

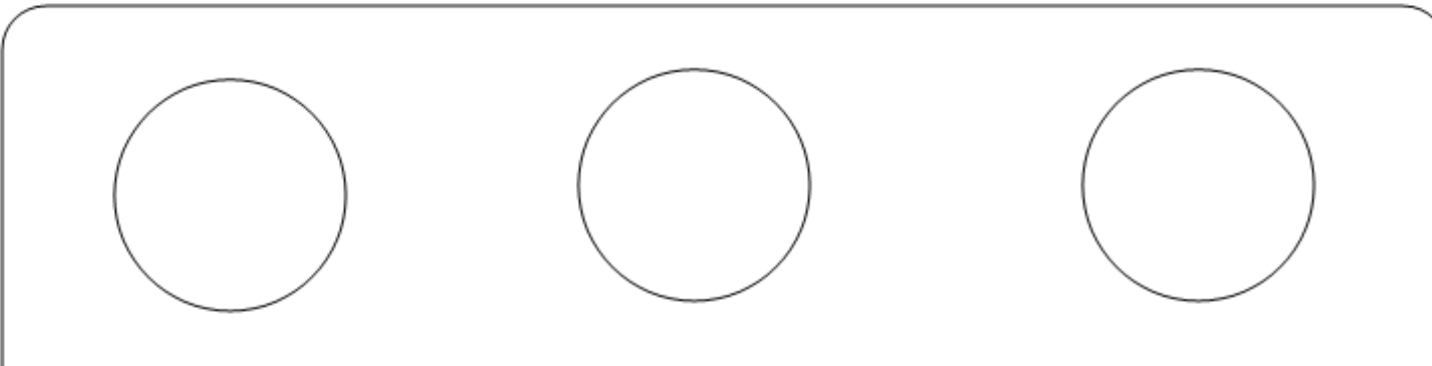
Vertex Location: INSIDE the circle (but not at center)

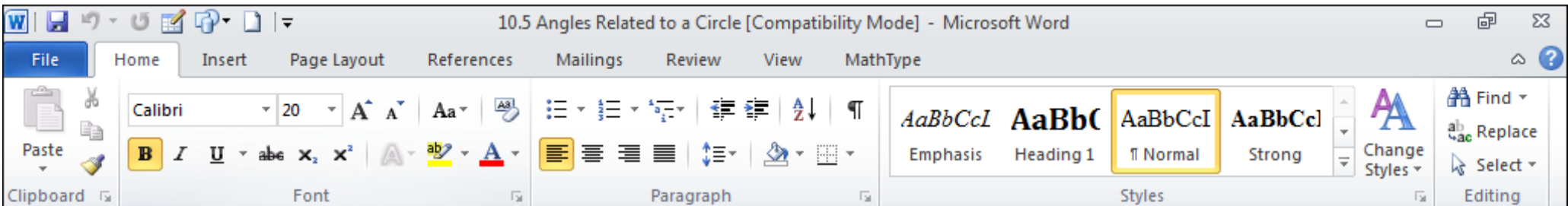
→ chord-chord \angle

Formula: $m\angle ACB = \frac{1}{2}(m\widehat{AB} + m\widehat{DE})$
(or $\angle DCE$)

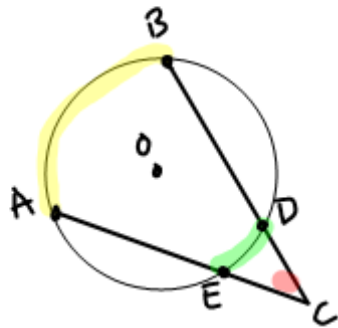
Pf: $\angle ACB = \angle 3 = \angle 1 + \angle 2$ (Ext. \angle in Δ .)
 $\angle 1 = \frac{1}{2}m\widehat{DE}$ and $\angle 2 = \frac{1}{2}m\widehat{AB}$.
 By substitution,
 $\angle ACB = \frac{1}{2}m\widehat{AB} + \frac{1}{2}m\widehat{DE} = \frac{1}{2}(m\widehat{AB} + m\widehat{DE})$.

Vertex Location: OUTSIDE the circle

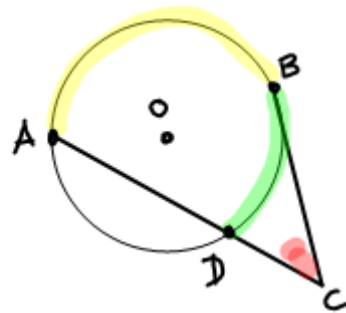




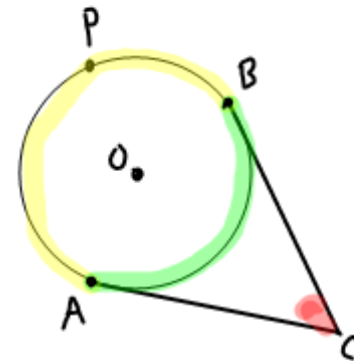
Vertex Location: OUTSIDE the circle



Secant-Secant \angle
 $m\angle C = \frac{1}{2}(m\widehat{AB} - m\widehat{DE})$

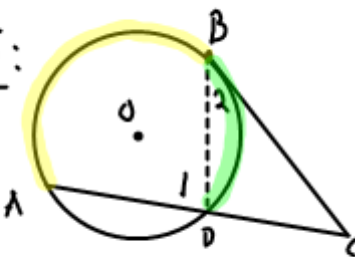


Tangent-Secant \angle
 $m\angle C = \frac{1}{2}(m\widehat{AB} - m\widehat{BD})$

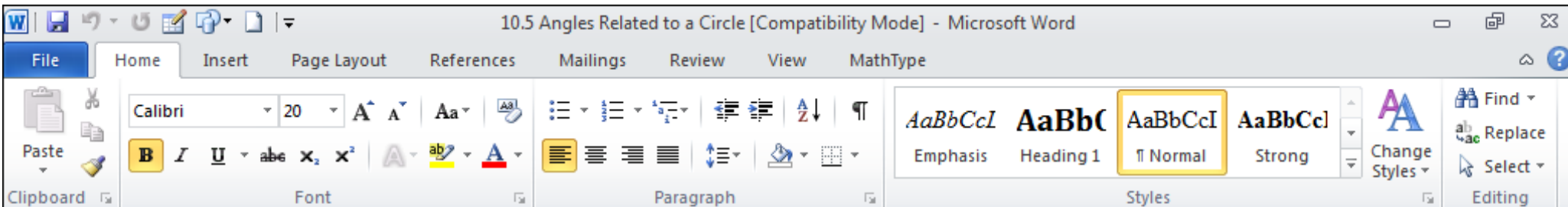


Tangent-Tangent \angle
 $m\angle C = \frac{1}{2}(m\widehat{APB} - m\widehat{AQB})$

Pf:

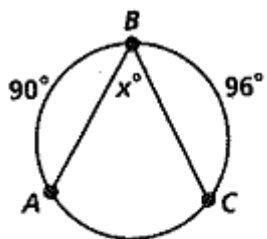


$$\begin{aligned} \angle 1 &= \angle 2 + \angle C \quad (\text{Ext. } \angle \text{ in } \triangle) \\ \therefore \angle C &= \angle 1 - \angle 2 \\ &= \frac{1}{2}m\widehat{AB} - \frac{1}{2}m\widehat{BD} \\ &= \frac{1}{2}(m\widehat{AB} - m\widehat{BD}). \end{aligned}$$



Where is the vertex? Find the value of each variable.

1.



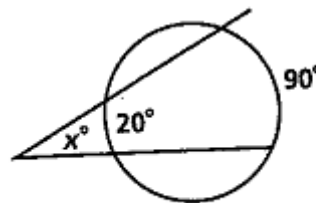
ON

$$360 - 90 - 96 = 174$$

$$x = \frac{1}{2}(174)$$

$$= 87$$

2.



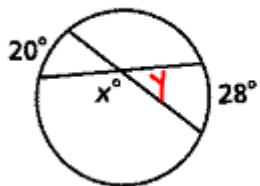
OUT

$$x = \frac{1}{2}(90 - 20)$$

$$= \frac{1}{2}(70)$$

$$= 35$$

3.



IN

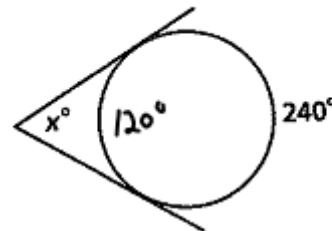
$$y = \frac{1}{2}(20 + 28)$$

$$= \frac{1}{2}(48)$$

$$= 24$$

$$\text{So } x = 180 - 24 = 156$$

4.



OUT

$$360 - 240 = 120$$

$$x = \frac{1}{2}(240 - 120)$$

$$= \frac{1}{2}(120)$$

$$= 60$$



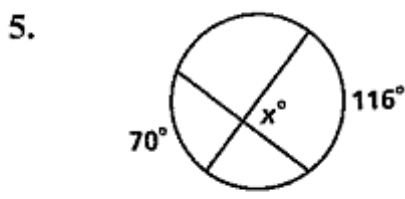
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B I U abc x₂ x² Paragraph

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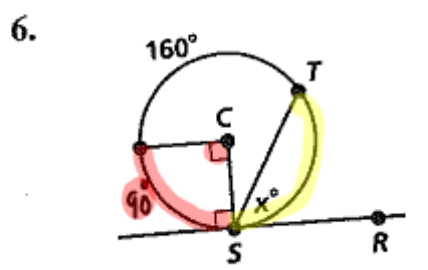


IN

$$x = \frac{1}{2}(116 + 70)$$

$$= \frac{1}{2}(186)$$

$$= 93$$

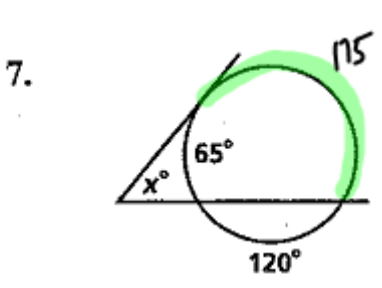


ON

$$360 - 160 - 90 = 110$$

So $m\widehat{ST} = 110$

$$x = \frac{1}{2}(110) = 55$$

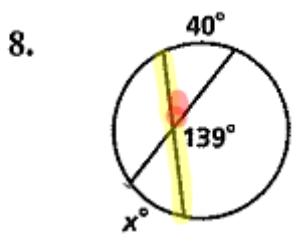


OUT

$$360 - 120 - 65 = 175$$

$$x = \frac{1}{2}(175 - 65)$$

$$= \frac{1}{2}(110) = 55$$



IN

$$180 - 139 = 41$$

$$2 \cdot 41 = \frac{1}{2}(40 + x)$$

$$82 = 40 + x$$

$$\begin{array}{r} 82 = 40 + x \\ -40 \quad -40 \\ \hline 42 = x \end{array}$$

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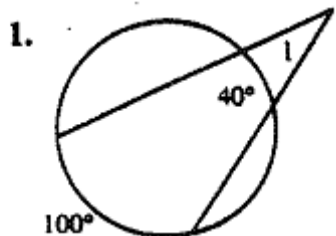
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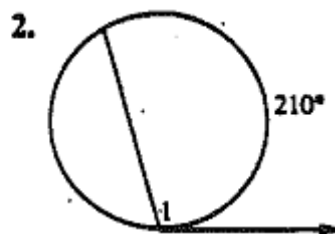
Find Replace Select

Find the measure of each indicated arc or angle. When point O is shown, it is the center of the circle. You may assume that segments that look like tangents are tangents.

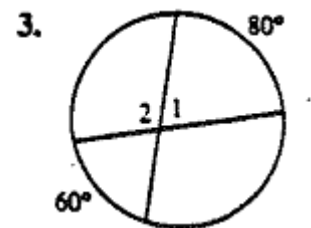
Try it!



$m\angle 1 = 30$

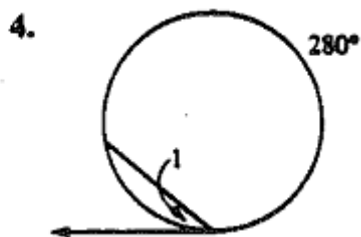


$m\angle 1 = 105$

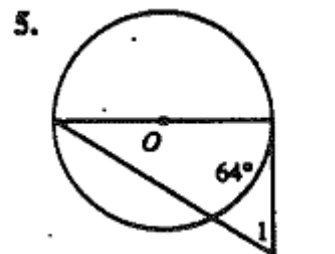


$m\angle 1 = 70$

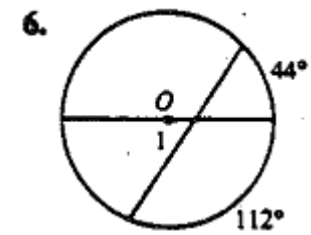
$m\angle 2 = 110$



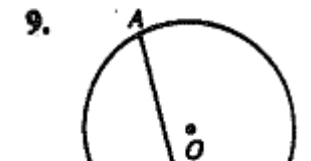
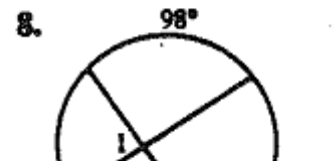
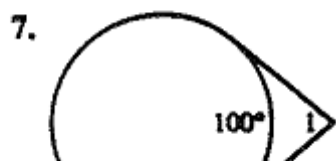
$m\angle 1 = 40$



$m\angle 1 = 58$



$m\angle 1 = 56$



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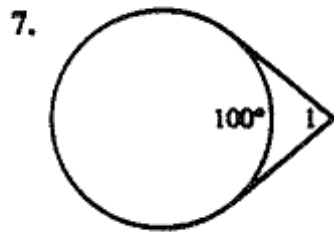
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B I U abc x x² Paragraph

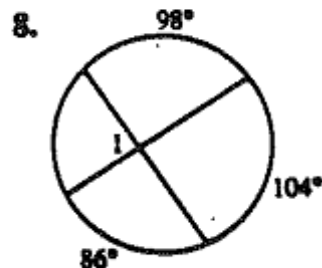
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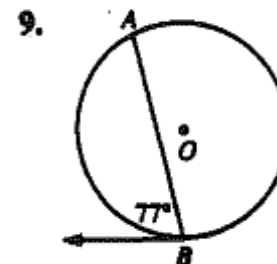
Find Replace Select Editing



$m\angle 1 = \underline{80}$

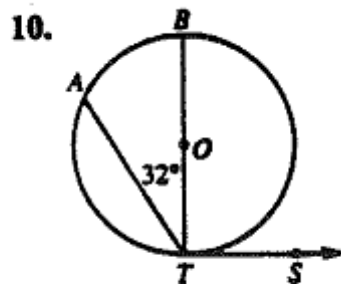


$m\angle 1 = \underline{88}$



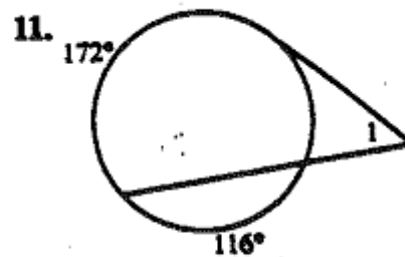
$m\widehat{AB} = \underline{154}$

$\angle B = \frac{1}{2} m\widehat{AB}$
 $77 = \frac{1}{2} m\widehat{AB}$
 $154 = m\widehat{AB}$

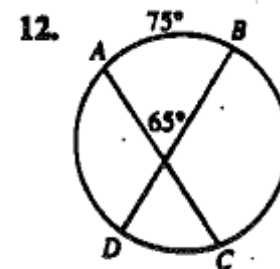


$m\widehat{AB} = \underline{64}$

$m\angle ATS = \underline{122}$



$m\angle 1 = \underline{50}$



$m\widehat{DC} = \underline{55}$

$65 = \frac{1}{2}(x + 75)$