



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P3  
FEBRUARY/MARCH 2009**

**MARKS: 100**

**TIME: 2 hours**

**This question paper consists of 10 pages, an information sheet and 2 diagram sheets.**

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Diagrams are NOT necessarily drawn to scale.
6. TWO diagram sheets for answering QUESTION 5.1, QUESTION 5.3, QUESTION 6.2, QUESTION 7, QUESTION 8 and QUESTION 9 are attached at the end of this question paper. Write your examination number on these sheets in the spaces provided and hand them in together with the ANSWER BOOK.
7. Number the answers correctly according to the numbering system used in this question paper.
8. It is in your own interest to write legibly and to present the work neatly.

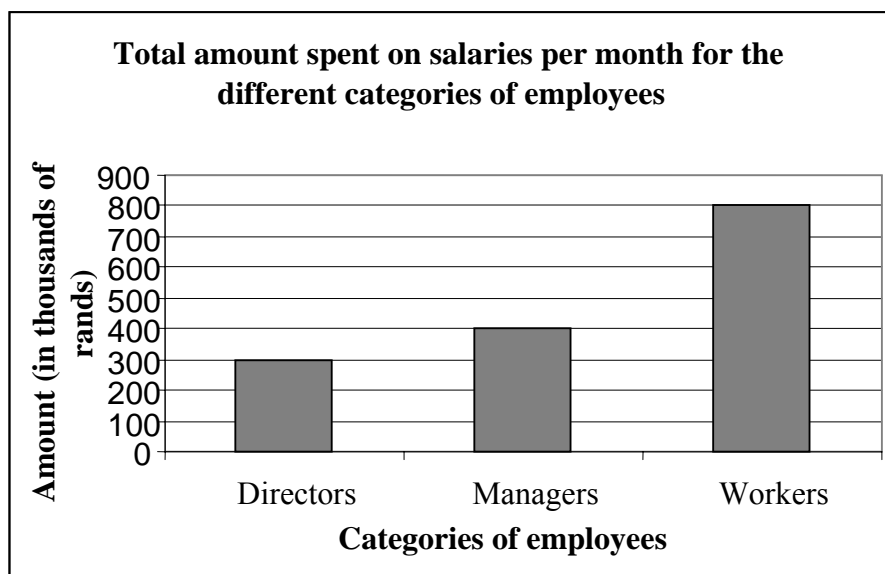
**QUESTION 1**

Consider the sequence: 3; 8; 13; 18; 23; 28; ...

- 1.1 If the sequence continues to behave in the same manner, write down the next term. (1)
- 1.2 Write down a recursive formula that will determine the  $n$ -th term of the sequence. (3)
- [4]

**QUESTION 2**

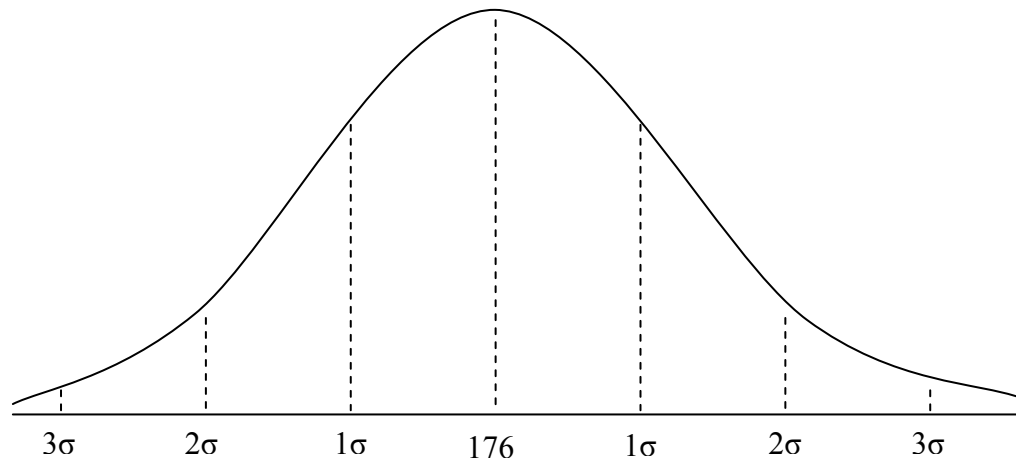
In a company there are 2 directors, 16 managers and 200 workers. At salary negotiations the directors presented the following bar chart to show the total amount spent on salaries for the different categories of employees.



- 2.1 The directors stated that the total salaries earned by workers are twice as much as the total earned by managers. Do you agree with this statement? Motivate your answer. (2)
- 2.2 The directors suggest that the percentage increase in the salaries for workers should be the lowest since the workers' wage bill is the largest. Do you think that this is fair? Explain. (2)
- 2.3 Calculate the mean monthly salary for the workers. (2)
- 2.4 You are the representative of the workers. Prepare a bar graph to show clearly that the workers deserve the highest percentage increase in their monthly salary. (4)
- [10]

**QUESTION 3**

The duration of telephone calls made by a receptionist was monitored for a week. The data obtained is represented by the normal distribution curve below. The mean time was 176 seconds with a standard deviation of 30 seconds.



It is also known that:

Approximately 68% of the duration of the telephone calls recorded is within one standard deviation of the mean: 34% above and 34% below.

Approximately 96% of the duration of the telephone calls recorded is within two standard deviations of the mean: 48% above and 48% below.

Approximately 100% of the duration of the telephone calls recorded is within three standard deviations of the mean: 50% above and 50% below.

- 3.1 What percentage of calls made was between 146 seconds and 206 seconds in duration? (3)
- 3.2 Determine the time interval for the duration of calls for the middle 96% of the data. (3)
- 3.3 What percentage of calls made were in excess of 146 seconds? (2)
- [8]**

**QUESTION 4**

- 4.1 In a company there are three vacancies. The company had identified candidates to fill each post.

<b>POST</b>	<b>CANDIDATES</b>
Clerk	Craig, Luke and Tom
Sales representative	Ann, Sandile, Sizwe and Devon
Sales manager	John and Debby

- 4.1.1 In how many different ways can these three posts be filled? (3)
- 4.1.2 If it is certain that Craig will get the job as clerk, in how many different ways can the three posts be filled? (2)
- 4.2 There are 20 boys and 15 girls in a class. The teacher chooses individual learners at random to deliver a speech.
- 4.2.1 Calculate the probability that the first learner chosen is a boy. (1)
- 4.2.2 Draw a tree diagram to represent the situation if the teacher chooses three learners, one after the other. Indicate on your diagram ALL possible outcomes. (4)
- 4.2.3 Calculate the probability that a boy, then a girl and then another boy is chosen in that order. (3)
- 4.2.4 Calculate the probability that all three learners chosen are girls. (2)
- 4.2.5 Calculate the probability that at least one of the learners chosen is a boy. (3)
- 4.3 In a Mathematics quiz, two teams work independently on a problem. They are allowed a maximum of 10 minutes to solve the problem. The probabilities that each team will solve the problem are  $\frac{1}{2}$  and  $\frac{1}{3}$  respectively. Calculate the probability that the problem will be solved in the ten minutes allowed. (4)
- [22]**

**QUESTION 5**

During the month of July a number of patients visited a local clinic suffering from influenza. The table below shows the cumulative number of patients treated as per the dates given.

<b>Dates in the month of July</b>	3	5	8	12	15	19	22	26
<b>Number of patients treated</b>	270	275	376	420	602	684	800	820

- 5.1 Draw a scatter plot of the above data. (3)
- 5.2 Determine the equation of the least squares line for the data. (4)
- 5.3 Draw the least squares line for the data. (2)
- 5.4 Estimate how many patients were treated as at 30 June. (2)
- 5.5 Estimate how many patients were treated as at 24 July. (2)
- 5.6 Determine the correlation coefficient for the data. Interpret this result. (3)

**[16]**

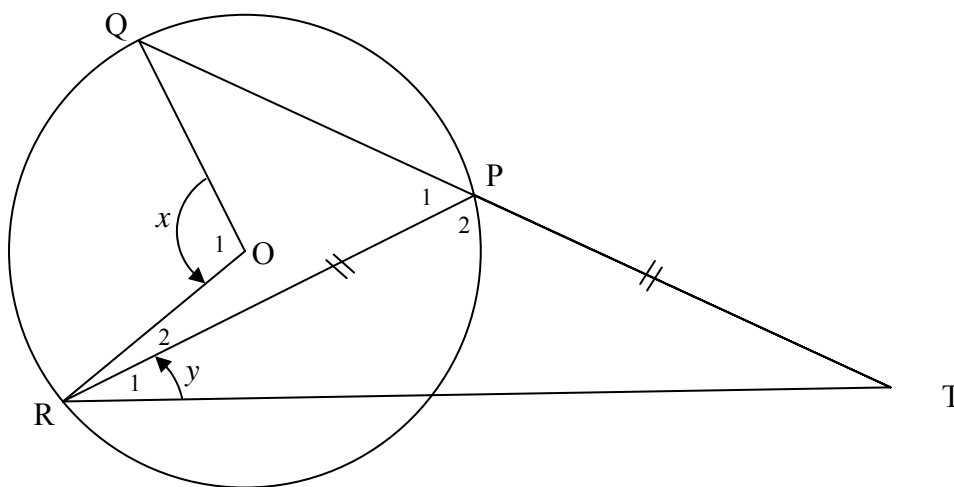
**QUESTION 6**

6.1 Complete the statement below by filling in the missing word(s) so that the statement is CORRECT:

The angle subtended by a chord or arc at the centre of a circle is ... (1)

6.2 In the figure below, O is the centre of the circle and  $PT = PR$ .

Let  $\hat{R}_1 = y$  and  $\hat{O}_1 = x$ .



6.2.1 Express  $x$  in terms of  $y$ . (3)

6.2.2 If  $TQ = TR$  and  $x = 120^\circ$ , calculate the measure of:

(a)  $y$  (2)

(b)  $\hat{R}_2$  (Hint: Draw QR) (3)

**[9]**

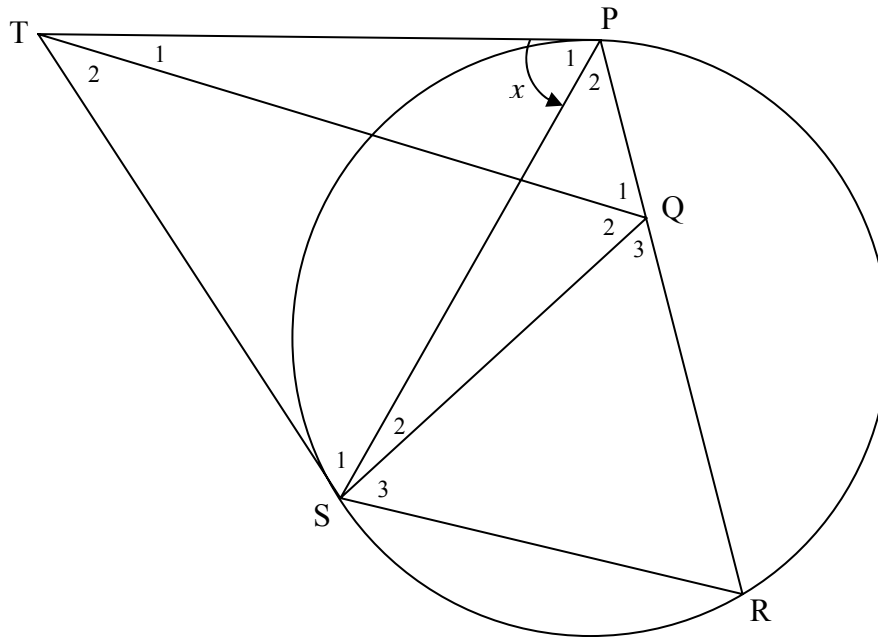
**QUESTION 7**

In the figure TP and TS are tangents to the given circle. R is a point on the circumference.

Q is a point on PR such that  $\hat{Q}_1 = \hat{P}_1$ .

SQ is drawn.

Let  $\hat{P}_1 = x$ .



Prove that:

7.1  $TQ \parallel SR$  (4)

7.2 QPTS is a cyclic quadrilateral (4)

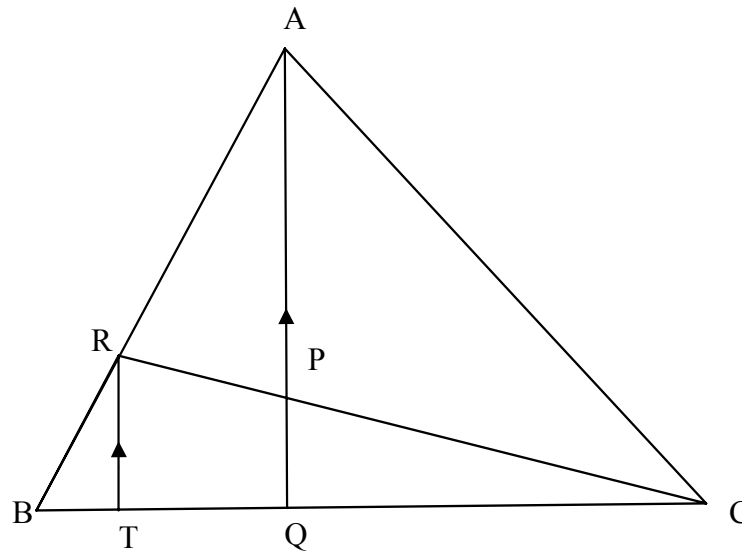
7.3 TQ bisects  $\hat{SQP}$  (3)

**[11]**



**QUESTION 8**

In the figure  $AQ \parallel RT$ ,  $\frac{BQ}{QC} = \frac{3}{5}$  and  $\frac{BR}{RA} = \frac{1}{2}$ .



8.1 If  $BT = k$ , calculate  $TQ$  in terms of  $k$ . (3)

8.2 Hence, or otherwise, calculate the numerical value of:

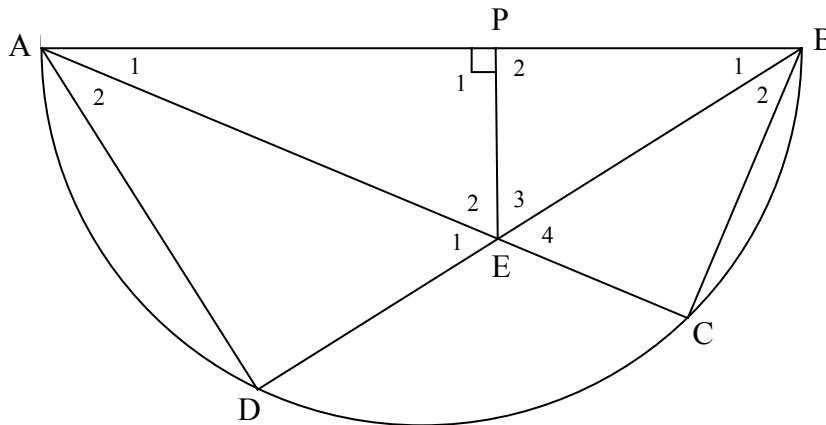
8.2.1  $\frac{CP}{PR}$  (3)

8.2.2  $\frac{\text{Area } \triangle RCT}{\text{Area } \triangle ABC}$  (4)

**[10]**

**QUESTION 9**

In the accompanying figure, AB is the diameter of circle ADCB. Chords AC and BD intersect at E. EP is perpendicular to AB.



- 9.1 Prove that  $\triangle BPE \sim \triangle BDA$ . (3)
- 9.2 Hence show that  $\frac{BP}{BD} = \frac{PE}{AD}$ . (2)
- 9.3 Prove that  $AB^2 = BD^2 + \frac{BD^2 \cdot PE^2}{BP^2}$ . (5)
- [10]**

**TOTAL: 100**



**INFORMATION SHEET: MATHEMATICS**  
**INLIGTINGSBLAD: WISKUNDE**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$\sum_{i=1}^n 1 = n$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$\sum_{i=1}^n (a + (i-1)d) = \frac{n}{2}(2a + (n-1)d)$$

$$\sum_{i=1}^n ar^{i-1} = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$\sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1-r}; \quad -1 < r < 1$$

$$F = \frac{x[(1+i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1+i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

In  $\triangle ABC$ :

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

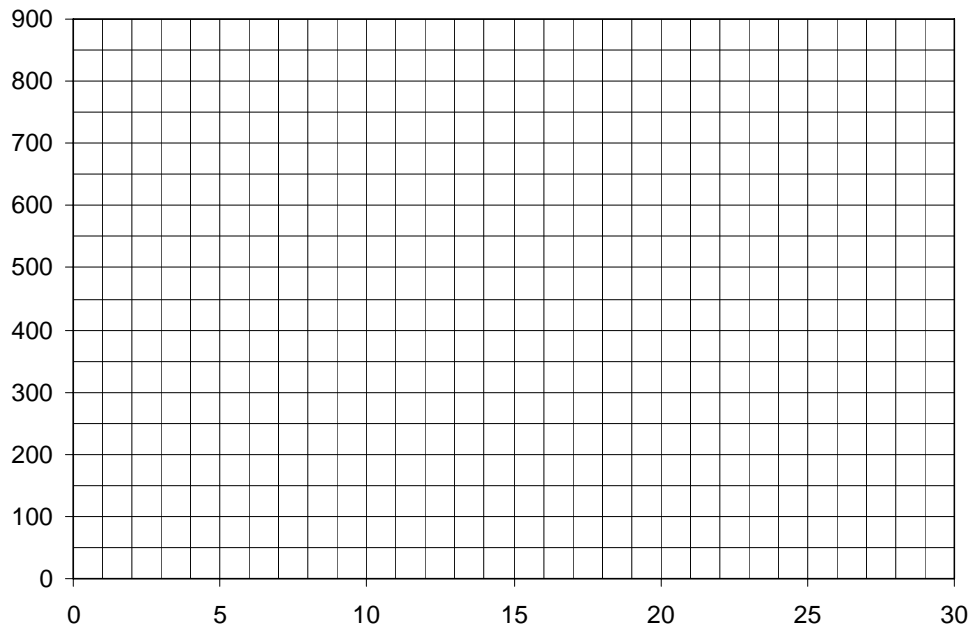
$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

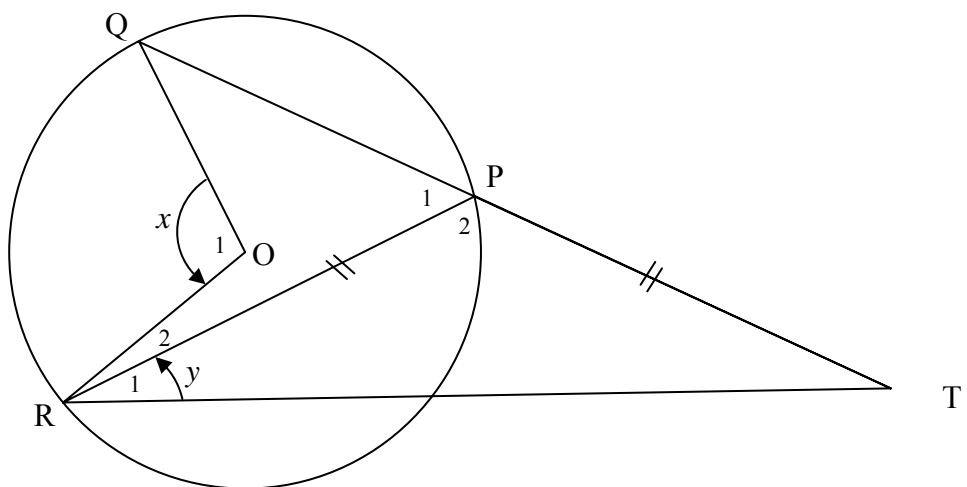
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**DIAGRAM SHEET 1**

**QUESTIONS 5.1 AND 5.3**



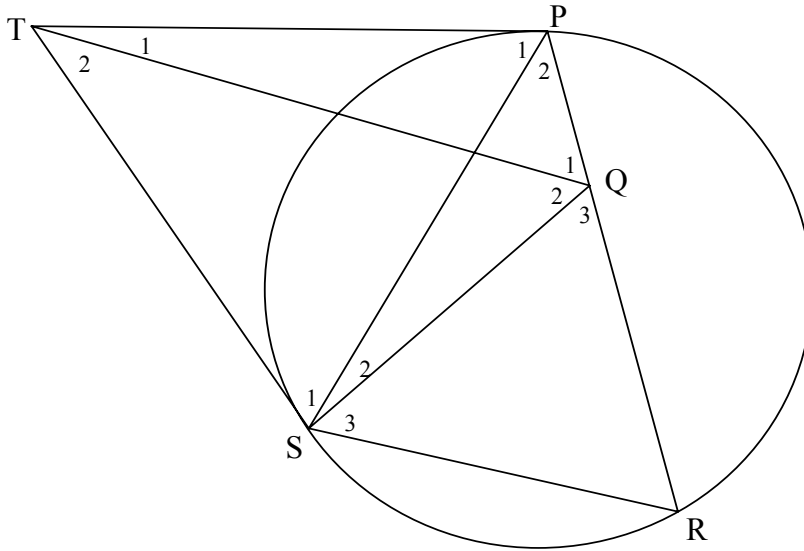
**QUESTION 6.2**



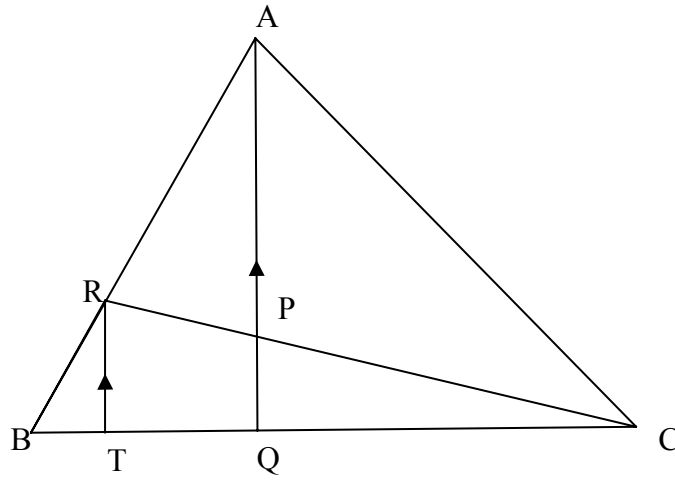
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**DIAGRAM SHEET 2**

**QUESTION 7**



**QUESTION 8**



**QUESTION 9**

