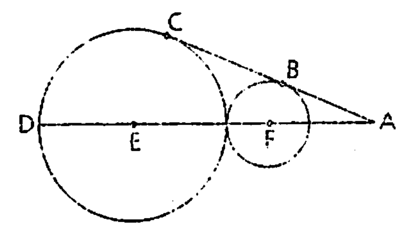


23 B is 34 mm from the center of circle O, which has radius 16 mm. $\overline{BP}$ and $\overline{BR}$ are tangent segments. $\overleftrightarrow{AC}$ is tangent to ⊙O at point Q. Find the perimeter of △ABC.



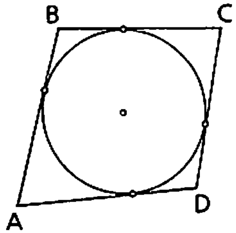
27 Given: ⊚ E and F, with $\overline{AC}$ tangent at B and C, DE = 10, FB = 4

Find: AB



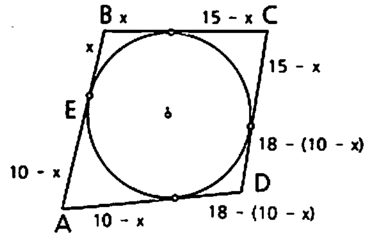
Problem 4 *A walk-around problem:*
Given: Each side of quadrilateral ABCD is tangent to the circle. AB = 10, BC = 15, AD = 18

Find: CD



Solution Let BE = x and "walk around" the figure, using the given information and the Two-Tangent Theorem.

$CD = 15 - x + 18 - (10 - x)$
$= 15 - x + 18 - 10 + x$
$= 23$

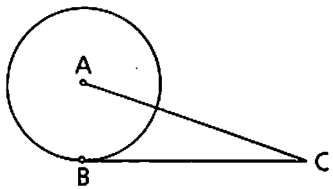


See problems 16, 21, 22, and 29 for other types of walk-around problems.

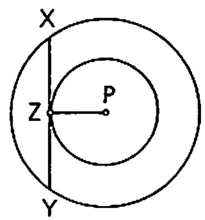
Part Three: Problem Sets

Problem Set A

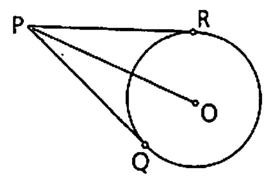
1 The radius of ⊙A is 8 cm.
Tangent segment $\overline{BC}$ is 15 cm long.
Find the length of $\overline{AC}$.



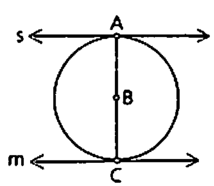
2 Concentric circles with radii 8 and 10 have center P.
$\overline{XY}$ is a tangent to the inner circle and is a chord of the outer circle.
Find $\overline{XY}$. (Hint: Draw $\overline{PX}$ and $\overline{PY}$.)



3 Given: $\overline{PR}$ and $\overline{PQ}$ are tangents to ⊙O at R and Q.
Prove: $\overrightarrow{PO}$ bisects ∠RPQ. (Hint: Draw $\overline{RO}$ and $\overline{OQ}$.)

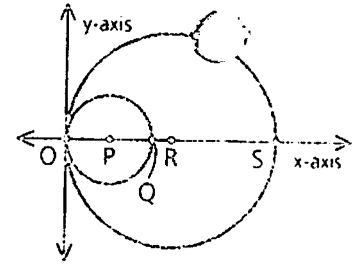


4 Given: $\overline{AC}$ is a diameter of ⊙B.
Lines s and m are tangents to the ⊙ at A and C.
Conclusion: s ∥ m

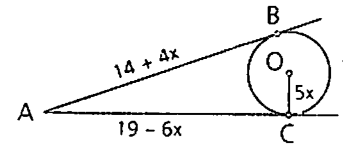


Problem Set A, *continued*

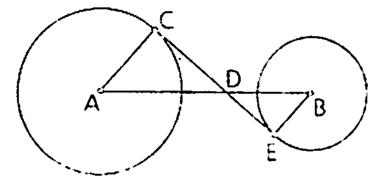
5 ⊙P and ⊙R are internally tangent at O.
P is at (8, 0) and R is at (19, 0).
a Find the coordinates of Q and S.
b Find the length of $\overline{QR}$.



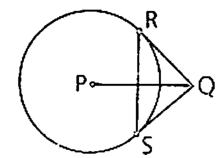
6 $\overline{AB}$ and $\overline{AC}$ are tangents to ⊙O, and OC = 5x. Find OC.



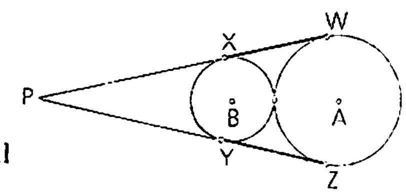
7 Given: $\overline{CE}$ is a common internal tangent to circles A and B at C and E.
Prove: **a** ∠A ≅ ∠B
b $\frac{AD}{BD} = \frac{CD}{DE}$



8 Given: $\overline{QR}$ and $\overline{QS}$ are tangent to ⊙P at points R and S.
Prove: $\overline{PQ} \perp \overline{RS}$ (Hint: This can be proved in just a few steps.)



9 Given: $\overline{PW}$ and $\overline{PZ}$ are common tangents to ⊚ A and B at W, X, Y, and Z.
Prove: $\overline{WX} \cong \overline{YZ}$ (Hint: No auxiliary lines are needed.)
Note This is part of the proof of a useful property: The common external tangent segments of two circles are congruent.



Problem Set B

10 ⊙P is tangent to each side of ABCD.
AB = 20, BC = 11, and DC = 14. Let AQ = x and find AD.