education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 11

MATHEMATICS

COMMON TEST

SEPTEMBER 2018

MARKS: 75

TIME: 1½ hour

This question paper consists of 9 pages and 2 diagram sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 6 questions.

2. Answer ALL the questions.

3. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.

4. Answers only will not necessarily be awarded full marks.

5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

6. If necessary, round off answers to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

8. Number the answers correctly according to the numbering system used in this question paper.

9. Write neatly and legibly.

QUESTION 1

1.1   For two events A and B, it is given that P(A) = 0,4 and P(B) = 0,3.
        Calculate P(A or B) if:

   1.1.1   A and B are mutually exclusive.   (2)

    1.1.2   A and B are independent.   (3)

1.2   A survey was carried out among **100 learners** about which movies they have
        watched recently. The results are given below:

    •   43 watched Braven (B)
    •   41 watched Hereditary (H)
    •   50 watched The Kissing Booth (K)
    •   6 watched all 3 movies
    •   7 watched Braven and The Kissing Booth but not Hereditary
    •   18 watched Hereditary and The Kissing Booth
    •   15 watched only Hereditary

The above information is represented in the Venn diagram below.
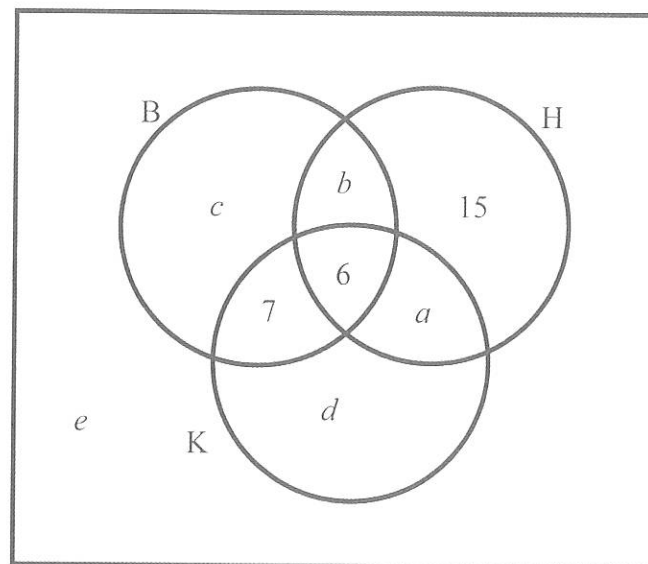
    1.2.1   Write down the values of a, b, c and d in the Venn diagram above.   (4)

    1.2.2   Calculate the probability that a learner selected at random from this group
             has not watched Braven or Hereditary or The Kissing Booth.   (3)

    1.2.3   Calculate the probability that a learner selected at random from this group
   has watched at least 2 of these movies.   (3)

                                                                                        [15]

QUESTION 2

2.1   Jane bought a laptop for R9 600. Calculate the book value of the laptop after 3 years, if it depreciates at 20% p.a. on the reducing balance method.

                                                                                 (2)

2.2   Sandra invests R20 000 in a savings account that pays interest at the rate of 12% p.a., compounded monthly. How much will she have accumulated in this account after 4 years?

                                                                                 (3)

2.3   Thuli has two sons: Bongani and Sbu. They share the same birthday.
On the day that Bongani had his 12th birthday and Sbu his 15th birthday, she opened an account for each of them, and invested some money in each account.
The total amount that she invested in the two accounts was R150 000.
Both accounts earn interest at 9,6% p.a., compounded quarterly.
She divided the R150 000 between the two accounts in such a way that each of the boys will receive the same amount of money on his 25th birthday.
How much money does she invest for Bongani?

                                                                                 (5)
                                                                                 [10]

QUESTION 3

ABCD is a cyclic quadrilateral and CB is extended to E.

DA = 155mm and DC = 136mm. $A\hat{B}E = 81°$ and CE = 193 mm. AD ∥ CE.
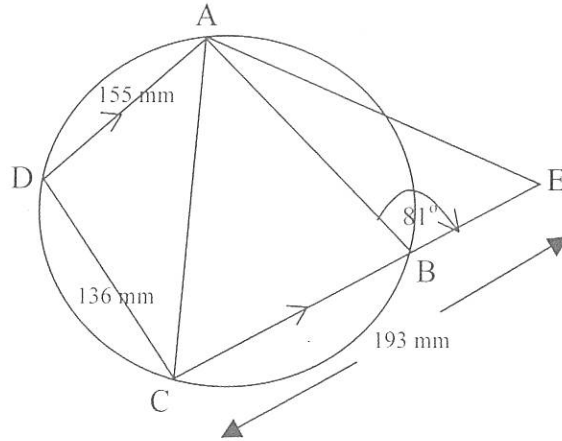

3.1   Give a reason why $\hat{D} = 81°$.   (1)

3.2   Calculate the length of AC.   (3)

3.3   Calculate the size of $D\hat{A}C$.   (3)

3.4   Calculate the area of ΔACE   (4)

[11]

QUESTION 4

The organiser of the regional school soccer league decided to have a trophy made to present to the winning team of the season. He had it made in the shape of a cylinder with a sphere on top of it. The radius of the cylinder is 5 cm and its height is 20 cm. The total volume of metal used to make this trophy is 2000 cm^3.

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20 cm
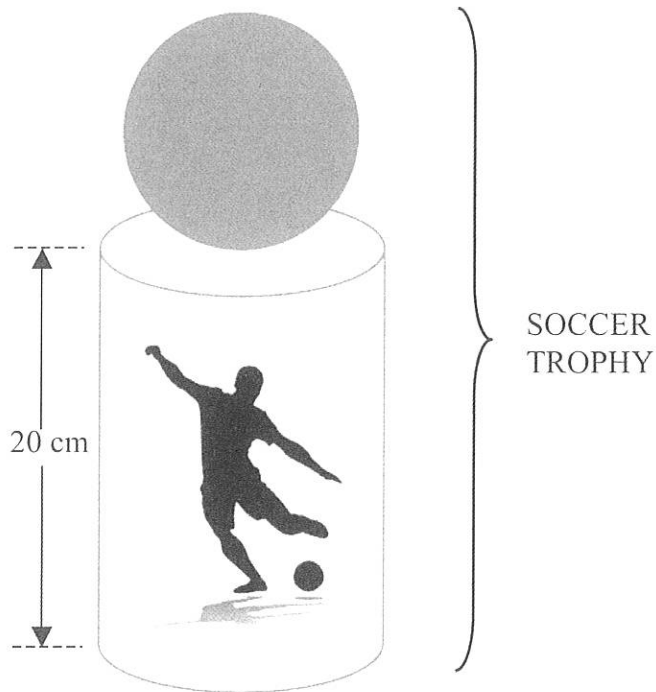
$$V = \frac{1}{3}\pi r^2 h$$
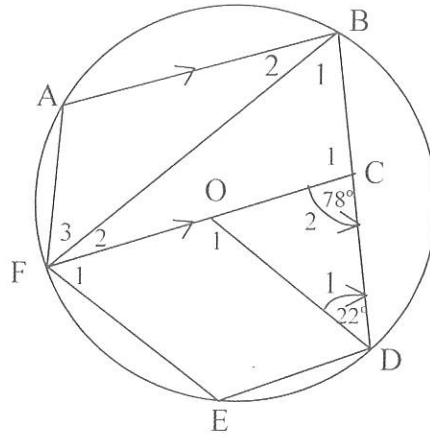$$V = \pi r^2 h$$
$$V = \frac{4}{3}\pi r^3$$

Calculate the radius of the sphere.   [5]

Give reasons for your statements and calculations in questions 5, 6 and 7.

QUESTION 5

In the figure, O is the centre of the circle and A, B, D, E, and F are points on the circumference such that AB//FOC. $\hat{D}_1 = 22°$ and $\hat{C}_2 = 78°$.

Calculate the size of each of the following angles, giving reasons:

5.1 $\hat{O}_1$ (2)

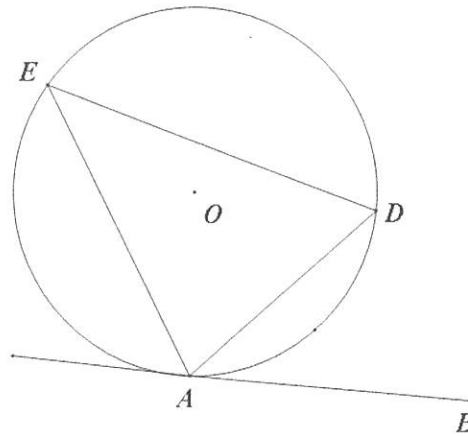5.2 $\hat{B}_1$ (2)

5.3 $\hat{E}$ (2)

5.4 $\hat{B}_2$ (3)

                                                                    [9]

QUESTION 6

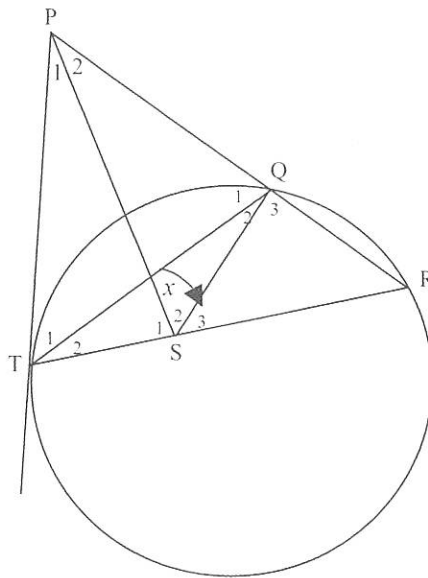6.1 In the figure below AB is a tangent at A to the circle with centre O. D and E are points on the circle

Prove the theorem that states that $D\hat{A}B = \hat{E}$.

(5)

6.2 In the figure PT is a tangent to the circle at T and TR is a chord. PR cuts the circle at Q. S is a point on TR so that PTSQ is a cyclic quadrilateral. PS, TQ and SQ are joined.

Let $\hat{S}_2 = x$

6.2.1 Prove that PS is a tangent to circle QSR at S. (5)
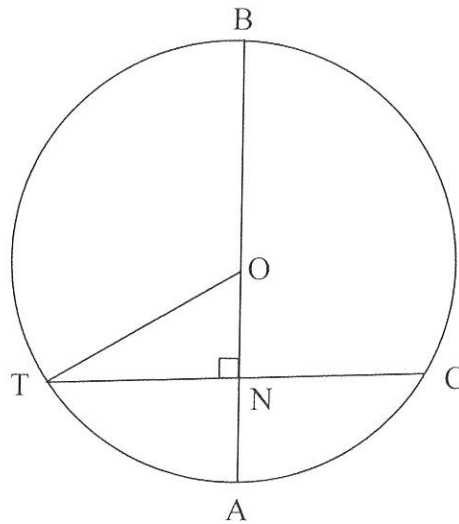
6.2.2 Prove that PT = PS. (6)

[16]

QUESTION 7

O is the centre of the circle. BOA is a diameter and cuts chord TC at N such that
BONA $\perp$ TC. $\dfrac{\text{NA}}{\text{BN}} = \dfrac{4}{9}$. **TC = 24 units.**
Let NA = $4x$.

7.1   Write down, giving a reason, the length of TN.   (2)

7.2   Write down, in terms of x, the lengths of:

    7.2.1   BA   (1)

    7.2.2   ON   (2)

7.3   Calculate the length of the radius of the circle.   (4)
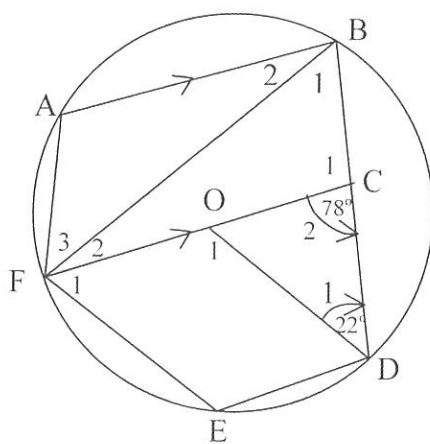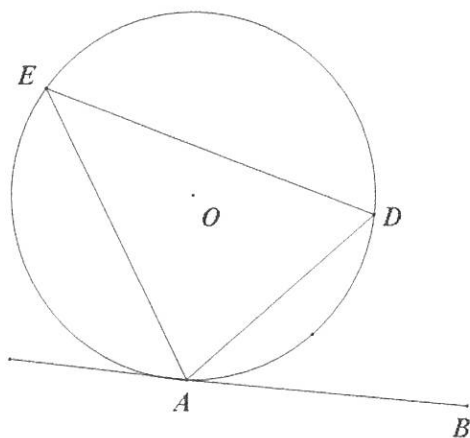
                                                                               [9]

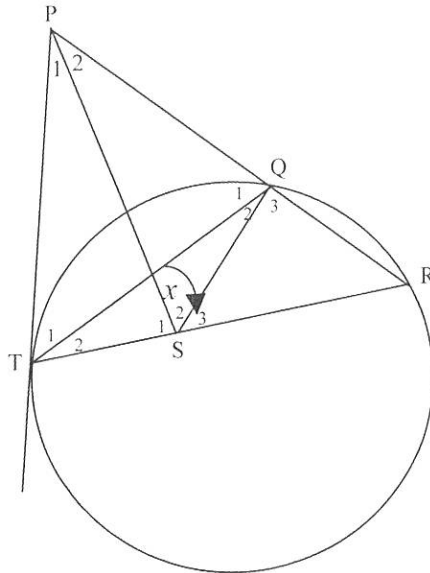**TOTAL: 75**

DIAGRAM SHEETS: HAND IN WITH YOUR ANSWER BOOK

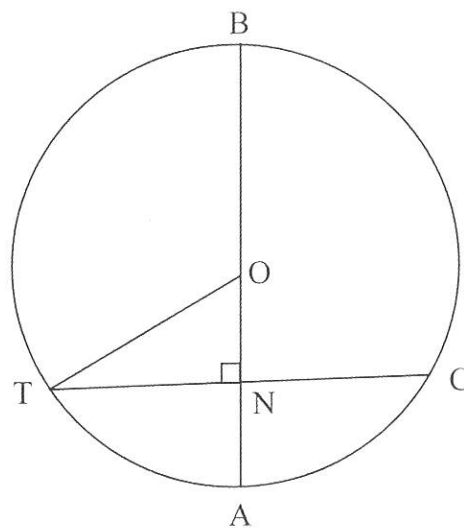NAME: _____ GRADE: _____

QUESTION 5

QUESTION 6.1

QUESTION 6.2

QUESTION 7

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MARKING GUIDELINE

MARKS: 75

This marking guideline consists of 7 pages.

QUESTION 1

1.1.1	$P(A \text{ or } B) = P(A) + P(B)$ $\qquad = 0,4 + 0,3$ $\qquad = 0,7$	✓subst. into correct formula ✓answer (2)
1.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A).P(B)$ $\qquad = 0,4 + 0,3 - (0,4)(0,3)$ $\qquad = 0,58$	✓ correct formula ✓subst. into correct formula ✓ answer (3)
1.2.1	$a = 12$ $b = 8$ $c = 22$ $d = 25$	✓$a = 12$ ✓$b = 8$ ✓$c = 22$ ✓$d = 25$ (4)
1.2.2	Number that did not watch any of these movies $\qquad = 100 - (22 + 8 + 6 + 7 + 25 + 12 + 15)$ $\qquad = 5$ P(did not watch any of these movies) $= \dfrac{5}{100}$ or 0,05 or 5%	✓$100 - (22+8+6+7+25+12+15)$ ✓ 5 ✓answer (3)
1.2.3	P(watched at least 2 of these movies) $= \dfrac{6+8+7+12}{100}$ $= \dfrac{33}{100}$ or 0,33 or 33%	✓number that watched at least 2 of these movies ✓ dividing by 100 ✓answer (3)
		[15]

QUESTION 2

2.1	$A = P(1-i)^n$ Book value $= 9\,600(1-0,2)^3$ $\qquad\qquad = R4\,915,20$	✓ substitution into correct formula ✓ answer (2)
2.2	$A = P(1+i)^n$ $A = 20\,000\left(1+\dfrac{0,12}{12}\right)^{48}$ $\qquad = R32\,244,52$	✓ $i = \dfrac{0,12}{12}$ ✓ substitution into correct formula ✓ answer (3)
2.3	Let the amount that Thuli invested for Bongani be x $\therefore$ the amount that Thuli invested for Sbu is $150\,000 - x$ $x\left(1+\dfrac{0,096}{4}\right)^{4\times13} = (150\,000-x)\left(1+\dfrac{0,096}{4}\right)^{4\times10}$ $x\left(1+\dfrac{0,096}{4}\right)^{52} = 150\,000\left(1+\dfrac{0,096}{4}\right)^{40} - x\left(1+\dfrac{0,096}{4}\right)^{40}$ $x\left(\left(1+\dfrac{0,096}{4}\right)^{52} + \left(1+\dfrac{0,096}{4}\right)^{40}\right) = 150\,000\left(1+\dfrac{0,096}{4}\right)^{40}$ $x = \dfrac{150\,000\left(1+\dfrac{0,096}{4}\right)^{40}}{\left(\left(1+\dfrac{0,096}{4}\right)^{52} + \left(1+\dfrac{0,096}{4}\right)^{40}\right)}$ $x = R64\,399,02$ OR $x\left(1+\dfrac{0,096}{4}\right)^{4\times13} = (150\,000-x)\left(1+\dfrac{0,096}{4}\right)^{4\times10}$ $\qquad 3,43239883x = (150\,000-x)(2,582249878)$ $\qquad 3,43239883x = 387\,337,4817 - 2,582249878x$ $\qquad 6,014648708x = 387\,337,4817$ $\qquad\qquad x = \dfrac{387\,337,4817}{6,014648798}$ $\qquad\qquad x = 64\,339,02$	✓ $x\left(1+\dfrac{0,096}{4}\right)^{4\times13}$ ✓✓ $= (150\,000-x)\left(1+\dfrac{0,096}{4}\right)^{4\times10}$ ✓ simplification ✓ answer (5) OR ✓ $x\left(1+\dfrac{0,096}{4}\right)^{4\times13}$ ✓✓ $= (150\,000-x)\left(1+\dfrac{0,096}{4}\right)^{4\times10}$ ✓ simplification ✓ answer (5) **NOTE: Answer only: full marks** **[10]**

QUESTION 3

3.1	Exterior angle of a cyclic quadrilateral = opposite interior angle.	✓ correct reason (1)
3.2	$AC^2 = AD^2 + DC^2 - 2(AD)(DC)\cos\hat{D}$ $= 155^2 + 136^2 - 2(155)(136)(\cos 81°)$ $= 35925,72...$ $AC = 189,54 \text{ mm}$	✓ applying cosine rule ✓ substitution ✓ answer (3)
3.3	$\dfrac{\sin D\hat{A}C}{DC} = \dfrac{\sin \hat{D}}{AC}$ $\dfrac{\sin D\hat{A}C}{136} = \dfrac{\sin 81°}{189,54}$ $D\hat{A}C = 45,13°$	✓ applying sine rule ✓ substitution ✓ answer (3)
3.4	$A\hat{C}B = D\hat{A}C = 45,13°$ [alt. ∠'s; AD ∥ BC] Area of $\triangle ACE = \dfrac{1}{2}(AC)(CE)\sin A\hat{C}B$ $= \dfrac{1}{2}(189,54)(193)\sin 45,13°$ $= 12962,73 \text{ mm}^2$	✓ $A\hat{C}B = D\hat{A}C$ ✓ applying area rule ✓ substitution ✓ answer (4)
		[11]

QUESTION 4

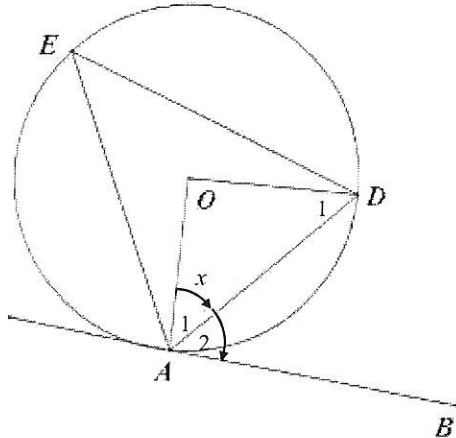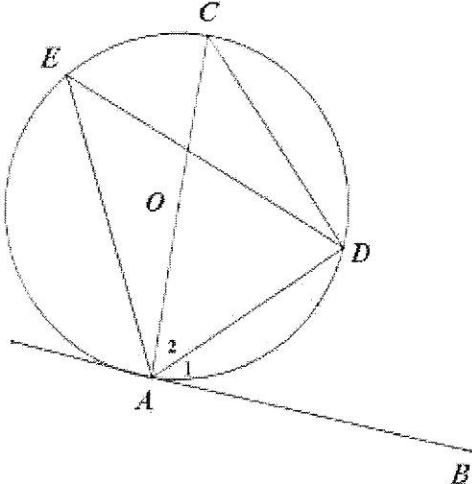|		
	Total V = V of cylinder + V of sphere $2000 = \pi r^2 h + \dfrac{4}{3}\pi r^3$ $2000 = \pi(5)^2(20) + \dfrac{4}{3}\pi r^3$ $= 500\pi + \dfrac{4}{3}\pi r^3$ $\dfrac{4}{3}r^3 = \dfrac{2000 - 500\pi}{\pi}$ $r^3 = \left(\dfrac{3}{4}\right)136,619...$ $r^3 = 102,4648....$ $r = 4,68 \text{ cm}$	✓ $\pi r^2 h + \dfrac{4}{3}\pi r^3$ ✓ equating to 2000 ✓ substitution ✓ making r^3 the subject of the formula ✓ answer	
		[5]

QUESTION 5

5.1	$\hat{O}_1 = 100°$ [ext. angle of $\triangle$]	✓S ✓R (2)
5.2	$\hat{B}_1 = 50°$ [$\angle$ at centre $= 2 \times \angle$ at circumference]	✓S ✓R (2)
5.3	$\hat{E} = 130°$ [opp. angles of cyclic quad]	✓S ✓R (2)
5.4	$A\hat{B}C = \hat{C}_2$ [corresp. $\angle$'s; AB $\parallel$ FC] $= 78°$ $B_2 = 78° - 50°$ $= 28°$ **OR** $\hat{F}_2 = 78° - 50°$ [ext. angle of $\triangle$] $= 28°$ $B_2 = 28°$ [alt. $\angle$'s; AB $\parallel$ FC]	✓S ✓R ✓answer (3) **OR** ✓S ✓answer ✓R (3)
		[9]

QUESTION 6

6.1	**Construction :** Join OA and OD	✓ for construction
	Proof:	
	Let $\hat{A}_1 = x$	
	$\therefore \hat{A}_2 = 90° - x$ [tangent $\perp$ to radius]	✓S/R
	AO = OD [radii]	
	$\hat{D}_1 = \hat{A}_1 = x$ [$\angle$'s opposite = sides]	✓ S/R
	$A\hat{O}D = 180° - 2x$ [sum of $\angle$'s of Δ]	✓S/R
	$\hat{E} = \frac{1}{2}A\hat{O}D$ [$\angle$ at centre $= 2 \times \angle$ at circumference]	✓S ✓R
	$\quad = 90° - x$	(5)
	$\hat{E} = \hat{A}_2$	
	OR	**OR**
	Construction: Draw diameter AC, and join C and D.	✓ for construction
	$\hat{A}_1 + \hat{A}_2 = 90°$ [tangent $\perp$ to radius]	✓S/R
	$A\hat{D}C = 90°$ [$\angle$ in semicircle]	
	$\hat{C} + \hat{A}_2 = 90°$ [sum of $\angle$'s of Δ]	✓S/R
	$\therefore \hat{C} = \hat{A}_1$	
	But $\hat{C} = \hat{E}$ [$\angle$'s in the same segment]	✓S ✓R
		(5)

	$\therefore \hat{A}_1 = \hat{E}$	

6.2.1	$\hat{T}_1 = \hat{S}_2 = x$ [angles in the same segment]	✓ S ✓ R
	$\hat{T}_1 = \hat{R} = x$ [tan-chord-theorem]	✓ S ✓ R
	$\hat{S}_2 = \hat{R}$	
	$\therefore$ PS is a tangent to circle QST [converse: tan-chord-theorem]	✓ R (5)
6.2.2	Let $\hat{T}_2 = y$	
	$\hat{P}_2 = \hat{T}_2 = y$ [angles in the same segment]	✓ S ✓ R
	$P\hat{T}R = \hat{T}_1 + \hat{T}_2 = x + y$	
	$\hat{S}_1 = \hat{P}_2 + \hat{R} = y + x$ [ext. angle of $\triangle$]	✓ S ✓ R
	$\therefore \hat{S}_1 = P\hat{T}R$	✓ S
	$\therefore$ PT = PS [sides opp. equal angles]	✓ R (6)
		[16]

QUESTION 7

7.1	TN = 12 units [line from centre of circle $\perp$ to chord]	✓ S ✓ R (2)
7.2.1	BA = $4x + 9x = 13x$	✓ answer (1)
7.2.2	$OA = \dfrac{13x}{2}$ [radius = $\dfrac{1}{2} \times$ diameter]	✓ length of radius
	$ON = OA - NA = \dfrac{13x}{2} - 4x = \dfrac{5x}{2}$	✓ answer (2)
7.3	$TN^2 + ON^2 = OT^2$ [Pythagoras]	✓ S/R
	$12^2 + \left(\dfrac{5x}{2}\right)^2 = \left(\dfrac{13x}{2}\right)^2$	✓ substitution
	$144 + \dfrac{25x^2}{4} = \dfrac{169x^2}{4}$	
	$36x^2 = 144$	
	$x^2 = 4$	
	$x = 2$	
	radius $= \dfrac{13x}{2} = \dfrac{13(2)}{2} = 13$	✓ value of x ✓ answer (4)
		[9]

TOTAL: 75