KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

COMMON TEST

JUNE 2022



MARKS: 150

TIME: 3 hours

This question paper consists of 9 pages and 2 diagram sheets and 1 information sheet.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

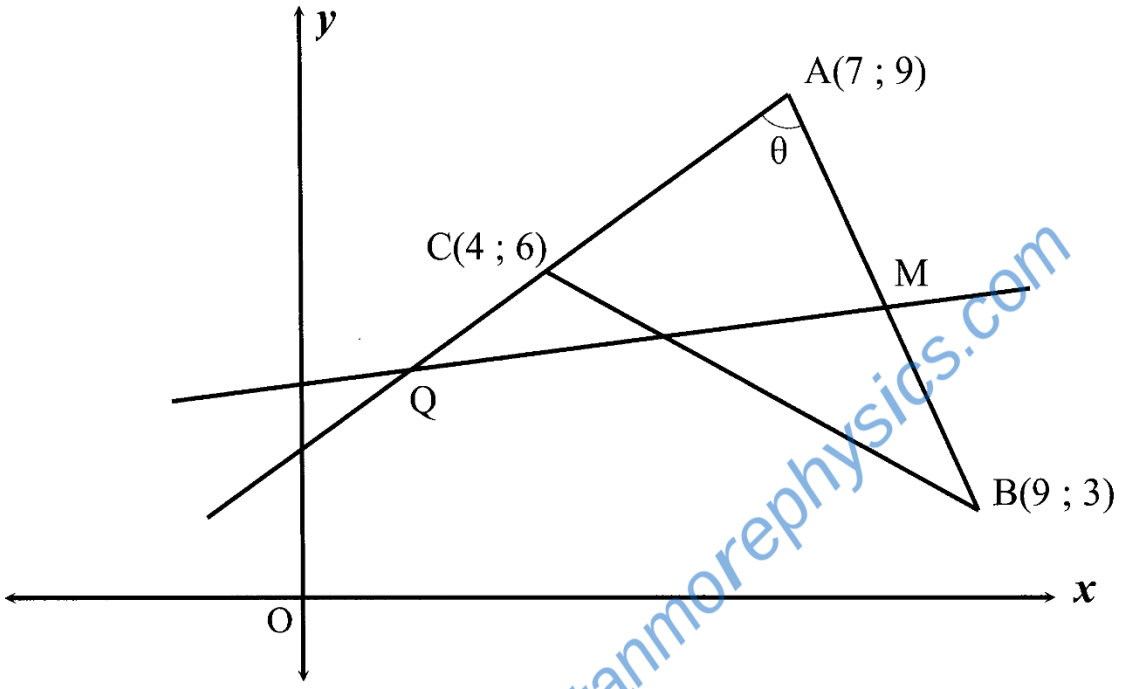
1. This question paper consists of **9** questions.
2. Read the questions carefully.
3. Answer ALL the questions.
4. Number your answers exactly as the questions are numbered.
5. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
6. Answers only will 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. Write neatly and legibly.

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QUESTION 1

In the diagram below, $A(7;9)$, $B(9;3)$ and $C(4;6)$ are the vertices of ΔABC.
QM is the perpendicular bisector of AB. Q lies in quadrant 1 on AC produced. $C\hat{A}B = \theta$.



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1.1 Write down the gradient of AB. (2)

1.2 Determine the coordinates of M. (2)

1.3 Determine the equation of MQ. (3)

1.4 Calculate the coordinates of Q. (5)

1.5 Show that QA = QB. (3)

1.6 Calculate the coordinates of D, if ABCD is a parallelogram. (4)

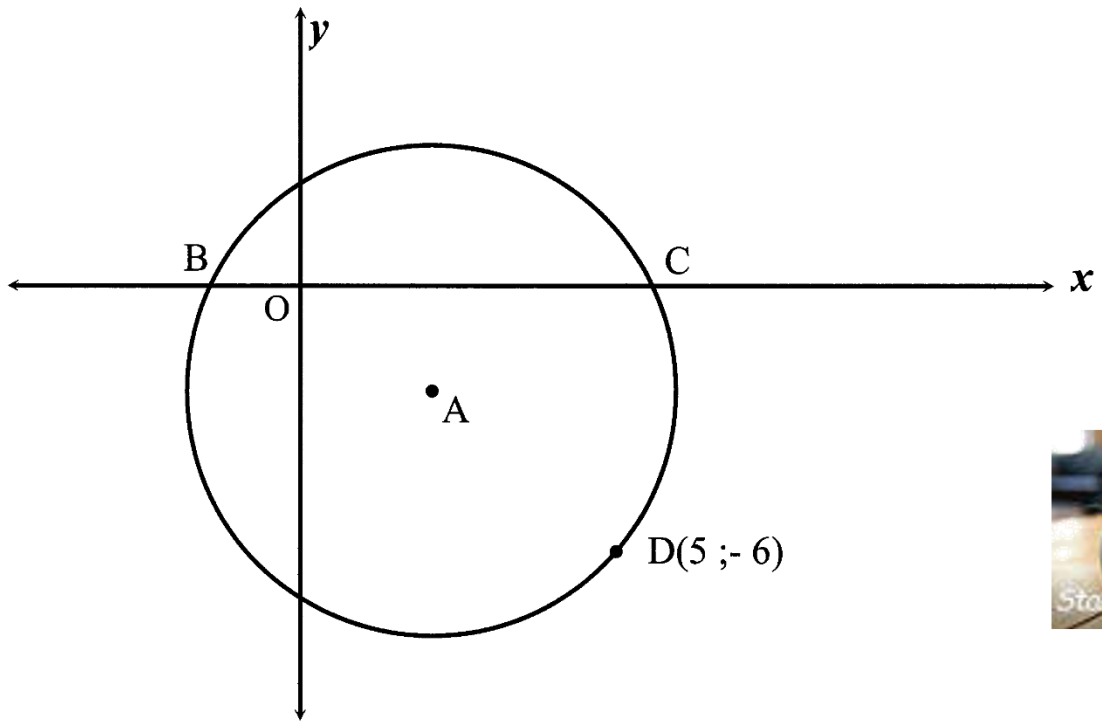
1.7 Calculate the size of θ, correct to 1 decimal place. (5)

[24]

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QUESTION 2

In the diagram, the equation of the circle with centre A is $x^2+y^2-2x+6y=15$.
D$(5;-6)$ is a point on the circle. The circle intersects the x-axis at B and C.





2.1 Calculate the coordinates of the centre of the circle, A. (4)

2.2 Determine the coordinates of the x-intercepts of the circle. (4)

2.3 Determine the equation of the tangent to the circle at D. (5)

2.4 Determine the area of ΔABC. (3)

2.5 Given that another circle $(x-1)^2+(y-b)=1$ touches this circle with centre A at one point only, give one possible value of b. (4)

2.6 Does the point P(-1; -7) lie inside or outside the circle centered at A.
Justify your answer. (3)

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QUESTION 3

Given P(a ; –40) , OP = 41 units and $P\hat{O}X = \theta$ where $\theta \in [270^\circ; 360^\circ]$. Calculate, **without using a calculator** and with the aid of a sketch, the values of the following (in simplest form):

3.1 $82\cos\theta + \sin(\theta - 180°)$ (6)

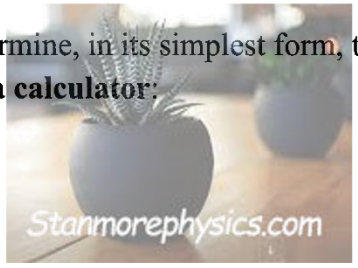
3.2 $27\tan\theta - \cos(90° - \theta)$ (4)

3.3 $\cos 2\theta + 1$ (3)

[13]

QUESTION 4

Given that $\sin\theta\cos\theta = t$ where $2\theta \in [0^\circ; 90^\circ]$, determine, in its simplest form, the value of each of the following in terms of t , **without using a calculator**:



4.1 $\tan 2\theta$ (4)

4.2 $\sin\theta$ (4)

[8]

QUESTION 5

5.1 Simplify the following, without using a calculator:

5.1.1 $$\frac{\tan 480°.\sin 300°.\cos 14°.\sin(-135°)}{\sin 104°.\cos 225°}$$ (6)

5.1.2 $\cos(90° - 2x).\tan(180° + x) + \sin^2(360° - x)$ (6)

5.2 Shown below are three trigonometric identities which form a pattern:

$$\frac{\sin\theta - \cos\theta}{1 - \tan\theta} = -\cos\theta \quad ; \quad \frac{\sin^2\theta - \cos^2\theta}{1 - \tan^2\theta} = -\cos^2\theta \quad ; \quad \frac{\sin^3\theta - \cos^3\theta}{1 - \tan^3\theta} = -\cos^3\theta$$

5.2.1 Use the pattern to write down the value of: $\dfrac{\sin^{2022}\theta - \cos^{2022}\theta}{1 - \tan^{2022}\theta}$ (2)

5.2.2 For which values of θ are the identities in the pattern undefined, where $\theta \in [0^\circ; 180^\circ]$? (5)

5.2.3 Write down the n^{th} term of the above pattern in terms of the given identities. (2)

5.2.4 Show that: $\dfrac{\sin^n\theta - \cos^n\theta}{1 - \tan^n\theta} = -\cos^n\theta$ (5)

[26]

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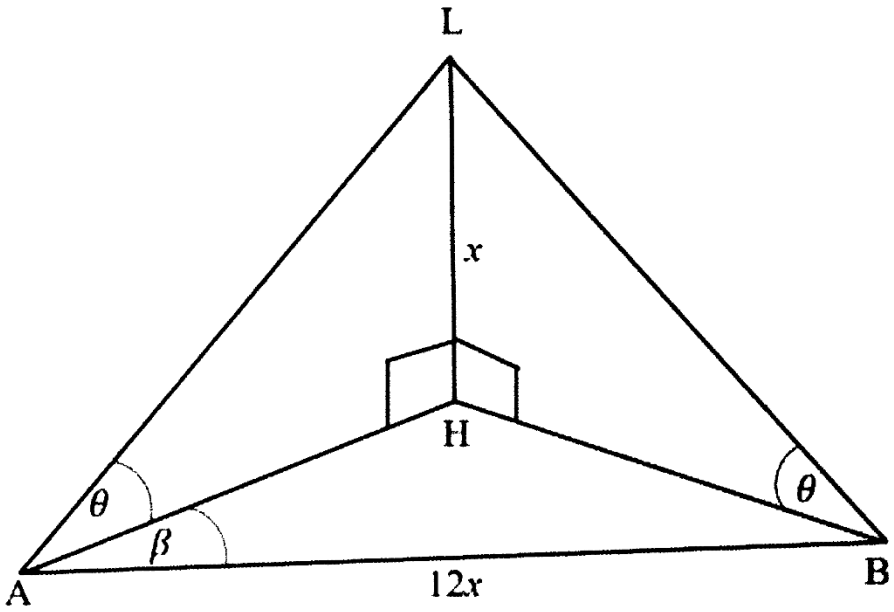
QUESTION 6

The captain of a boat at sea, at point A, notices a lighthouse LH directly north of his position. He determines that the angle of elevation of L, the top of the lighthouse, from A is θ and the height of the lighthouse is x metres.

From point A the captain sails $12x$ metres in a direction β degrees east of north to point B.

From point B, he notices that the angle of elevation of L is also θ.

A, H and B lie in the same horizontal plane.



6.1 Determine AH in terms of x and θ. (2)

6.2 Prove that $\tan\theta = \frac{\cos\beta}{6}$. (5)

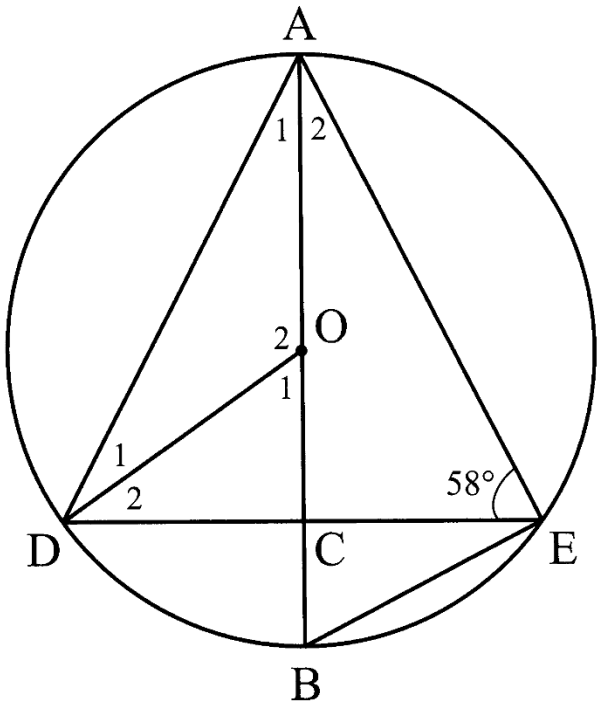
6.3 If it is given that AH = 60 m and $\beta = 40^\circ$, then calculate the height of the lighthouse. (4)

[11]

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QUESTION 7

In the diagram below, AB is the diameter of a circle centered at O.
AB intersects chord DE at C. Radius DO and chords AD, AE and BE are drawn. $A\hat{E}D = 58°$



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

7.1 $\hat{O}_2$ (2)

7.2 $D\hat{E}B$ (2)

7.3 $\hat{A}_1$ (2)

7.4 $A\hat{B}E$, if DC = CE. (3)

7.5 DC in terms of r, if $AC = \frac{3}{2}CB$ and the radius of the circle is r units. (5)

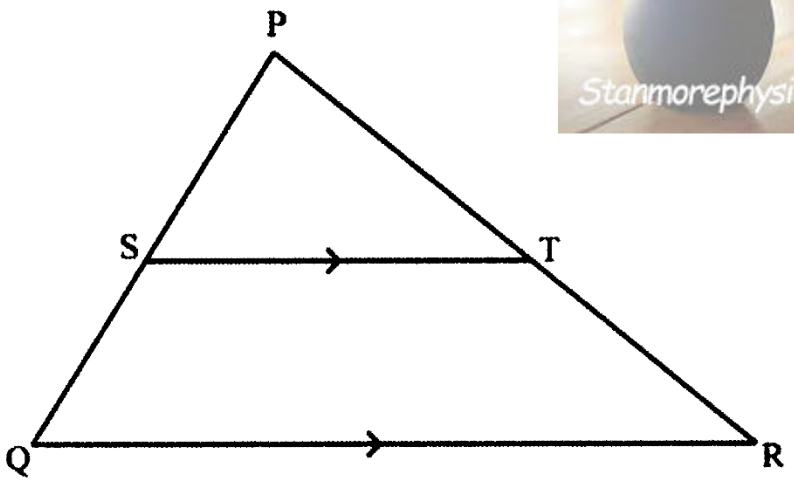
[14]

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QUESTION 8

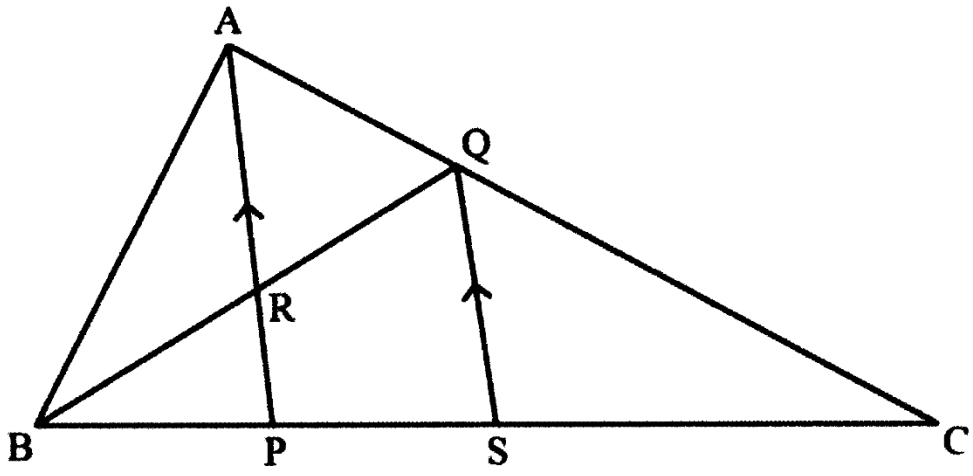
8.1 In the diagram, PQR is a triangle with S and T being points on PQ and PR respectively such that ST // QR.

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Use the diagram to prove that: $\frac{PS}{SQ} = \frac{PT}{TR}$ (6)

8.2 In ΔABC, AQ : QC = 1 : 3. AP // QS with P and S on BC and Q on AC. BQ intersects AP in R. $BP = \frac{1}{3}BC$.



Determine, with reasons, the following:

8.2.1 $\frac{BP}{PS}$ (5)

8.2.2 $\frac{BR}{RQ}$ (2)

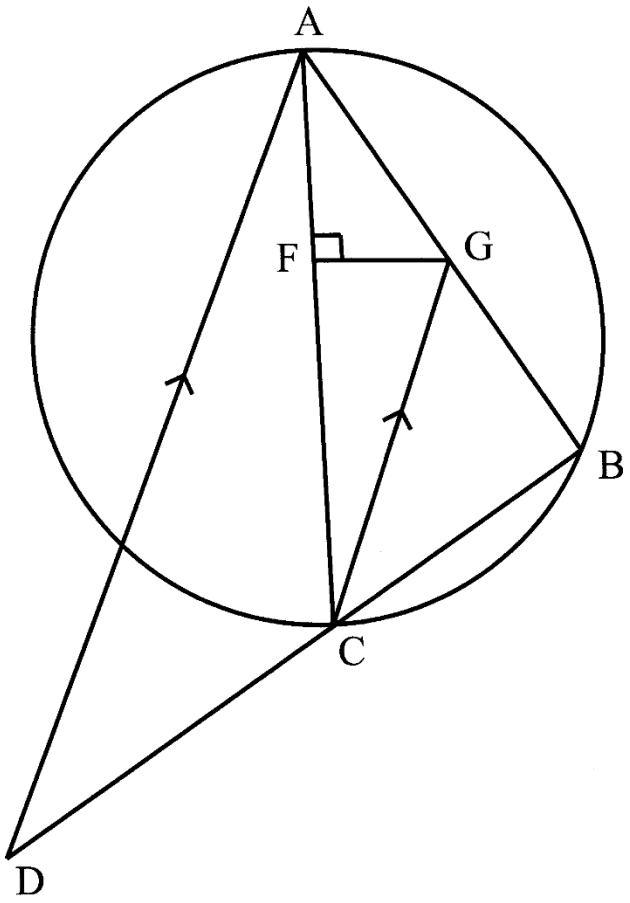
[13]

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QUESTION 9

In the figure AC is a diameter of the circle. CG bisects $A\hat{C}B$ with G on AB. GF ⊥ AC with F on AC. AD // GC.





9.1 Prove that:

9.1.1 ΔCAD is isosceles. (4)

9.1.2 $\frac{BC}{AC} = \frac{BG}{GA}$ (3)

9.1.3 ΔAFG /// ΔABC (3)

9.2 If BC = 12 units and the radius of the circle is 10 units, calculate the length of:

9.2.1 AB (3)

9.2.2 GF (3)

9.2.3 AF (2)

[18]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

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

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

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

$$T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r-1} \; ; \; r \neq 1 \qquad S_\infty = \frac{a}{1-r} \; ; \; -1 < r < 1$$

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right) \qquad m = \tan\theta$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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

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

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

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

$$P(A) = \frac{n(A)}{n(S)} \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

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