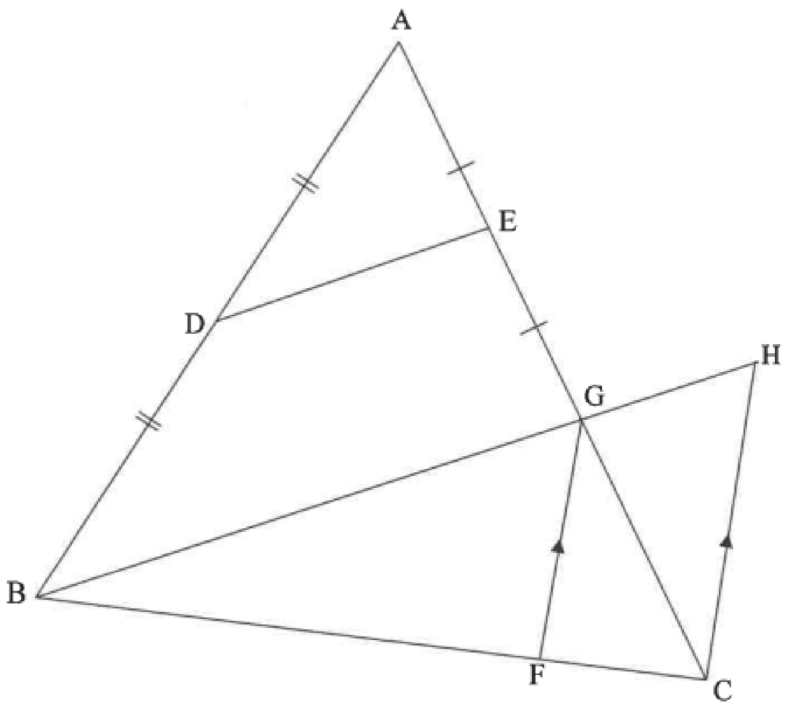
PAST PAPER QUESTIONS ON PROPORTIONALITY AND SIMILARITY

8.2 In the diagram, ΔABG is drawn. D and E are midpoints of AB and AG respectively. AG and BG are produced to C and H respectively. F is a point on BC such that FG || CH.



8.2.1 Give a reason why DE || BH. (1)

8.2.2 If it is further given that $\frac{FC}{BF} = \frac{1}{4}$, $DE = 3x - 1$ and $GH = x + 1$, calculate, giving reasons, the value of x. (6)

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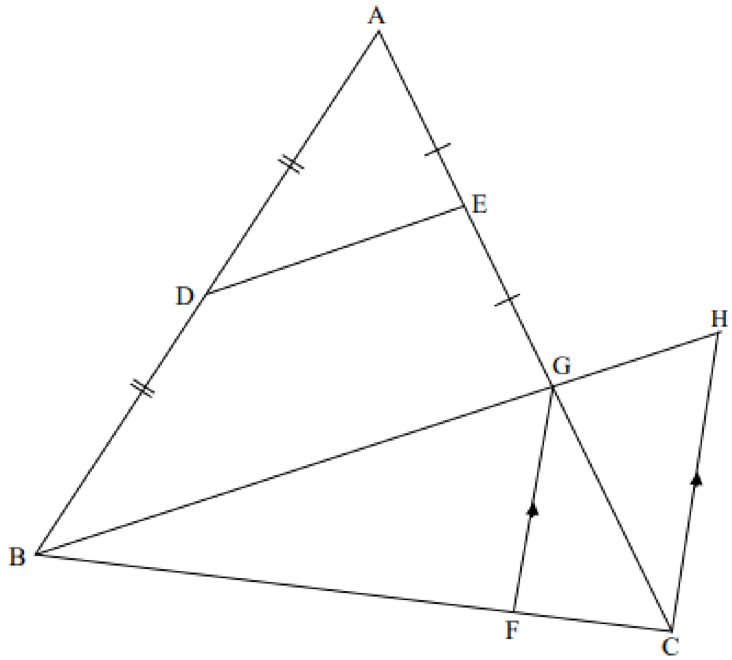
8.2



8.2.1	Midpt theorem/*Midpt. Stelling* **OR/*OF*** Converse prop intercept theorem	✓ R (1) ✓ R (1)
8.2.2	BG = 2DE or $6x - 2$ [Midpt theorem/*Midpt. stelling*] BG = $6x - 2$ $\frac{GH}{BG} = \frac{FC}{BF}$ [line ‖ one side of Δ **OR** prop theorem; FG ‖ CH / *lyn ‖ een sy v.* Δ] $\frac{x+1}{6x-2} = \frac{1}{4}$ $4x + 4 = 6x - 2$ $2x = 6$ $x = 3$ **OR/*OF***	✓ S ✓ R ✓ S ✓R ✓ equation into x ✓ answer (6)

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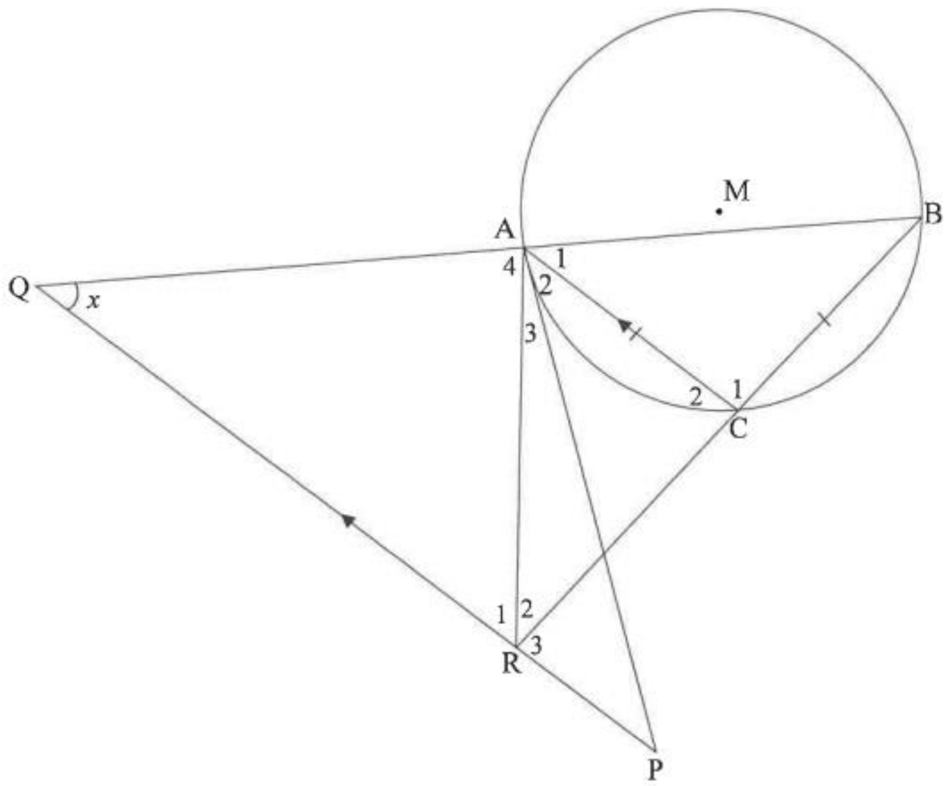
9.2 In the diagram, M is the centre of the circle. A, B and C are points on the circle such that AC = BC. PA is a tangent to the circle at A. PQ is drawn parallel to CA to meet BA produced at Q. BC produced meets PQ at R and AR is drawn.
Let $\hat{Q} = x$.



9.2.1 Determine, giving reasons, FOUR other angles EACH equal to x. (6)

9.2.2 Prove that ABPR is a cyclic quadrilateral. (2)

9.2.3 Prove that $\frac{BA}{BQ} = \frac{BC}{QR}$. (3)

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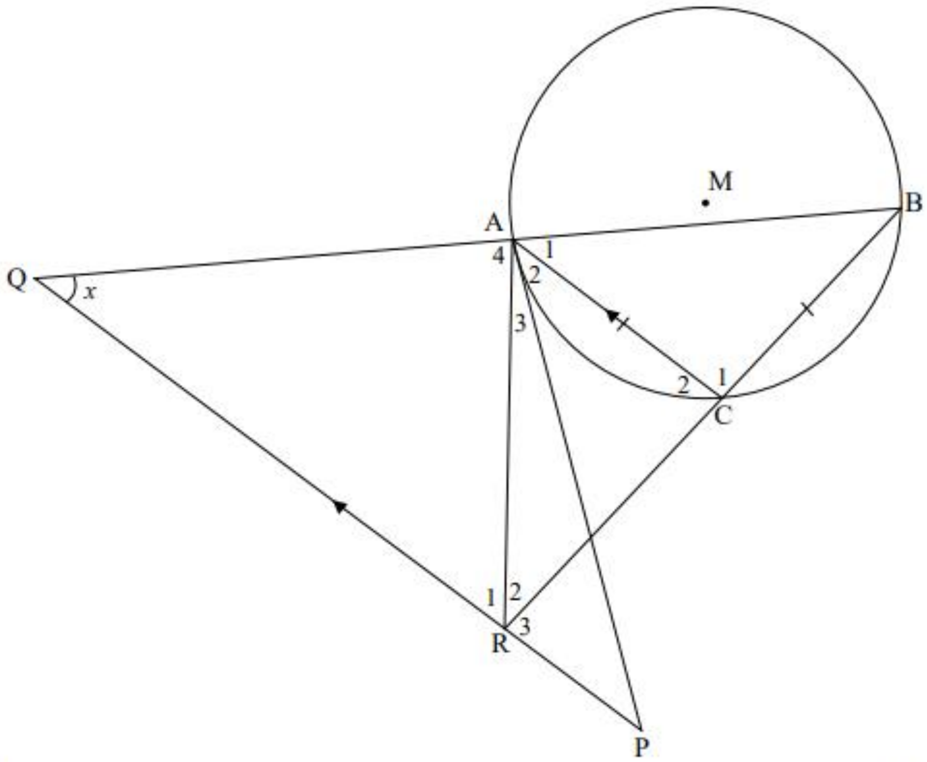
9.2



9.2.1	$\hat{A}_1 = x$ [corresp ∠s; PQ ∥ CA/*ooreenkomstige ∠e,* PQ ∥ CA] $\hat{B} = x$ [∠s opp equal sides/*∠e teenoor gelyke sye*] $\hat{A}_2 = x$ [tan-chord theorem/*∠ tussen raaklyn en koord*] $\hat{P} = x$ [alt ∠s; PQ ∥ CA/*verw. ∠e,* PQ ∥ CA]	✓S ✓R ✓S/R ✓S ✓R ✓S/R	(6)
9.2.2	$\hat{B} = \hat{P}$ [proved in 9.2.1/*bewys in 9.2.1*] ∴ A, B, P and R are concyclic ∴ ABPR is a cyclic quadrilateral [conv ∠s in the same segment/ *koord onderspan gelyke omtreks ∠e*]	✓S ✓R	(2)
9.2.3	$\frac{BA}{BQ} = \frac{BC}{BR}$ [prop th; AC ∥ QP] **OR** [line ∥ one side Δ/*lyn* ∥ *een syn v Δ*] But QR = BR [sides opp = ∠s/*sye teenoor = ∠e*] $\therefore \frac{BA}{BQ} = \frac{BC}{QR}$	✓S ✓R ✓S	(3)

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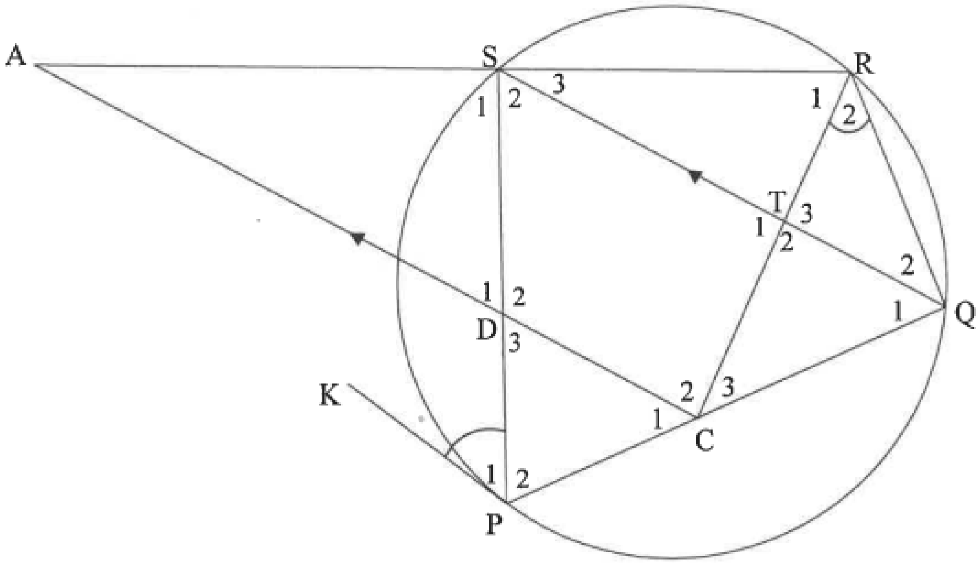
QUESTION 10

In the diagram, PQRS is a cyclic quadrilateral. KP is a tangent to the circle at P. C and D are points on chords PQ and PS respectively and CD produced meets RS produced at A. CA || QS. RC is drawn. $\hat{P}_1 = \hat{R}_2$.



Prove, giving reasons, that:

10.1 $\hat{S}_1 = \hat{T}_2$ (4)

10.2 $\frac{AD}{AR} = \frac{AS}{AC}$ (5)

10.3 $AC \times SD = AR \times TC$ (4)

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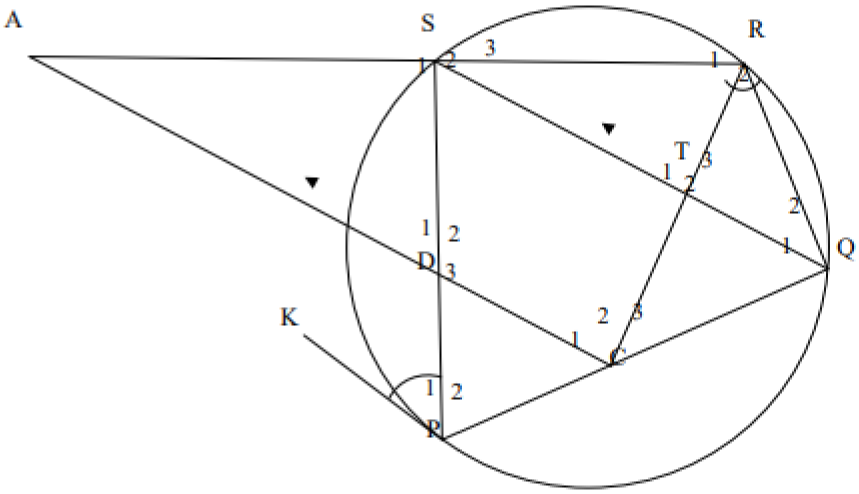
QUESTION/*VRAAG* 10



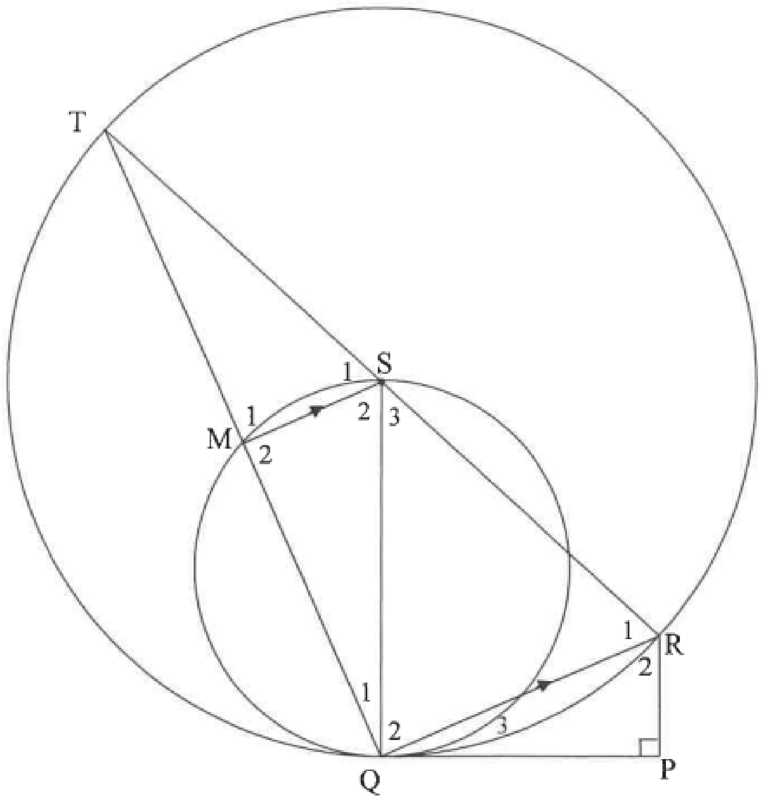
10.1	$\hat{P}_1 = \hat{Q}_1$ [tan-chord theorem/∠ *tussen raaklyn en koord*] $\hat{S}_1 = \hat{Q}_1 + \hat{Q}_2$ [ext ∠ of cyclic quad/*buite ∠v. kvh*] $\therefore \hat{S}_1 = \hat{P}_1 + \hat{Q}_2$ $\hat{T}_2 = \hat{R}_2 + \hat{Q}_2$ [ext ∠ of Δ/*buite ∠v.* Δ] but $\hat{P}_1 = \hat{R}_2$ [given/*gegee*] $\hat{T}_2 = \hat{P}_1 + \hat{Q}_2$ $\therefore \hat{S}_1 = \hat{T}_2 = \hat{P}_1 + \hat{Q}_2$	✓ S ✓ S / R ✓ S ✓ S (4)
10.2	In Δ ASD and ΔACR $\hat{A} = \hat{A}$ [common ∠/*gemeenskaplike* ∠] $\hat{S}_1 = \hat{T}_2$ [proven/*reeds bewys*] $\hat{T}_2 = \hat{C}_2$ [alt ∠s; QS ∥ CA/verw. ∠*e*; QS ∥ CA] $\therefore \hat{S}_1 = \hat{C}_2$ $\hat{D}_1 = \hat{R}_1$ [sum of ∠s in Δ/∠*e v.* Δ] ΔASD ∥∣ ΔACR $\therefore \frac{AD}{AR} = \frac{AS}{AC}$ [corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*] **OR/*OF***	✓ identifying Δ's ✓ S ✓ S / R ✓ S ✓ S (5)

	In Δ ASD and ΔACR $\hat{A} = \hat{A}$ [common $\angle$/*gemeenskaplike* $\angle$] $\hat{S}_1 = \hat{T}_2$ [proven/*gegee*] $\hat{T}_2 = \hat{C}_2$ [alt $\angle$s; QS || CA/verw. $\angle$*e*; QS || CA] $\therefore \hat{S}_1 = \hat{C}_2$ $\Delta ASD \parallel\!\mid \Delta ACR$ [$\angle;\angle;\angle$] $\therefore \frac{AD}{AR} = \frac{AS}{AC}$ [corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*]	✓ identifying Δ's ✓ S ✓ S/R ✓ S ✓ R (5)
10.3	$\frac{AS}{AC} = \frac{SD}{CR}$ [$\Delta ASD \parallel\!\mid \Delta ACR$] $\therefore AS = \frac{AC \times SD}{CR}$ $\frac{AS}{AR} = \frac{CT}{CR}$ [line || one side of Δ OR prop theorem; TS || CA/*lyn* || *een sy v.* Δ] $\therefore AS = \frac{AR \times CT}{CR}$ $\therefore \frac{AC \times SD}{CR} = \frac{AR \times CT}{CR}$ $\therefore AC \times SD = AR \times CT$	✓ S ✓ S ✓ R ✓ equating (4)
		[13]

PAST PAPER QUESTIONS ON PROPORTIONALITY AND SIMILARITY

QUESTION 10

In the diagram, TSR is a diameter of the larger circle having centre S. Chord TQ of the larger circle cuts the smaller circle at M. PQ is a common tangent to the two circles at Q. SQ is drawn.
RP $\perp$ PQ and MS || QR.



10.1 Prove, giving reasons that:

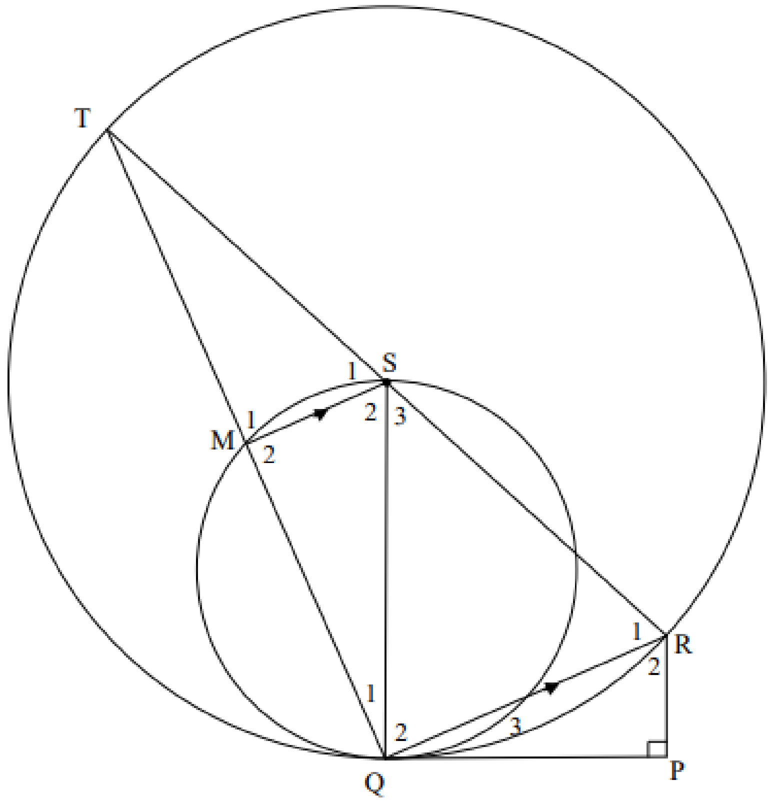
10.1.1 SQ is the diameter of the smaller circle (3)

10.1.2 $RT = \dfrac{RQ^2}{RP}$ (6)

10.2 If MS = 14 units and $PQ = \sqrt{640}$ units, calculate, giving reasons, the length of the radius of the larger circle. (6)

PAST PAPER QUESTIONS ON PROPORTIONALITY AND SIMILARITY

QUESTION/VRAAG 10



10.1.1	$\hat{Q}_1 + \hat{Q}_2 = 90°$	[∠ in semi circle/∠ *in halwe sirkel*]	✓ S/R
	$\therefore \hat{M}_2 = 90°$	[co-interior ∠, MS ‖ QR/*ko-binne ∠e,* MS ‖ QR]	✓ S/R
	∴ SQ is a diameter	[converse: ∠ in semi circle/ *Omgekeerde: ∠ in halwe sirkel*]	✓ R (3)
	OR		
	MS ‖ QR		
	$\frac{TS}{SR} = \frac{TM}{MQ} = \frac{1}{1}$	[prop theorem; SM ‖ QR] **OR** [line ‖ one side of Δ]/*lyn ‖ een sy v*Δ	✓ S/R
	$\therefore TM = MQ$		
	$\therefore \hat{M}_2 = 90°$	[Line from centre bisects chord/*midpt. sirkel; midpt koord*]	✓ S/R
	∴ SQ is a diameter	[converse: ∠ in semi circle/ *Omgekeerde: ∠ in halwe sirkel*]	✓ R (3)
	OR		
	SQ ⊥ QP	[tan ⊥ rad/*raaklyn ⊥ radius*]	✓ S ✓ R
	∴ SQ is a diameter	[converse: tan ⊥ rad/*Omgekeerde: raaklyn ⊥ radius*]	✓ R (3)

PAST PAPER QUESTIONS ON PROPORTIONALITY AND SIMILARITY

10.1.2	In ΔRTQ and ΔRQP $\hat{T} = \hat{Q}_3$ [tan-chord theorem/$\angle$ *tussen raaklyn en koord*] $\hat{Q}_1 + \hat{Q}_2 = 90°$ [co-interior $\angle$s, MS ∥ QR/*ko-binne $\angle$e,* MS ∥ QR] **or** [$\angle$ in semi circle/$\angle$ *in halwe sirkel*] $\therefore \hat{Q}_1 + \hat{Q}_2 = \hat{P} = 90°$ $\hat{R}_1 = \hat{R}_2$ [$\angle$s of Δ/$\angle$*e van Δ*] $\Delta RTQ \mid\mid\mid \Delta RQP$ $\frac{RT}{RQ} = \frac{RQ}{RP}$ $RT = \frac{RQ^2}{RP}$ **OR** In ΔRTQ and ΔRQP $\hat{T} = \hat{Q}_3$ [tan-chord theorem $\angle$ *tussen raaklyn en koord*] $\hat{Q}_1 + \hat{Q}_2 = 90°$ [co-interior $\angle$s, MS ∥ QR/*ko-binne $\angle$e,* MS ∥ QR] **or** [$\angle$ in semi circle/$\angle$ *in halwe sirkel*] $\therefore \hat{Q}_1 + \hat{Q}_2 = \hat{P} = 90°$ $\Delta RTQ \mid\mid\mid \Delta RQP$ [$\angle,\angle,\angle$] $\frac{RT}{RQ} = \frac{RQ}{RP}$ $RT = \frac{RQ^2}{RP}$	✓ S ✓ R ✓ S ✓ S ✓ S ✓ ratio (6) ✓ S ✓ R ✓ S ✓ S ✓ R ✓ ratio (6)
10.2	QR = 28 units [midpoint theorem/*midpt. stelling*] $RP^2 = 28^2 - \left(\sqrt{640}\right)^2$ [Pythagoras/*Pythagoras*] RP = 12 units $RT = \frac{RQ^2}{RP}$ $RT = \frac{28^2}{12}$ $RT = \frac{196}{3}$ Radius = $\frac{98}{3}$ units	✓ S ✓ R ✓ S ✓ RP = 12 ✓ RT ✓ answer (6)
		[15]