

CANDIDATE NUMBER: \_\_\_\_\_



# CENTRAL EAST EDUCATION DIVISION

2023 MALAWI SCHOOLS CERTIFICATE OF EDUCATION MOCK EXAMINATIONS

## ADDITIONAL MATHEMATICS

Subject Number : M132/I

Friday, 9<sup>th</sup> March

Time Allowed: 2h 30min

(1.30 – 4.00pm)

### PAPER I

(100marks)

#### Instructions

1. This paper contains eleven printed pages. Please check.
2. Answer all the seven questions in Section A and any two questions from section B.
3. Section A carries 60 marks and Section B carries 40marks.
4. All answers should be written in the spaces provided after every question.
5. Calculators may be used.
6. All necessary working should be shown and any numerical expressions being evaluated by calculators must be clearly stated; otherwise marks for method may be lost.
7. The final answer to a question requiring the use of calculators should normally be given to three significant figures.
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9. Write your examination number on top of each page of your question paper.

	Tick if answered	Do not write in these columns	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

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1. (a) Evaluate  $\lim_{h \rightarrow 0} \frac{(1+h)^2 - 1}{h}$   
(5marks)

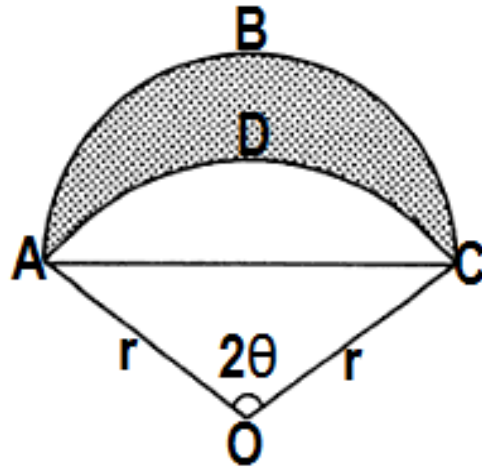
- (b) The functions  $f$  and  $g$ , are defined by  $f(x) = \cos x$  and  $g(x) = x - \frac{\pi}{2}$ , find  
 $f(\pi) + g(\pi)$   
(3marks)

2. (a) Part of expansion of  $(a + bx)^5$  is  $32 + 40x + 20x^2$ . Find the values of  $a$  and  $b$  and the remaining terms of the expression.  
(5marks)

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(b) Solve the inequality  $\left| \frac{2x-1}{3} \right| \geq 2$  (6 marks)

3. (a) In the figure below, ADC is an arc of a circle, centre O, radius r and  $\angle AOC = 2\theta$  radians. ABC is a semicircle on AC as diameter.



Show that the area of segment ADC = shaded region is  $r^2(\theta - \frac{1}{2}\sin 2\theta)$  (6 marks)

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(b) Prove the identity  $\frac{1-\cos 2\theta}{3+\cos 2\theta} = \frac{\sin^2 \theta}{1+\cos^2 \theta}$

**(5marks)**

4. (a) The table gives values of  $x$  and  $y$  for a mass of air expanding. It is believed that the quantities are connected by the law of the type  $y = \dots$

<b>x</b>	<b>100</b>	<b>125</b>	<b>150</b>	<b>175</b>	<b>200</b>
<b>y</b>	<b>58.6</b>	<b>42.4</b>	<b>32.8</b>	<b>27.0</b>	<b>22.3</b>

Without drawing the graph, find the values of  $k$  and  $n$   
**(5marks)**

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- (b) A right circular cylinder with top and bottom is to have minimal surface. Assuming the cylinder has a fixed volume, find the dimensions of radius and height of the cylinder that gives minimum surface area, leaving yours in terms of  $\pi$  and volume ( $v$ ) in simplest form

**(6marks)**

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5. Solve the equation  $\sin 3x + \sin x = \cos x$  for  $0^\circ \leq x \leq 180^\circ$   
(6marks)

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6. Calculate the area bounded by the curve  $y = x + \sin 2$ , the x axis and the straight line drawn parallel to the y axis at the maximum turning point of the curve. **(8marks)**

7. Evaluate  $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} 4 \cos(2\pi - x) dx$  **(6marks)**

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**Section B (40marks)**

**Answer any two questions from this section**

8. (a) The normal to the curve  $y = 2x - x^2$  at the point  $(2, 0)$  meets the y-axis at P.  
Find the coordinates of P.

**(10marks)**

- (b) (i) On the **graph paper provided**, plot the graph of  $f(x) = 2^x$ .

- (ii) Use your graph to solve the equation  $5 = 2^x$

**(10marks)**



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9. (a) A can of radius  $r$  cm and height  $h$  cm is in shape of a closed cylinder with a hemisphere at one end. Its volume is  $45\pi\text{cm}^3$ , find the value of  $r$  which gives the minimum surface area of the can. Surface area of a sphere  $= 4\pi r^2$ .

**(10marks)**

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- (b) If  $y = x(4x^2 - 3x^3)$ , find the turning points of the curve and classify them.  
Sketch the curve.

**(10marks)**

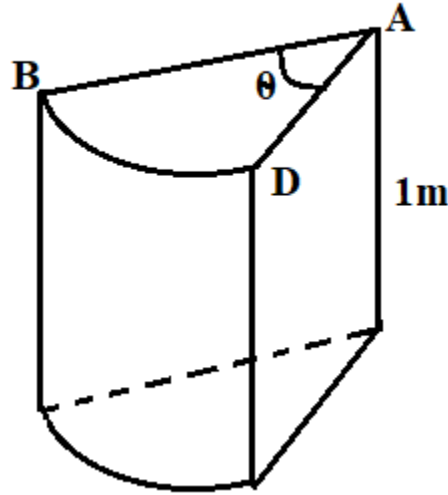
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10. (a) The distance travelled by a particle in metres is given by  $S = t^2 - kt$  where  $t$  is time in seconds after the start. The particle comes to instantaneous rest after 2 seconds. Calculate the initial velocity of the particle.

**(10marks)**

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(b) A water tank has a capacity of 20 litres and its uniform cross-sectional area is in the form of a sector as shown in the figure below. The height of the tank is 1m and the perimeter of the sector ABCD is 60cm.



Find the value of  $\theta$   
(10marks)

**END OF QUESTIONS**