



**KWAZULU-NATAL PROVINCE**

**EDUCATION**  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P2**  
**PREPARATORY EXAMINATION**  
**SEPTEMBER 2022**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 13 pages and 1 information sheet and 1 answer sheet.**

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Read the questions carefully.
3. Answer ALL the questions.
4. Number your answers exactly as the questions are numbered.
5. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
6. Answers only will NOT necessarily be awarded full marks.
7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
9. Diagrams are NOT necessarily drawn to scale.
10. An information sheet with formulae is included at the end of the question paper.
11. Write neatly and legibly.

**QUESTION 1**

The weight (in kg) of 20 boys in the soccer squad of school A are given below:

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 40 | 47 | 48 | 51 | 53 | 57 | 58 | 58 | 59 | 59 |
| 60 | 60 | 60 | 60 | 61 | 62 | 63 | 64 | 66 | 69 |

1.1 Calculate:

1.1.1 the mean weight of the boys in this soccer squad. (2)

1.1.2 the standard deviation of this data. (1)

1.2 Determine the number of boys that have a weight within one standard deviation of the mean. (2)

1.3 The following information was obtained from the coach of the soccer squad of school B:

$$\sum_{n=1}^{22} x_n = 1320$$

1.3.1 How many boys are in the school B squad? (1)

1.3.2 Calculate the mean weight of a boy in the soccer squad of school B. (1)

1.4 Assume that the mean weight of the boys in the soccer squad at school B is 60 kg. Five boys of equal weight are added to the school A squad so that the means of both school squads are the same. Calculate the weight of each of these five boys. (4)

**[11]**

## QUESTION 2

A survey was done on 250 people to determine the distances they travel to work daily.

The results are shown in the table below.

| DISTANCE, $d$ (in km) | FREQUENCY | CUMULATIVE FREQUENCY |
|-----------------------|-----------|----------------------|
| $0 < d \leq 5$        | 8         |                      |
| $5 < d \leq 10$       | 41        |                      |
| $10 < d \leq 15$      | 63        |                      |
| $15 < d \leq 20$      | 52        |                      |
| $20 < d \leq 25$      | 41        |                      |
| $25 < d \leq 30$      | 38        |                      |
| $30 < d \leq 35$      | 7         |                      |
| <b>TOTAL</b>          |           |                      |

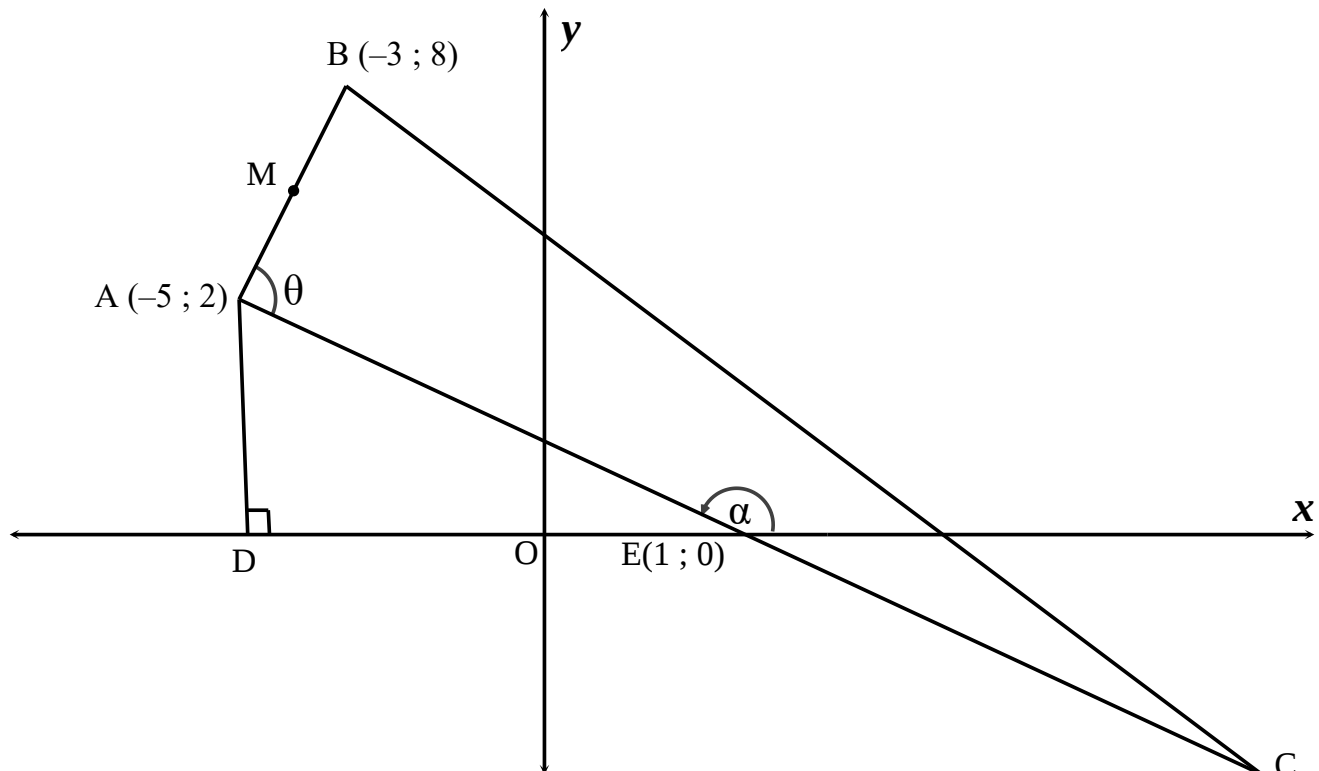
- 2.1 Complete the cumulative frequency column, on the attached ANSWER SHEET. (3)
- 2.2 Draw a cumulative frequency graph (ogive) for the given data on the grid provided on the attached ANSWER SHEET. (4)
- 2.3 Use the graph to determine the median distance travelled. Indicate on your graph the median distance. (2)

**[9]**

### QUESTION 3

In the diagram below,  $A(-5 ; 2)$ ,  $B(-3 ; 8)$  and  $C$  are vertices of  $\triangle ABC$ .

$E(1 ; 0)$  is the midpoint of  $AC$ .  $D$  is a point on the  $x$ -axis such that  $AD$  is a line perpendicular to the  $x$ -axis.  $\alpha$  is the angle of inclination of  $AC$ .

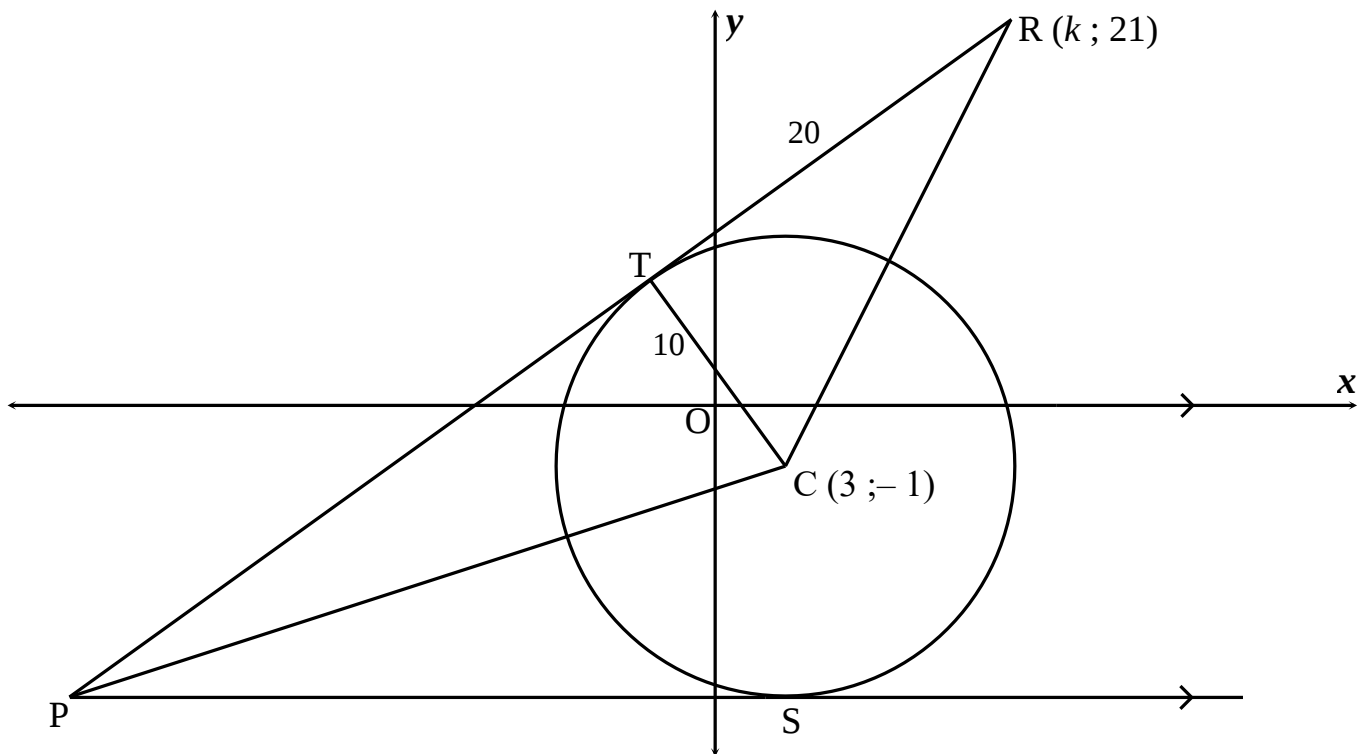


- 3.1 Determine the coordinates of  $M$ , the midpoint of  $AB$ . (2)
- 3.2 Write down the coordinates of point  $D$ . (1)
- 3.3 Show that the coordinates of  $C$  are  $(7 ; -2)$  (2)
- 3.4 Calculate the length of line  $AC$ . (Leave answer in simplest surd form) (2)
- 3.5 Determine the coordinates of  $F$ , if  $F$  lies in the first quadrant and  $CABF$  is a parallelogram. (2)
- 3.6 Determine the equation of the perpendicular bisector of  $AB$ . (4)
- 3.7 Calculate the size of  $\alpha$ , the angle of inclination of line  $AC$ . (3)
- 3.8 Determine the equation of the line parallel to  $AB$  passing through  $E$ . (2)
- 3.9 Calculate the size of angle  $\theta$ . (2)
- 3.10 Calculate the area of  $\triangle ABC$ . (4)

[24]

#### QUESTION 4

In the diagram, the circle TS centred at  $C(3;-1)$  has a radius  $CT$  of 10 units.  $PTR$ , where  $R(k; 21)$ , is a tangent to the circle at  $T$ .  $PS$  is a tangent to the circle at  $S$  and  $PS \parallel x$ -axis.  $PC$ ,  $TC$  and  $CR$  are drawn.  $TR = 20$  units.



- 4.1 Give a reason why  $CT \perp TR$ . (1)
- 4.2 Calculate the value of  $k$ , where  $R$  is in the first quadrant. (4)
- 4.3 Write down the equation of the given circle. (2)
- 4.4 Write down the equation of  $PS$ . (1)
- 4.5 The equation of tangent  $PTR$  is  $3y = 4x + 35$ .
- 4.5.1 Calculate the coordinates of  $P$ . (2)
- 4.5.2 Calculate the length of  $PT$ . (3)

**[13]****QUESTION 5**

- 5.1 If  $5\cos A = 2\sqrt{6}$  where  $A \in [90^\circ; 360^\circ]$ , calculate, **without using a calculator** and with the aid of a diagram, the values in simplest form of:

5.1.1  $-\sqrt{6} \cdot \tan A$  (4)

5.1.2  $\sin 2A$  (4)

- 5.2 Given:  $\sin 18^\circ = p$

**Without using a calculator**, determine each of the following in terms of  $p$ .

5.2.1  $\cos 18^\circ$  (2)

5.2.2  $\cos 48^\circ$  (5)

5.2.3  $\sin 9^\circ$  (3)

**[18]**

## QUESTION 6

- 6.1 **Without using a calculator**, simplify the following expression fully:

$$\frac{\sin(180^\circ - x) \cdot \tan(x - 180^\circ) \cdot \cos(360^\circ + x)}{\sin^2(180^\circ + x) + \sin^2(90^\circ - x)} \quad (6)$$

- 6.2 **Without using a calculator**, determine the value of:

$$\frac{\cos 330^\circ \cdot \tan 150^\circ \cdot \sin 12^\circ}{\tan 675^\circ \cdot \cos 258^\circ} \quad (7)$$

- 6.3 Given the identity:  $\frac{\cos \alpha + \cos 2\alpha}{\sin 2\alpha - \sin \alpha} = \frac{\cos \alpha + 1}{\sin \alpha}$

6.3.1 Prove the identity. (4)

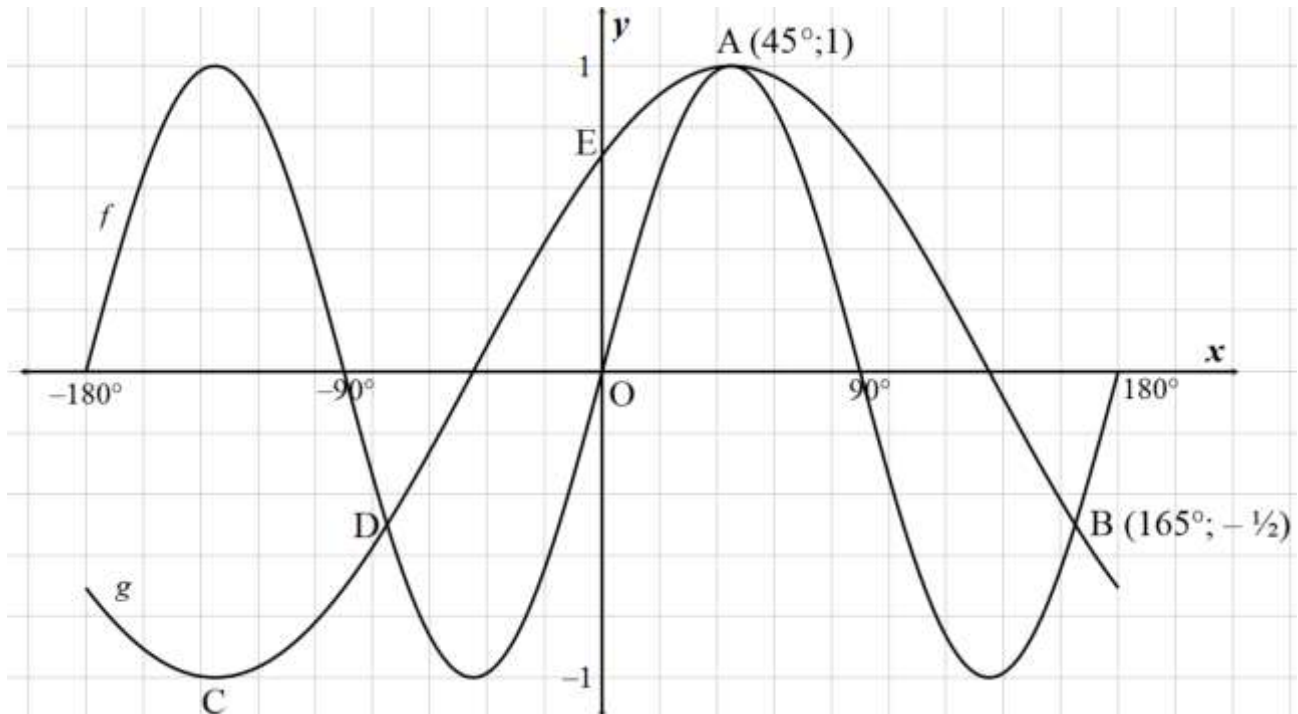
6.3.2 For which other values of  $\alpha$  is the identity undefined? (5)

**[22]**

## QUESTION 7

Given:  $f(x) = \sin 2x$  and  $g(x) = \cos(x+a)$  where  $x \in [-180^\circ; 180^\circ]$

The graphs of  $f$  and  $g$  intersect at B and D. E is the y-intercept of  $g$ , and C is a turning point of  $g$ . A is a turning point of both  $f$  and  $g$ .



- 7.1 Write down the value of  $a$ . (1)
- 7.2 State the period of  $f$ . (1)
- 7.3 Determine the coordinates of C and E. (3)
- 7.4 Write down the amplitude of  $h$  if  $h(x) = 3f(x)$ . (1)
- 7.5 Determine for which value(s) of  $x$ , if  $x \in [0^\circ; 180^\circ]$ , will:
- 7.5.1  $g(x) > f(x)$  (2)
- 7.5.2  $g'(x) \cdot f'(x) \geq 0$  (2)
- 7.6 **Without solving the equation**, use the above graphs to show how you would solve the following equation:

$$\sqrt{2} \sin 2x = \cos x + \sin x \quad (3)$$

[13]

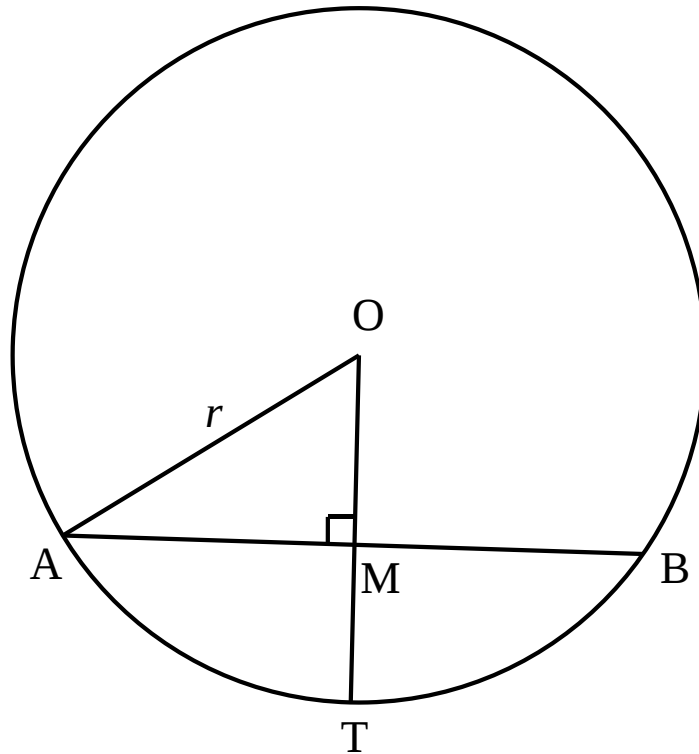
## QUESTION 8

8.1 Complete the following statement:

The line drawn from the centre of the circle perpendicular to the chord ..... (1)

8.2 The circle below with centre  $O$  has chord  $AB = 8$  cm.

$OMT \perp AB$  with  $MT = 2$  cm. The radius of the circle is  $r$  cm.

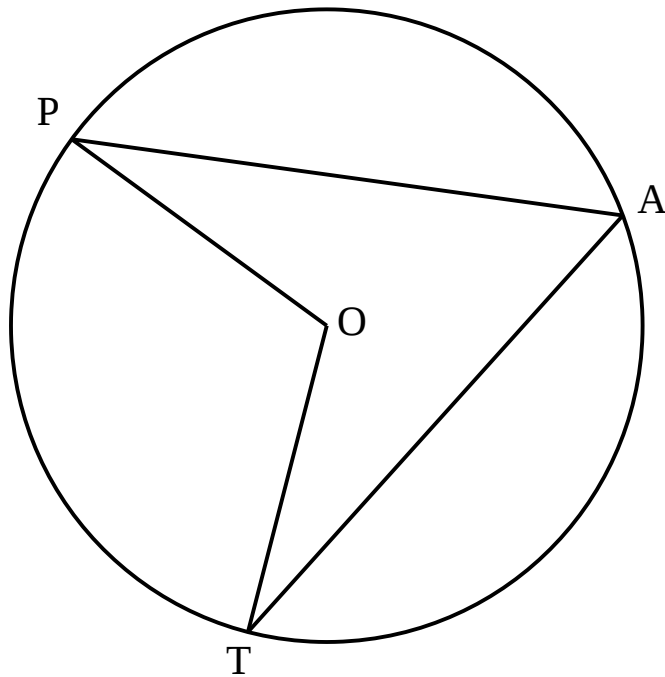


8.2.1 Write down, with a reason, the value of  $AM$ . (2)

8.2.2 Calculate the length of the radius of the circle. (4)  
[7]

## QUESTION 9

- 9.1 In the diagram below,  $O$  is the centre of the circle.  $P$ ,  $A$  and  $T$  are points on the circumference of the circle.  $PA$ ,  $TA$ ,  $PO$  and  $TO$  are drawn.

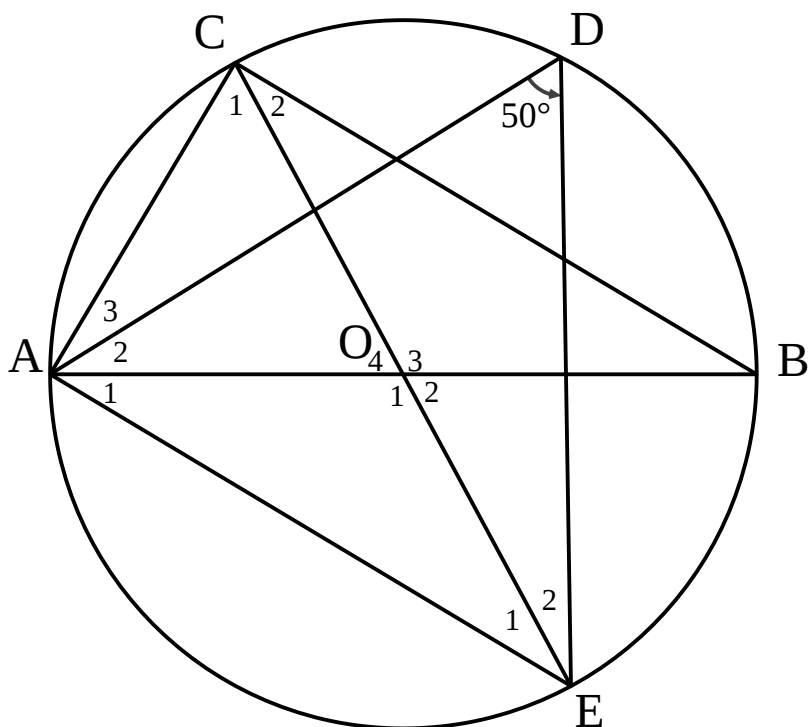


Prove the theorem which states that  $\angle POT = 2\angle PAT$ .

(5)

- 9.2  $AOB$  and  $COB$  are diameters of circle  $ACDBE$  with centre  $O$ .

Chords  $AC$ ,  $CB$ ,  $AE$ ,  $AD$  and  $DE$  are drawn.  $\hat{D} = 50^\circ$ .



9.2.1 Calculate, with reasons, the size of the following angles:

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

(b)  $\hat{E}_1$  (3)

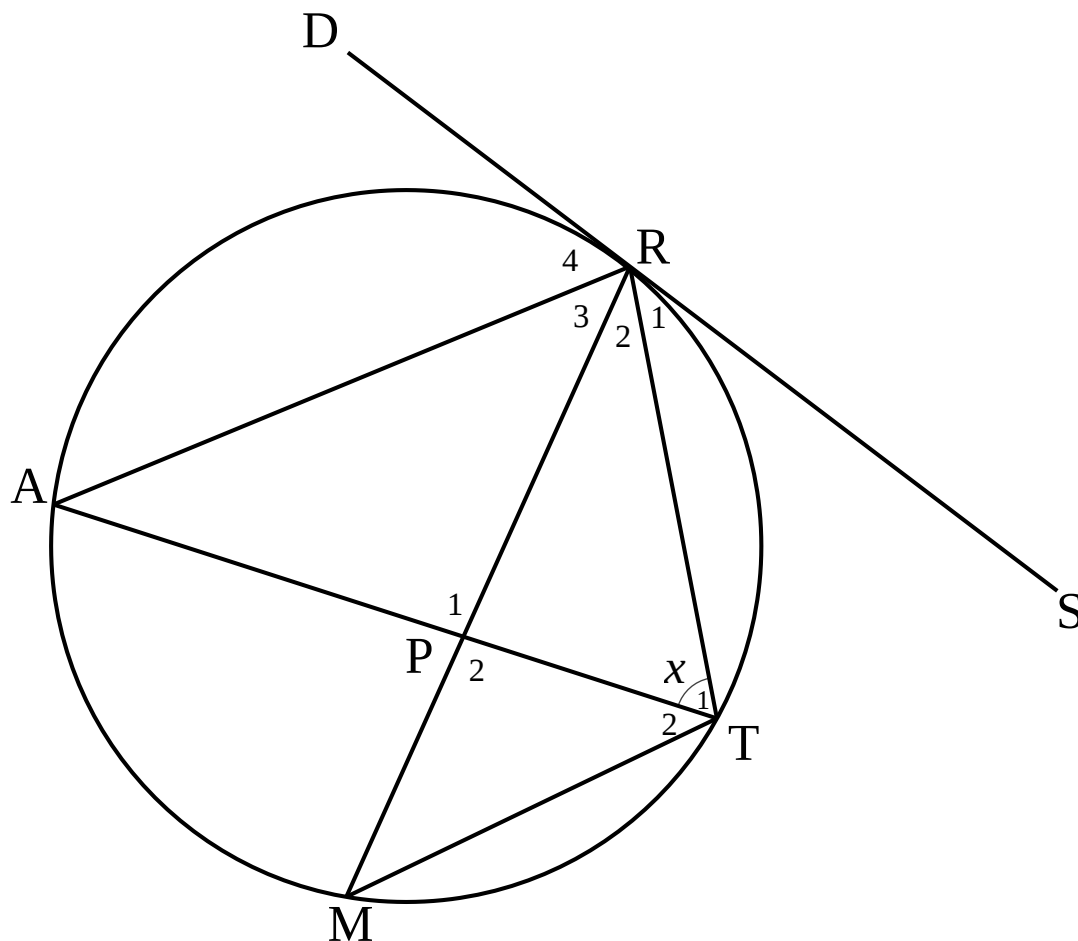
9.2.2 Prove that  $AE \parallel CB$ . (4)

**[14]**

**QUESTION 10**

In the diagram DRS is a tangent to the circle TMAR at R. AT bisects  $\hat{MTR}$ .

AT intersects MR at P. AR is drawn.  $\hat{T}_1 = x$ .



10.1 Prove, giving reasons, that:

10.1.1  $\hat{R}_3 = \hat{R}_4$ . (4)

10.1.2  $\triangle APR \parallel \triangle MPT$ . (3)

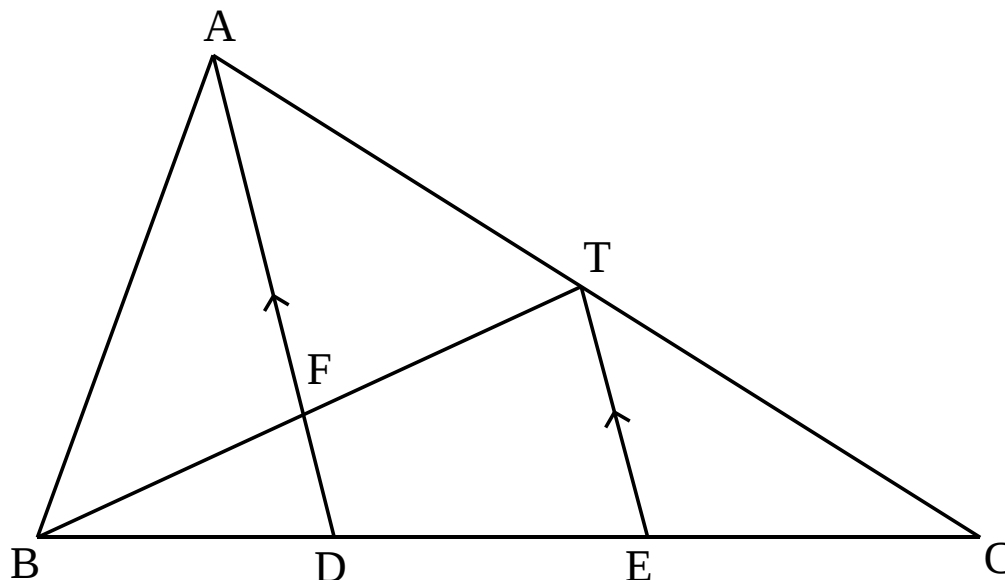
10.2 If  $AR = \frac{3}{2}MT$ , then calculate the value of  $\frac{PT}{PR}$ . (3)

**[10]**

**QUESTION 11**

In the diagram below,  $\triangle ABC$  has D and E on BC.  $BD = 6$  cm and  $DC = 9$  cm.

$AT : TC = 2 : 1$  and  $AD \parallel TE$ .



11.1 Write down the numerical value of  $\frac{CE}{ED}$ . (1)

11.2 Show that D is the midpoint of BE. (1)

11.3 If  $FD = 2$  cm, calculate the length of TE. (2)

11.4 Calculate the numerical value of :

11.4.1  $\frac{\text{Area of } \triangle ADC}{\text{Area of } \triangle ABD}$  (2)

11.4.2  $\frac{\text{Area of } \triangle TEC}{\text{Area of } \triangle ABC}$  (3)

**[9]**

**TOTAL: 150**

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

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

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

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

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

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2} \{2a + (n - 1)d\}$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; -1 < r < 1$$

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

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

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

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

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

$$m = \tan \theta$$

$$y = mx + c$$

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

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

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

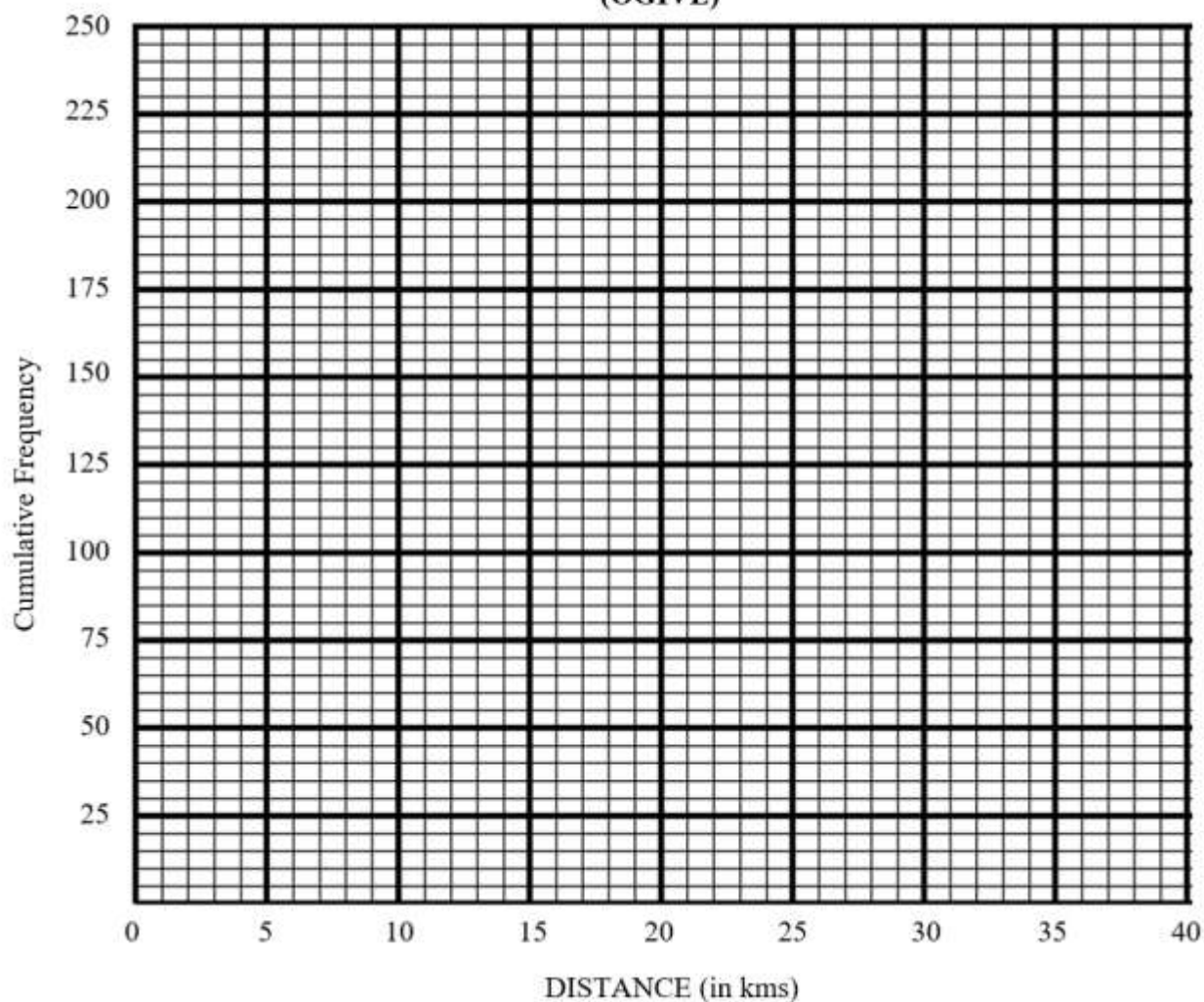
NAME and SURNAME:

## ANSWER SHEET

## QUESTION 2.1

| DISTANCE, $d$ (in km) | FREQUENCY | CUMULATIVE FREQUENCY |
|-----------------------|-----------|----------------------|
| $0 < d \leq 5$        | 8         |                      |
| $5 < d \leq 10$       | 41        |                      |
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| $25 < d \leq 30$      | 38        |                      |
| $30 < d \leq 35$      | 7         |                      |
| <b>TOTAL</b>          |           |                      |

## QUESTION 2.2

CUMULATIVE FREQUENCY GRAPH  
(OGIVE)

✂ Tear off and return