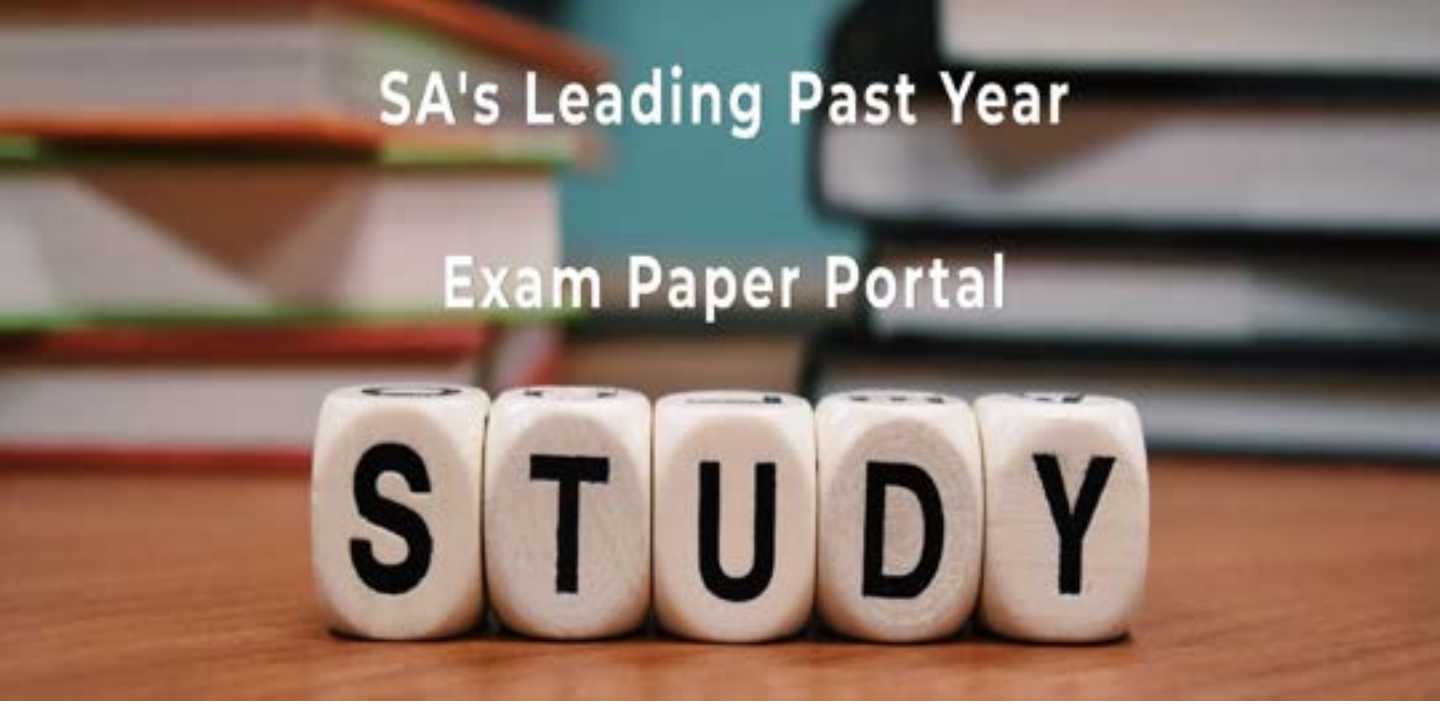

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GRADE 12

MATHEMATICS P2

September 2018

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages an information sheet and an answer book of 20 pages

QUESTION 1

Consider the following characteristics of a set of data:

- Median is 14
- Upper quartile is 20
- Lower quartile is 11
- Maximum value is 30
- Range is 20

1.1 Calculate the interquartile range of the data. (2)

1.2 Draw a box and whisker diagram on the number line in the answer book that represents the data. (3)

1.3 Comment on the skewness of the data. (1)

[6]

QUESTION 2

2.1 A training manager wants to know if there is a link between the hours in training spent by a particular category of employee and their productivity (units produced per day) on the job. The data below was extracted from the files of 10 employees.

Employee	1	2	3	4	5	6	7	8	9	10
Hours in training	16	36	20	38	40	30	35	22	40	24
Productivity (units produced per day)	45	70	44	56	60	48	75	60	63	38

2.1.1 Determine the equation of the least squares regression line. (3)

2.1.2 Estimate the productivity level for a particular employee who has received only 32 hours of training (to the nearest integer). (2)

2.1.3 Comment on the strength of the correlation between the hours in training spent and the productivity. Motivate your answer. (2)

2.2 Consider the productivity of units produced per day above and calculate:

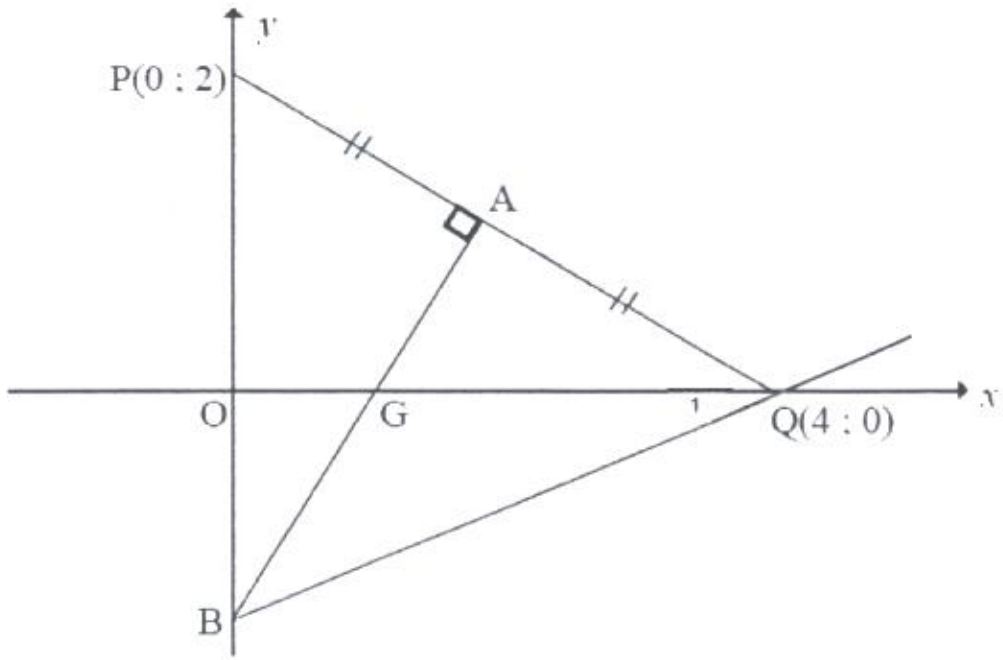
2.2.1 The average units produced per day by the 10 employees. (2)

2.2.2 The number of employees whose productivity are above one standard deviation from the mean. (4)

[13]

QUESTION 3

The diagram below, shows the points P(0 ; 2) and Q(4 ; 0). Point A is the midpoint of PQ. The line AB is perpendicular to PQ and intersects the x-axis at G and the y-axis at B.



3.1 Write down the gradient of PQ. (1)

3.2 Calculate the coordinates of A. (2)

3.3 Determine the equation of the line AB in the form $y = mx + c$. (3)

3.4 Calculate the length of BQ if it is given that B(0 ; –3). (2)

3.5 If PBQR is a rhombus, with R in the first quadrant, calculate the coordinates of R. (4)

3.6 Calculate the size of angle $A\hat{B}Q$. (5)

3.7 Determine:

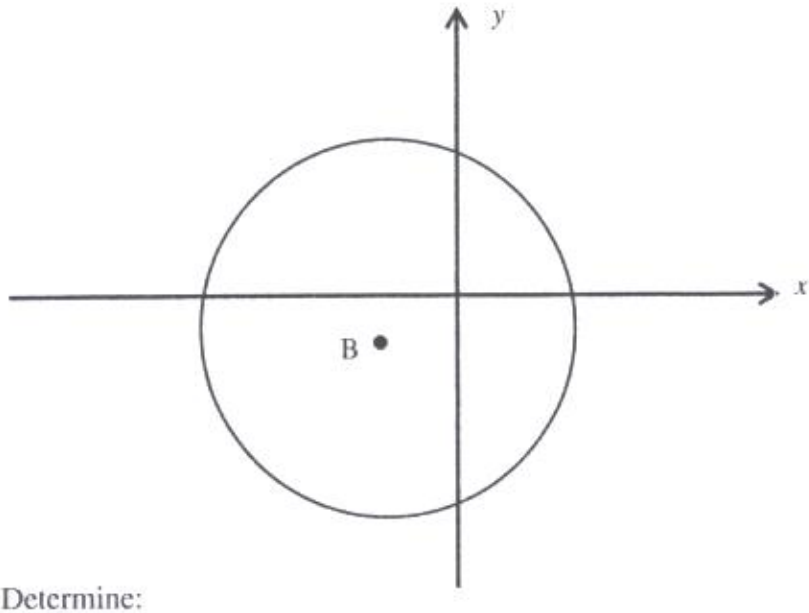
3.7.1 The equation of the circle passing through the points A, P and B. (6)

3.7.2 The equation of the tangent to the circle in **Question 3.7.1** at point P. (2)

[25]

QUESTION 4

In the diagram below, $x^2 + y^2 + 8x + 4y - 28 = 0$, is the equation of the circle centred at B.



4.1 Determine:

4.1.1 The coordinates of B. (4)

4.1.2 The radius of the circle. (1)

4.2 Another circle, with centre A, is drawn. The equation of the circle is $(x-4)^2 + (y-6)^2 = 26$.

Show by calculations that these two circles intersect each other. (6)

4.3 The two circles centred at A and B intersect each other at C and D. Determine the gradient of CD if AB passes through the midpoint of CD. (3)

[14]

QUESTION 5

5.1 Consider: $\frac{1-\tan^2\theta}{1+\tan^2\theta}$

5.1.1 Calculate the value of the expression if $\theta = 20^\circ$. (2)

5.1.2 Prove without using a calculator, that $\frac{1-\tan^2\theta}{1+\tan^2\theta} = \cos 2\theta$. (5)

5.1.3 Hence, determine the general solution, without using a calculator if

$$\frac{1-\tan^2\theta}{1+\tan^2\theta} = \frac{1}{2}$$ (5)

5.2 If $\cos 25^\circ = k$, express the following in terms of k:

5.2.1 $\sin 245^\circ$ (3)

5.2.2 $\sin 25^\circ$ (2)

5.2.3 $\cos 50^\circ$ (2)

5.3 Consider: $\sqrt{3}\cos\beta + \sin\beta$

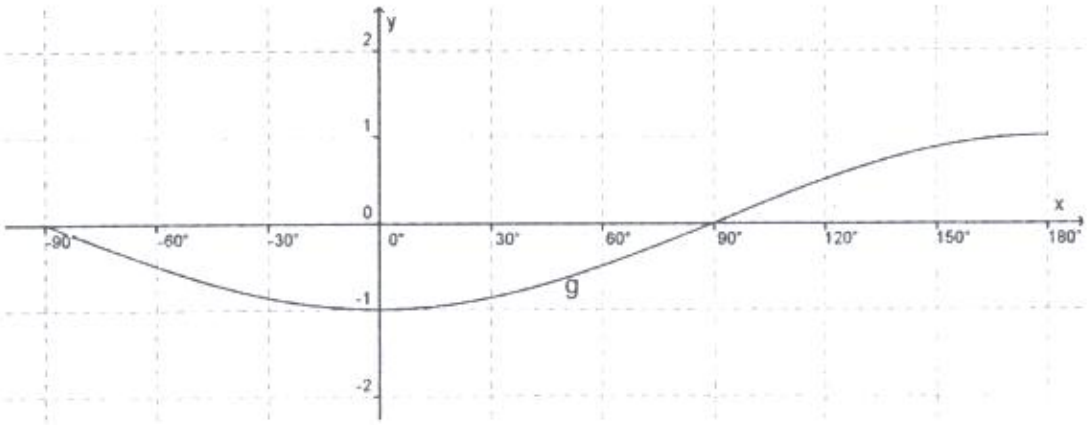
5.3.1 Rewrite $\sqrt{3}\cos\beta + \sin\beta$ in the form $p\sin(\alpha+\beta)$. (5)

5.3.2 Determine the maximum value of $\sqrt{3}\cos\beta + \sin\beta - 5$. (2)

[26]

QUESTION 6

In the diagram the graph of $g(x) = -\cos x$ is drawn for the interval $x \in [-90^\circ; 180^\circ]$.



6.1 On the same set of axis in the answer book draw the graph of $f(x) = \sin(x + 30^\circ)$ for $x \in [-90^\circ; 180^\circ]$. Show clearly all the intercepts with the axes, as well as the turning points. (4)

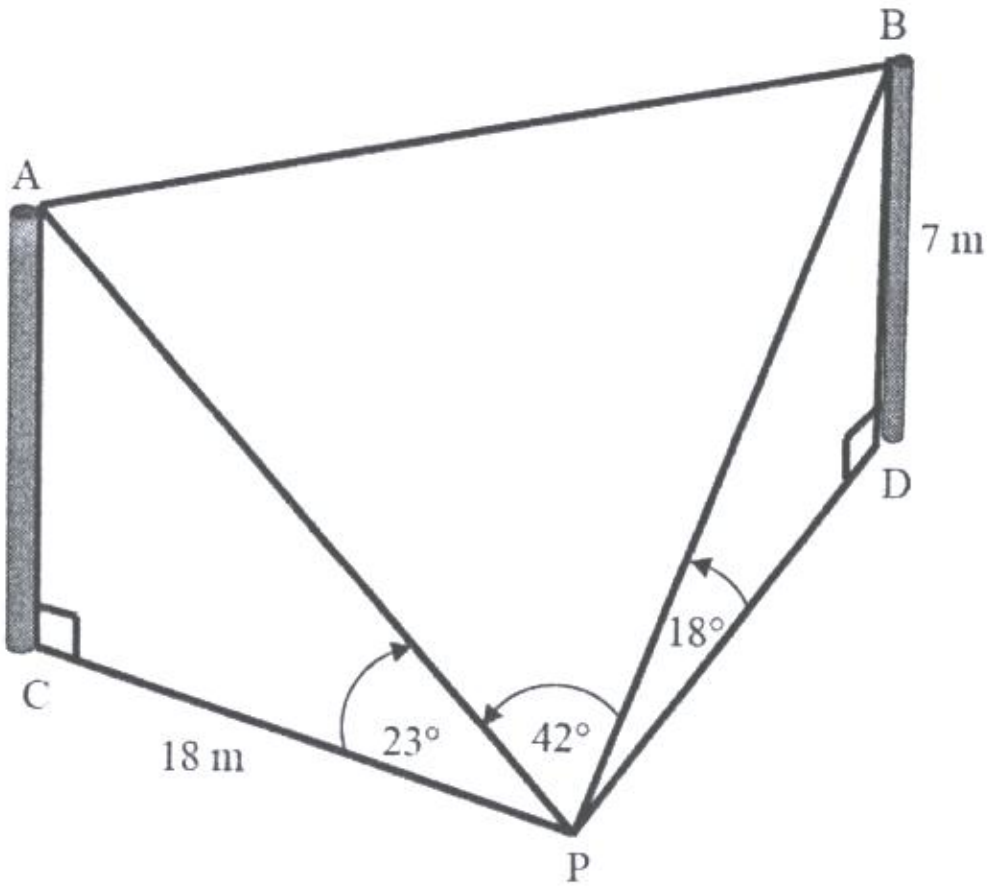
6.2 Write down the period of $g(2x)$. (2)

6.3 Determine for which values of x; $x \in [-90^\circ; 180^\circ]$, the graphs of f and g are both increasing. (2)

[8]

QUESTION 7

Thandi is standing at point P on the ground and observes two poles, AC and BD, of different heights. P, C and D are in the same horizontal plane. From P the angles of inclination to the top of the poles A and B are 23° and 18° respectively. Thandi is 18 m from the base of pole AC. The height of pole BD is 7 m.



Calculate:

7.1 The distance from Thandi to the top of pole AC, in other words AP. (2)

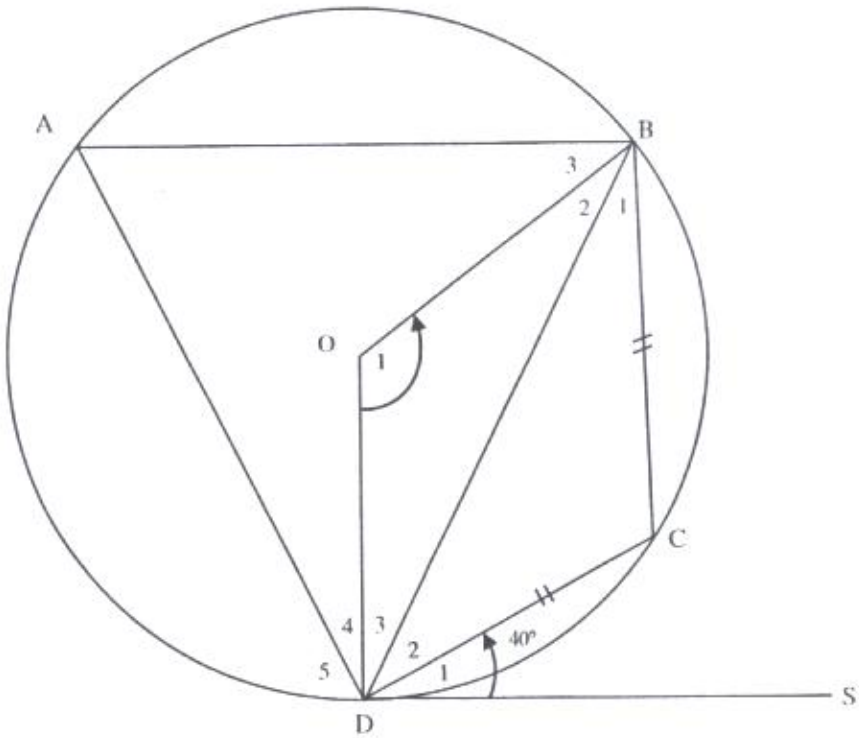
7.2 The distance between the top of the poles, AB, if $A\hat{P}B = 42^\circ$ and PB = 22.65 m.

(4)

[6]

QUESTION 8

8.1 In the figure below, ABCD is a cyclic quadrilateral in the circle centred at O and ΔDOB is drawn. DS is a tangent to the circle at D. BC = DC and $C\hat{D}S = 40^\circ$.



Calculate, with reasons, the size of:

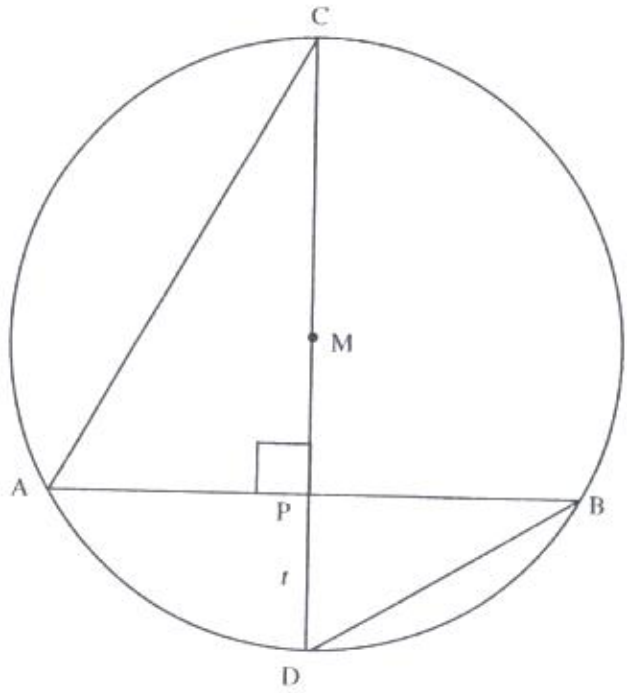
8.1.1 $B\hat{D}C$ (3)

8.1.2 $\hat{C}$ (2)

8.1.3 $\hat{A}$ (2)

8.1.4 $\hat{O}_1$ (2)

8.2 In the diagram, M is the centre of circle and diameter CMPD is perpendicular to chord AB. AB = $4t$, PD = t and CP = 15 cm.



8.2.1 Give a reason why AP = $2t$. (1)

8.2.2 If it is further given that $\Delta CAP \;|||\; \Delta BDP$, calculate:

a) The value of t. (4)

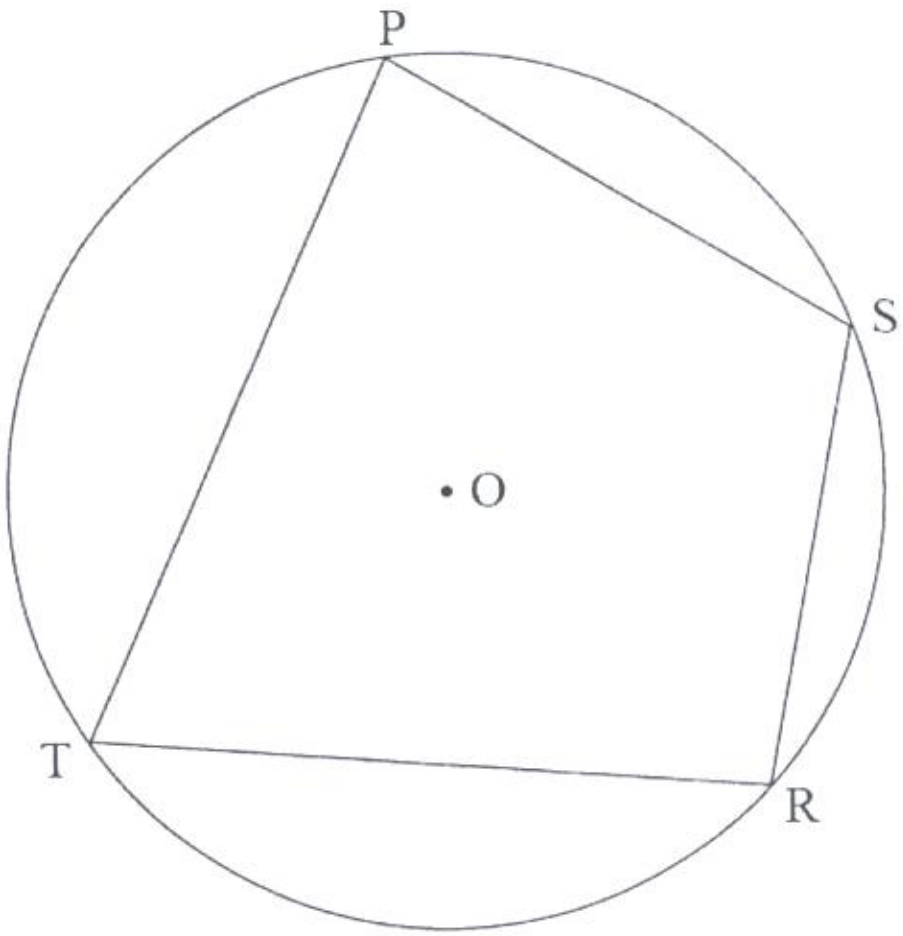
b) The length of the radius of the circle. (2)

[16]

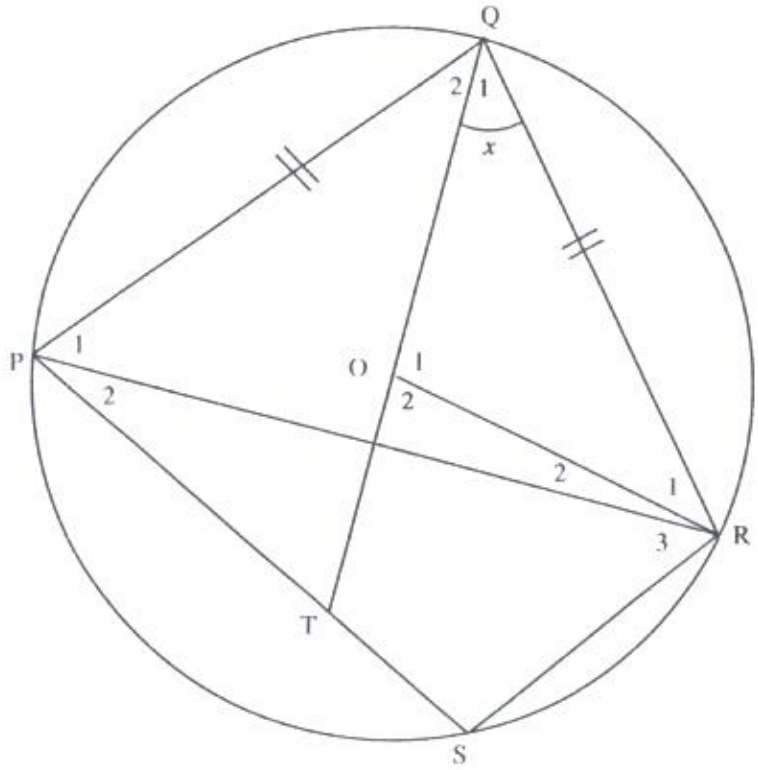
QUESTION 9

9.1 In the diagram below, O is the centre of the circle. PSRT is a cyclic quadrilateral. Prove the theorem that states that $\hat{PTR} + \hat{PSR} = 180^\circ$.

(5)



9.2 In the diagram below, O is the centre of the circle. P, Q, R and S are points on the circumference of the circle. TOQ is a straight line such that T lies on PS. PQ = QR and $Q_1 = x$.



9.2.1 Calculate, with reasons, $\hat{P}_1$ in terms of x. (4)

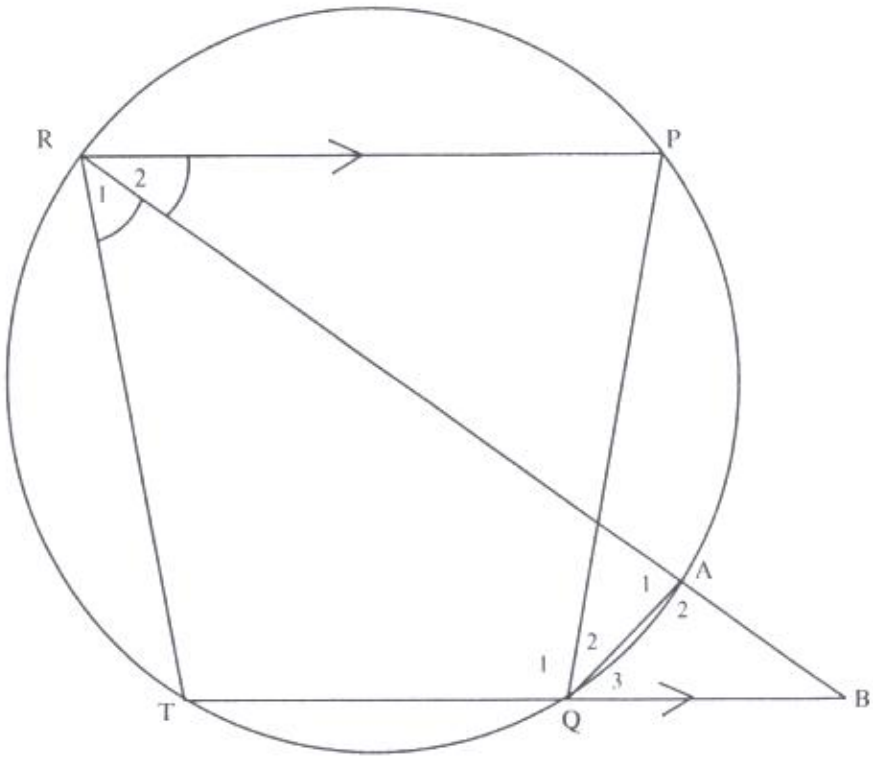
9.2.2 Prove that TQ bisects $P\hat{Q}R$. (3)

9.2.3 Prove that STOR is a cyclic quadrilateral. (5)

[17]

QUESTION 10

In the diagram below, points R, P, A, Q and T lie on a circle. RA bisects $\hat{R}$ and RP ∥ TB. RA and TQ produced meet at B.



Prove that:

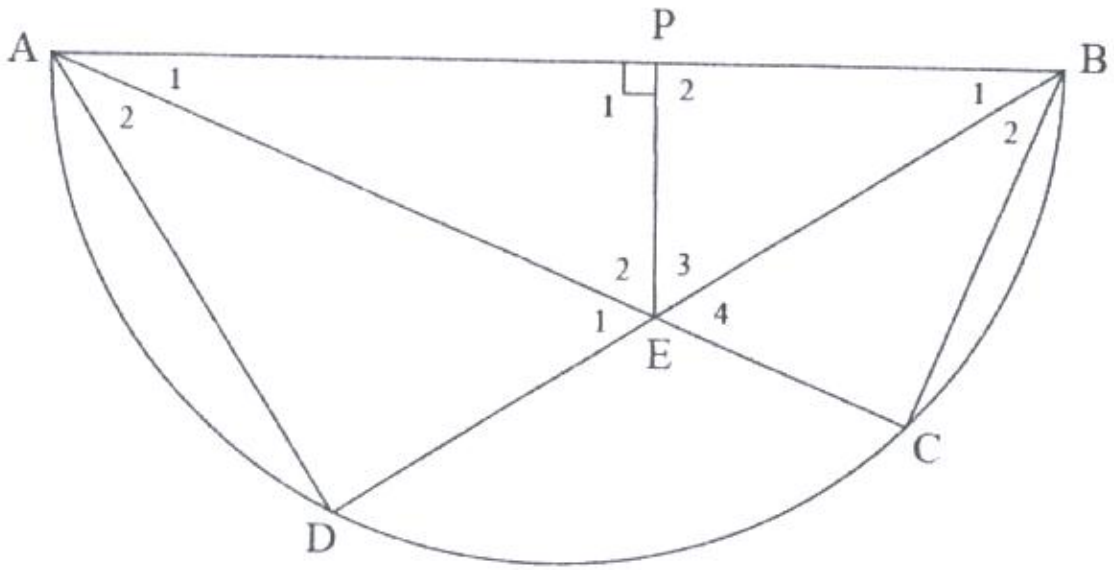
10.1 AQ bisects $P\hat{Q}B$. (5)

10.2 $T\hat{R}P = \hat{A}_1$ (4)

[9]

QUESTION 11

In the diagram below, AB is the diameter of semi-circle ADCB. Chords AC and BD intersect at E. EP is perpendicular to AB.



11.1 Prove that $\Delta BPE \;|||\; \Delta BDA$. (4)

11.2 Prove that $AB^2 = BD^2 + \dfrac{BD^2.PE^2}{BP^2}$ (6)

[10]

TOTAL: 150 MARKS