

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

PRACTICE

JUNE 2024

MARKS: 150

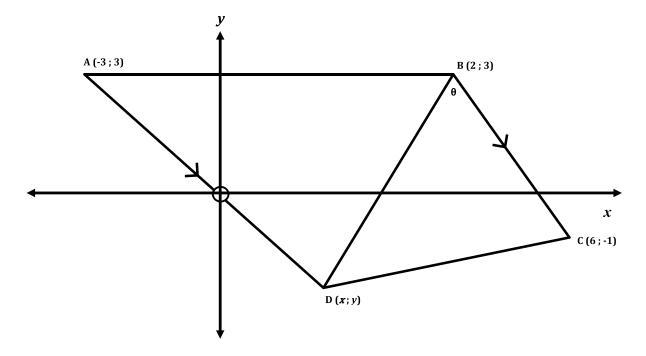
TIME: 3 HOURS

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

- 1. This question paper consists of **9** questions.
- 2. Answers **ALL** questions.
- 3. Clearly show **ALL** calculations, diagrams, graphs, et cetera that you have used in determining your answers.
- 4. Answers only will not necessarily be awarded full marks.
- 5. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
- 6. If necessary, answers should be rounded off 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.

A (-3; 3), B (2; 3), C (6; -1) and D (x; y) are vertices of quadrilateral ABCD in a Cartesian plane.



1.1 Determine the equation of AD. (4)

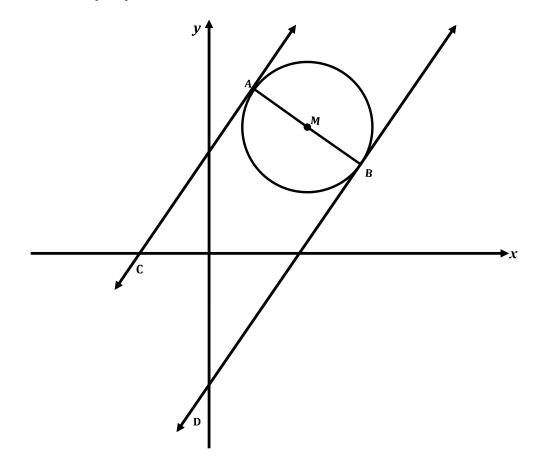
- 1.2 Prove that the coordinates of D are $\left(\frac{3}{2}; -\frac{3}{2}\right)$ if D is equidistant from B and C. (6)
- 1.3 Hence, or otherwise, determine the gradient of BD. (2)
- 1.4 Determine the size of θ , the angle between BD and BC, rounded off to one decimal digit. (4)
- 1.5 Calculate the area of $\triangle BDC$ rounded off to the nearest square unit. (5)

[21]

2.1 The equations of two circles O and M are:

0:
$$(x+1)^2 + (y-3)^2 = 1$$
 M: $x^2 + y^2 + 8x - 6y + 9 = 0$

- 2.1.1 Determine the coordinates of the centre of the circle M. (3)
- 2.1.2 Show, by calculation, that the circles touch each other, internally. (4)
- In the diagram below, the line AC with equation y x 2 = 0 is a tangent at A to the circle with centre M (4; 4) while AB is a diameter of the circle.



2.2.1 Determine the equation of the diameter AB. (3)

2.2.2 Show that the coordinates of A are (3; 5). (2)

2.2.3 Determine the equation of the circle. (4)

2.2.4 Calculate the coordinates of B. (2)

2.2.5 Write down the equation of the tangent BD. (4)

[22]

3.1 Given: $\sin \alpha = \frac{8}{17}$ where $90^{\circ} \le \alpha \le 270^{\circ}$

Calculate the following with the aid of a diagram and without using a calculator:

$$3.1.1 \quad 3\tan\alpha$$
 (3)

3.1.2
$$\sin(90^{\circ} + \alpha)$$
 (2)

$$3.1.3 \cos 2\alpha$$
 (3)

3.2 Given: $\sin\theta\cos\theta = \frac{k}{4}$

Use a diagram to find the value of $tan 2\theta$ in terms of k if 2θ is an acute angle. (5)

[13]

QUESTION 4

4.1 Simplify, without using a calculator:

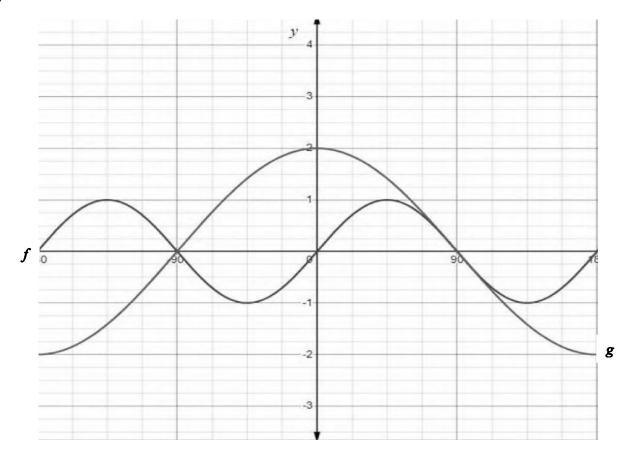
$$\frac{2\cos 105^{\circ}\cos 15^{\circ}}{\cos (45^{\circ}-x)\cos x - \sin (45^{\circ}-x)\sin x}$$
 (6)

4.2 Given:
$$\frac{1+\sin 2\theta}{\cos 2\theta} = \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}$$

- 4.2.2 Determine the values of θ for which the identity is undefined. (3)
- 4.2.3 Hence, or otherwise, without the use of a calculator, find the value of:

$$\frac{\cos 15^{\circ} + \sin 15^{\circ}}{\cos 15^{\circ} - \sin 15^{\circ}} \tag{3}$$

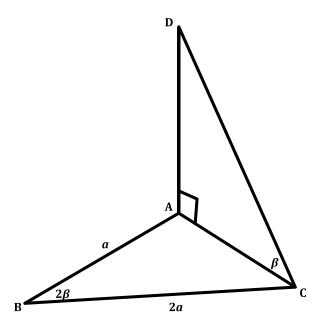
4.3 Determine the general solution for the equation:
$$7\cos x - 2\sin^2 x + 5 = 0$$
 (7)



In the diagram above the graphs of $f(x) = \sin ax$ and $g(x) = b\cos x$ for $x \in [-180^\circ; 180^\circ]$ are drawn.

- 5.1 Determine the numerical values of a and b. (2)
- 5.2 Write down the periods of f and g. (2)
- 5.3 State the amplitude of f. (1)
- 5.4 Determine the range of f(x) + 3. (2)
- 5.5 Determine the value(s) of x, if f(x). g(x) < 0, for $x \in [-180^\circ; 180^\circ]$. (3)
- 5.6 If the curve f is shifted 45° to the left, write down the new function as h(x) = ... (2)
- 5.7 If g is reflected about the x-axis, write down the new function as k(x) = ... (2)

[14]



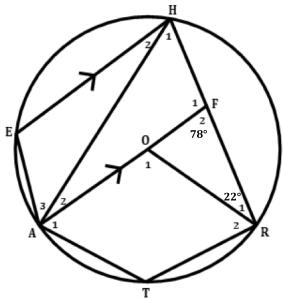
A, B and C are three points in the same horizontal plane. DA is perpendicular to the horizontal plane at A, and D is joined to C. $AB = \frac{1}{2}BC = \alpha$ and $A\widehat{C}D = \frac{1}{2}A\widehat{B}C = \beta$.

6.1 Determine AC in terms of
$$\boldsymbol{a}$$
 and $2\boldsymbol{\beta}$. (3)

6.2 Hence, show that
$$AD = \boldsymbol{a} \tan \boldsymbol{\beta} \sqrt{1 + 8\sin^2 \boldsymbol{\beta}}$$
 (4)

[7]

7.1 In the diagram O is the centre of circle HEATR. AOF is parallel to EH. $\widehat{F}_2=78^\circ$ and $\widehat{R}_1=22^\circ.$



Calculate, with reasons, the size of:

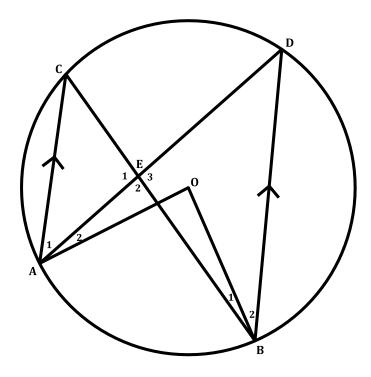
7.1.1
$$\hat{0}_1$$
 (2)

7.1.2
$$\hat{H}_1$$
 (2)

7.1.3
$$\hat{T}$$
 (2)

7.1.4
$$\hat{H}_2$$
 (2)

7.2 In the diagram, O is the centre of the circle. Chords AD and CB intersect at E and AC \parallel BD.

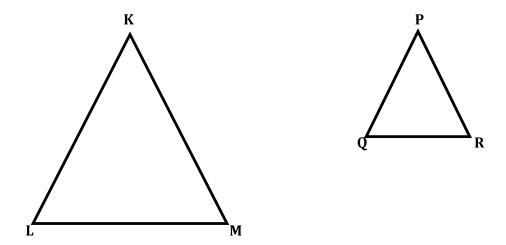


Prove, with reasons, that AEOB is a cyclic quadrilateral.

(6)

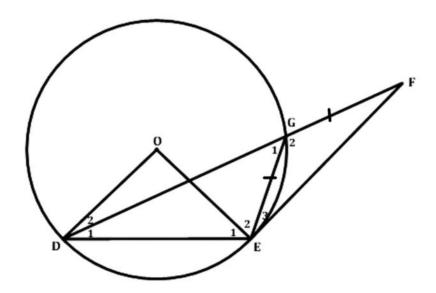
[14]

8.1 In the diagram, Δ KLM and Δ PQR are two triangles such that $\widehat{K} = \widehat{P}$, $\widehat{L} = \widehat{Q}$ and $\widehat{M} = \widehat{R}$.



Use the diagram to prove the theorem which states that $\frac{KL}{PQ} = \frac{KM}{PR}$. (6)

8.2 In the figure, FE is a tangent to the circle O. D and F are joined so that EG = GF.



8.2.1 If $\widehat{E}_3 = x$, name, with reasons, two other angles each equal to x. (4)

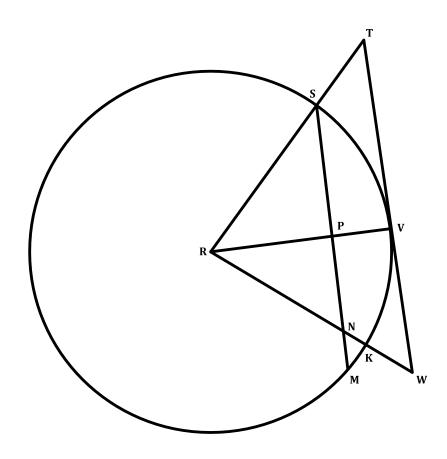
8.2.2 Prove that DE = EF. (2)

8.2.3 Express $D\widehat{O}E$ in terms of x. (4)

8.2.4 Prove that $EF^2 = DF \times GF$. (4)

[20]

In the figure below, TW is a tangent to the circle with centre R at point V. Radius RV intersects chord SM at P such that NP = PS. The circle has a radius of 10 units. RST and RKW are straight lines. RW intersects the circle at K and chord SM at N. ST = 7 units and NW = 6 units.



- 9.1 Prove that TW || SN. (4)
- 9.2 Determine the length of NK. (5)
- 9.3 Calculate the length of PN. (6)

[15]

TOTAL MARKS: 150