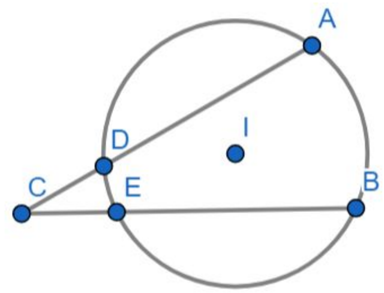
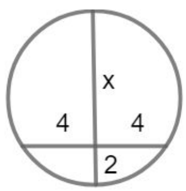
Goal: 33
Total: 38

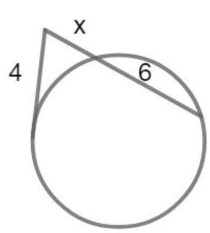
1. If $\angle C = 50^\circ$, $\angle B = 60^\circ$, and $\angle A = 70^\circ$, find $arc(AB) - arc(DE)$. (1)



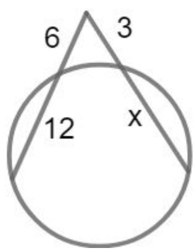
2. Find x. (1)



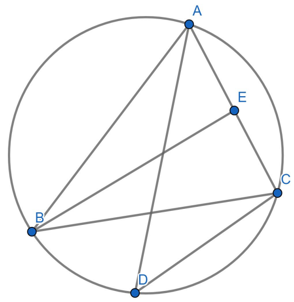
3. Find x. (1)



4. Find x. (1)

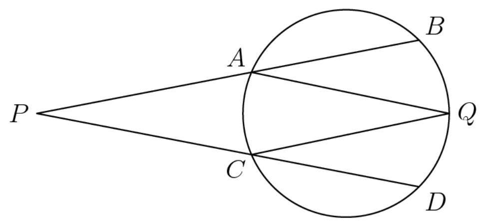


5. Given that A, B, C, and D are all on the circumference of the same circle, that BE is the angle bisector of $\angle BAC$, that $\angle AEB = \angle CEB$, and that $\angle ADC = 50^\circ$, find $\angle BAC$. (2)

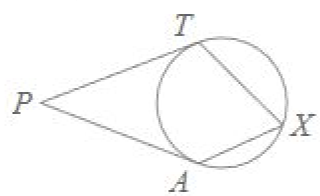


6. Given points A, B, C, D, E such that BE is the angle bisector of $\angle ABC$, $\angle AEB = \angle CEB$, $\angle BAC + \angle BDC = \angle ABD + \angle ACD$, and $\angle ADC = 48^\circ$, find $\angle BCA$. (2)

7. Points A, B, Q, D, and C lie on the circle as shown and the measures of arcs BQ and QD are 42° and 38° respectively. Find $\angle P + \angle Q$. (2)



8. Segments PA and PT are tangent to the circle. Find $\angle TXA$ if $\angle P = 42^\circ$. (2)

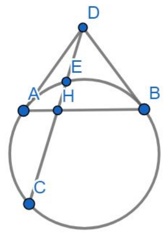


9. Consider any cyclic pentagon (a pentagon that can be inscribed within a circle) $ABCDE$. Then prove that, no matter what, $ABCP$ is not cyclic, where P is the center of the circle. (2)

10. Consider chord AB of length 8 inside a circle of radius 5. Prove that only one line DE has a length of 2 such that D is on the arc AB and E is on the line AB. (3)

11. Consider points A, B, I such that $\overline{AI} = \overline{BI}$. Given a point X such that $\angle IAX = \angle IBX = 90^\circ$, find $\overline{AX} - \overline{BX}$. (2)

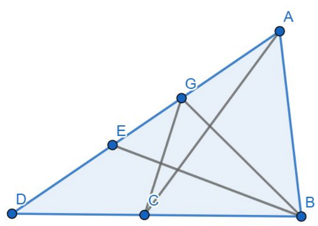
12. Given that $\overline{AD} = 4$, $\overline{DC} = 8$, $\overline{AH} = 1$, and $\overline{EH} = 1$, find the area of $\triangle ABD$. (2)



13. Consider $\triangle ABC$ with inradius r such that $\overline{AB} = 9,$ $\overline{BC} = 12,$ and $\overline{AC} = \overline{AB} + \overline{BC} - 2r.$ Find $[ABC].$ (3)

14. Consider $\overline{AB} = x$ and circle N centered at B with radius r such that $r < x.$ Find the length of the tangent from A to $N.$ (3)

15. Given that $m\measuredangle BAC = m\measuredangle BGC = 40^\circ,$ $m\measuredangle ABG = 80^\circ,$ $m\measuredangle GEB = 2m\measuredangle DBE,$ and $m\measuredangle DBE = m\measuredangle GBE,$ find $m\measuredangle ADB.$ (4)



16. Consider $\triangle ABC$ with point D on $BC.$ Let M, N be the circumcenters of $\triangle ABD$ and $\triangle ACD,$ respectively. Let the circumcircles of $\triangle ACD$ and $\triangle MND$ intersect at $H \neq D.$ Prove A, H, M are collinear. $(\star\ 7)$