



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**MATHEMATICS P2
PREPARATORY EXAMINATION
SEPTEMBER 2020**

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages and an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of **10** 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

The total number of red cards issued per country to players during a soccer competition are given in the table below:

NUMBER OF RED CARDS	NUMBER OF COUNTRIES (f)	MIDPOINT OF INTERVAL (x)	$f \cdot x$
$0 < x \leq 2$	27		
$2 < x \leq 4$	15		
$4 < x \leq 6$	5		
$6 < x \leq 8$	5		
$8 < x \leq 10$	3		
TOTAL			

- 1.1 Calculate the estimated mean of the number of red cards per country. (3)
- 1.2 Draw an ogive curve to represent the above data. (3)
- 1.3 Calculate the interquartile range of the number of red cards issued per country in the competition. (2)
- [8]**

QUESTION 2

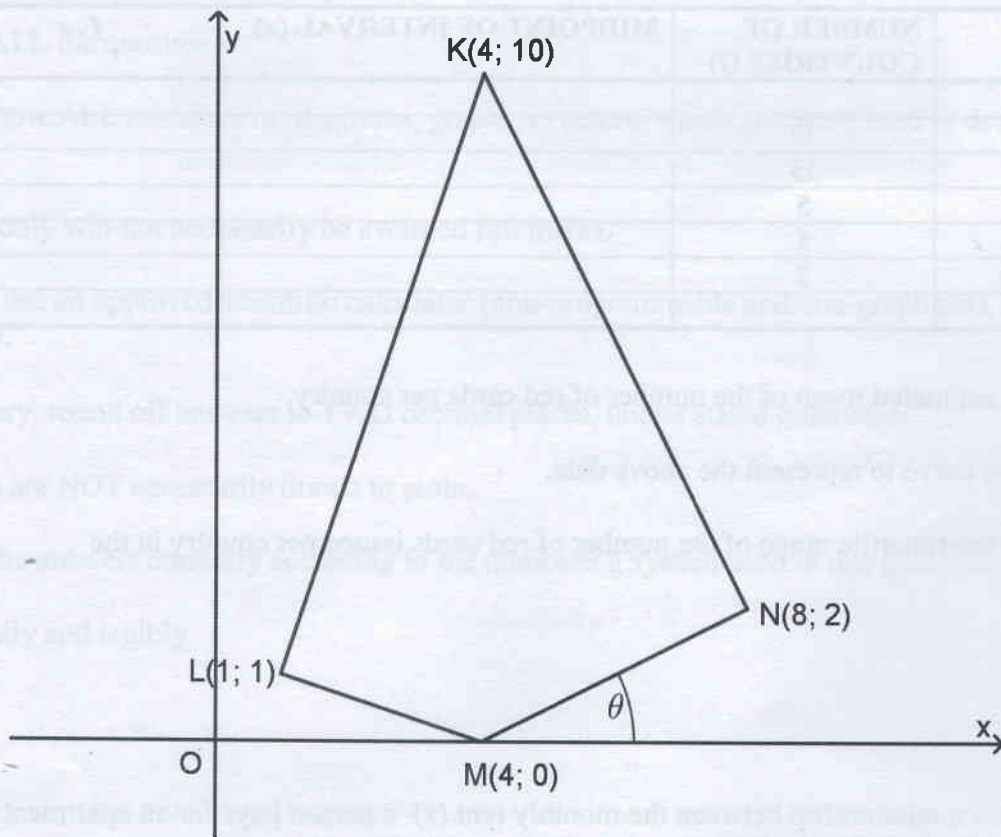
The table below shows a relationship between the monthly rent (x) a person pays for an apartment and the person's monthly income (y). Both are given in thousands of rands.

YEAR	2003	2004	2005	2006	2007	2008
Rent (x)	2	3	3,5	5,2	5,6	6
Income (y)	9	13,5	15	16,5	17	20

- 2.1 Determine the equation of the regression line. (4)
- 2.2 Determine the estimated monthly income if the rent per month is R9000. (2)
- 2.3 Calculate the value of the correlation coefficient. (2)
- 2.4 Describe the relationship between the monthly rent and the monthly income. (2)
- [10]**

QUESTION 3

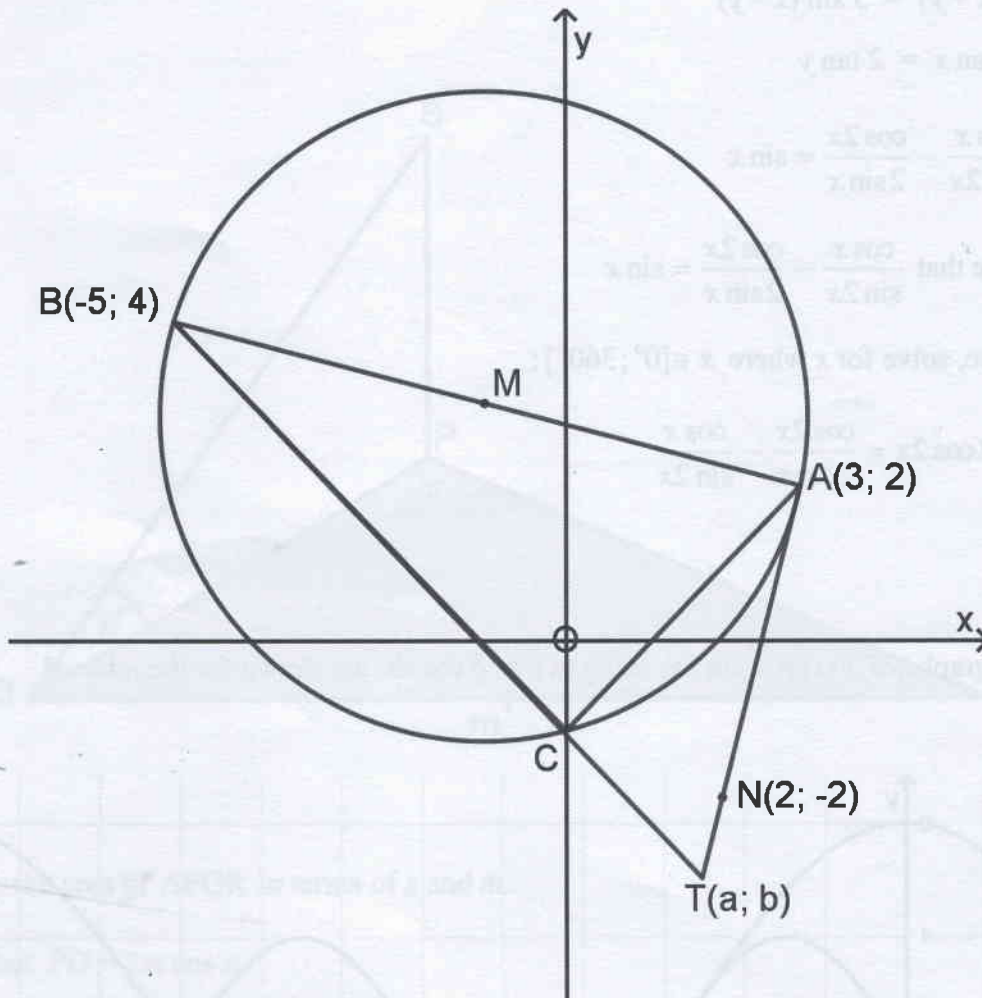
In the diagram KLMN is a quadrilateral with $K(4; 10)$, $L(1; 1)$, $M(4; 0)$ and $N(8; 2)$.



- 3.1 Determine the:
 - 3.1.1 gradient of LM and MN (4)
 - 3.1.2 length of KM. (2)
 - 3.1.3 value of θ (2)
 - 3.1.4 midpoint of LN (2)
 - 3.2 Show that $KL \perp LM$ (3)
 - 3.3 Prove that KLMN is a cyclic quadrilateral. (4)
- [17]**

QUESTION 4

In the sketch below, AB is a diameter with coordinates A(3; 2) and B(-5; 4) of circle ABC. M is the centre of the circle. BC produced meets AT in T. N(2; -2) is a point on the line TA. C is the y – intercept of the circle.



- 4.1 Determine the cō-ordinates of M the centre of the circle (2)
- 4.2 Write down the equation of the circle in the form $(x - p)^2 + (y - q)^2 = r^2$ (3)
- 4.3 Prove that TA is a tangent to the circle at A. (5)
- 4.4 Determine the equations of the lines
 - 4.4.1 TA and (4)
 - 4.4.2 BT (6)
- 4.5 If the coordinates of T are $(a; b)$, calculate the values of a and b . (3)

[23]

QUESTION 5

5.1 Without using a calculator, evaluate

$$\cos 79^\circ \cos 311^\circ + \sin 101^\circ \sin 49^\circ$$

(4)

5.2 Given: $\sin(x + y) = 3 \sin(x - y)$

Prove that: $\tan x = 2 \tan y$

(4)

5.3 Given: $\frac{\cos x}{\sin 2x} - \frac{\cos 2x}{2 \sin x} = \sin x$

5.3.1 Prove that $\frac{\cos x}{\sin 2x} - \frac{\cos 2x}{2 \sin x} = \sin x$

(4)

5.3.2 Hence, solve for x where $x \in [0^\circ; 360^\circ]$:

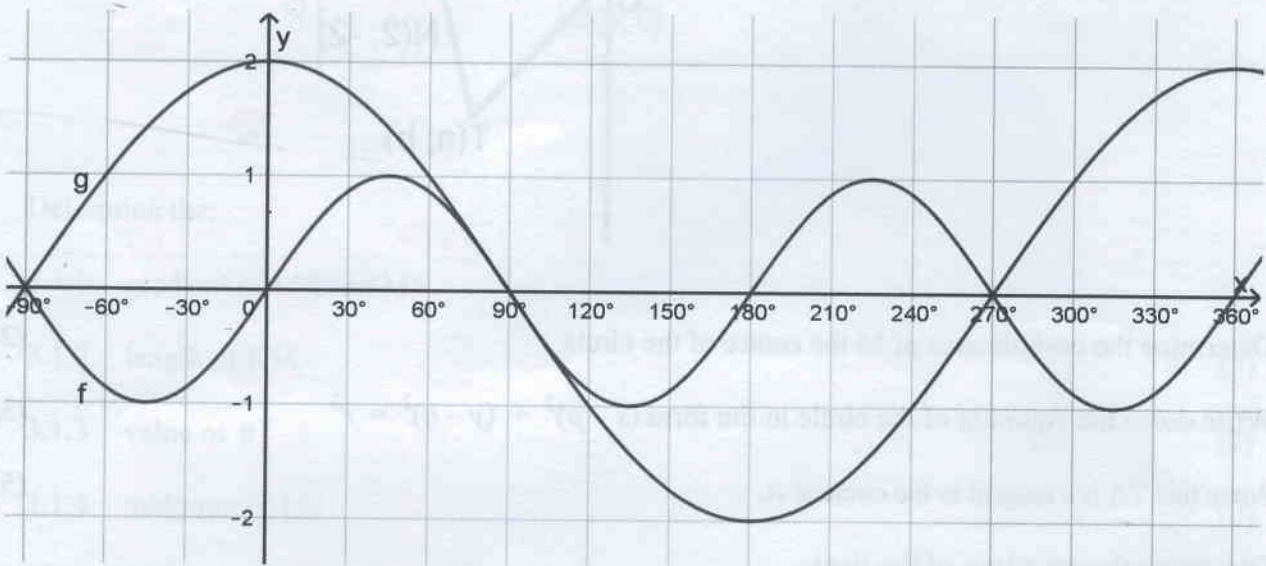
$$1 + 2 \cos 2x = \frac{\cos 2x}{2 \sin x} - \frac{\cos x}{\sin 2x}$$

(6)

[18]

QUESTION 6

In the diagram, the graphs of $f(x) = a \sin bx$ and $g(x) = c \cos dx$ are drawn for the interval $x \in [-90^\circ; 360^\circ]$



6.1 Determine the values of a , b , c and d .

(4)

6.2 Write down the period of g .

(1)

6.3 Determine the value(s) of x in the interval $x \in [-90^\circ; 360^\circ]$, for which

6.3.1 $f(x) \leq g(x)$

(2)

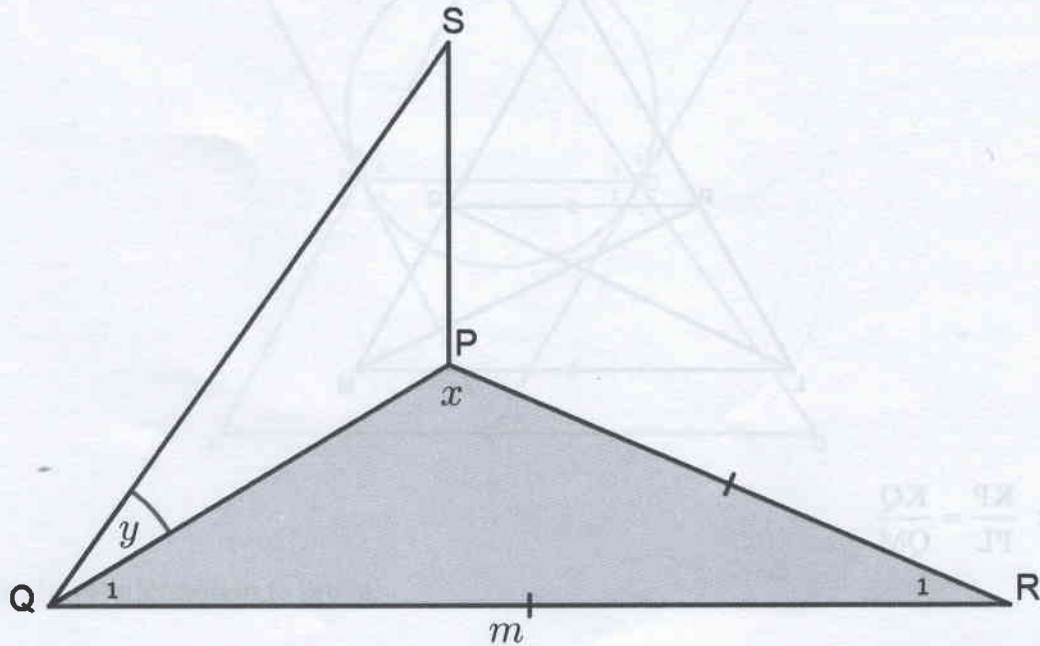
6.3.2 $f'(x) \times g'(x) > 0$ where $g(x) > 0$

(3)

[10]

QUESTION 7

In the diagram P, Q and R are three points in the same horizontal plane. $PR = QR = m$, $\hat{QPR} = x$. SP is perpendicular to PQ. The angle of elevation of S from Q is y .

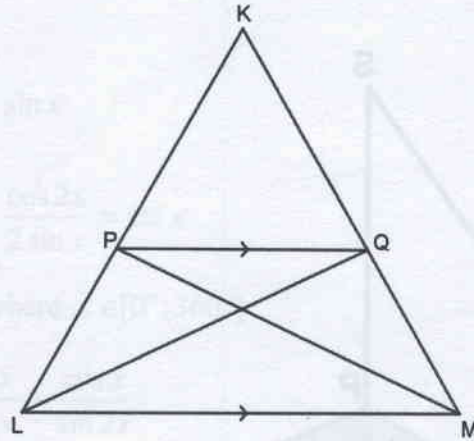


- 7.1 Express the area of ΔPQR in terms of x and m . (5)
- 7.2 Show that $PQ = 2m \cos x$ (4)
- 7.3 Hence, prove that $SP = 2m \cos x \tan y$ (2)

[11]

QUESTION 8

8.1 In the diagram below $\triangle KLM$ is given, with P and Q lying on KL and KM respectively such that $PQ \parallel LM$. PM and LQ are drawn.

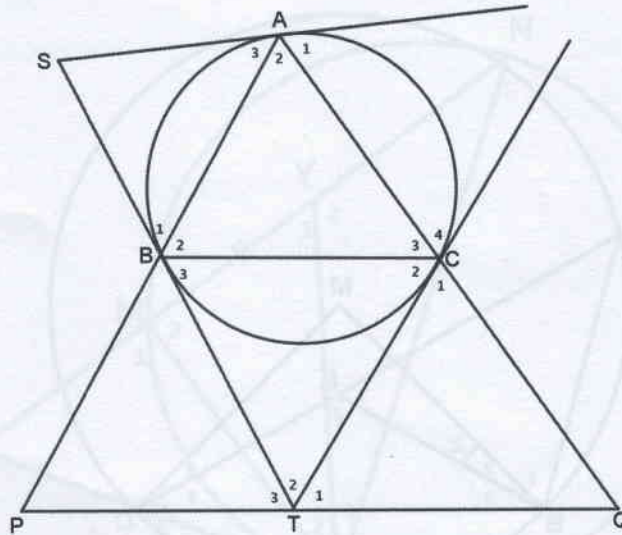


Prove that $\frac{KP}{PL} = \frac{KQ}{QM}$

(6)

8.2 In the diagram, SBT, SA and TC are tangents to the circle at B, A and C respectively. AB is produced to P and AC is produced to Q such that T lies on the line PQ.

In $\triangle APQ$, $\frac{AB}{AP} = \frac{AC}{AQ}$.



Use the above information to prove:

8.2.1 $\hat{A}_2 = \hat{T}_1$ (4)

8.2.2 $\triangle ABC \parallel \triangle TCQ$ (4)

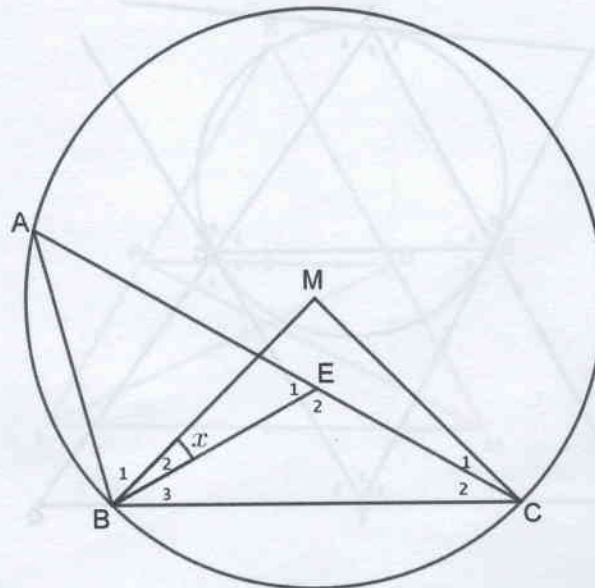
8.2.3 ABTQ is a cyclic quadrilateral. (4)

8.2.4 Prove that TQ is a tangent to circle TBC at T. (5)

[23]

QUESTION 9

In the diagram, M is the centre of the circle through A , B and C . E is on AC . AC bisects $M\hat{C}B$ and EB bisects $M\hat{B}C$. $\hat{B}_2 = x$



9.1 Determine the size of \hat{E}_2 in terms of x . (4)

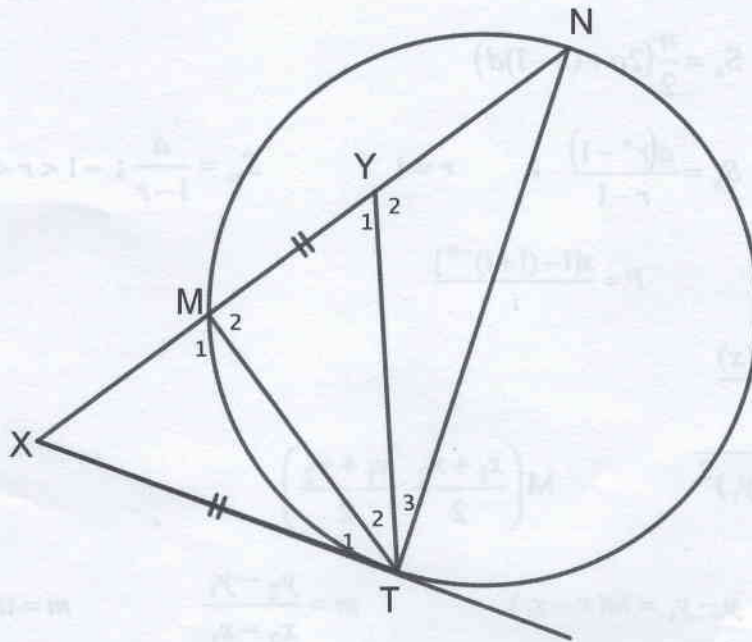
9.2 Show $B\hat{A}C = 90^\circ - 2x$ (3)

9.3 Prove that AE is a diameter of circle ABE . (5)

[12]

QUESTION 10

10.1 In the diagram XMN is a straight line and XT is a tangent to the circle. Y is a point on XN so that XY = XT.



Prove that:

10.1.1 YT bisect \widehat{MTN} .

(5)

10.1.2 $\frac{XM}{XT} = \frac{XT}{XN}$

(6)

10.2 Given that MY = 20 mm, YN = 50 mm and XT = k mm:

10.2.1 Express XM in terms of k.

(3)

10.2.2 Calculate the length of k.

(4)

[18]

TOTAL MARKS: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

$$\bar{x} = \frac{\sum f \cdot x}{n}$$

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

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

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

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

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