MATHS AA SL

June Exam

PAPER 2

Friday 13 June 2025

Duration : 90 min

7 questions

Total : / 56 marks

Calculator allowed !

Nom/Name _____

Problem 1

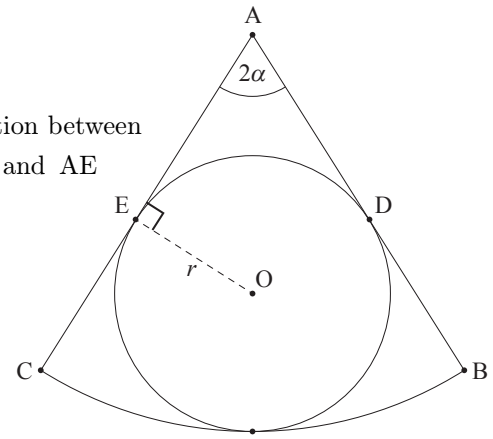
[/10 marks]

The following diagram shows a sector ABC of a circle with centre A. The angle $\hat{BAC} = 2\alpha$, where $0 < \alpha < \frac{\pi}{2}$, and $\hat{OEA} = \frac{\pi}{2}$.

A circle with centre O and radius r is inscribed in sector ABC.

AB and AC are both tangent to the circle at points D and E respectively.

diagram not to scale

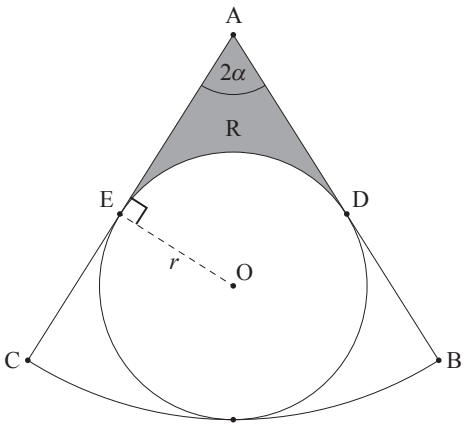


(a)

i) Find a relation between tang(α), r and AE [1]

ii) Hence:

Show that the area of the quadrilateral ADOE is $\frac{r^2}{\tan\alpha}$. [4]



(b) (i) Find $\hat{DOE}$ in terms of α.

(ii) Hence or otherwise, find an expression for the area of R. [5]

Problem 2 *[/9 marks]*

Let $f(x) = 2\sin(3x) + 3 \quad \text{for } x \in \mathbb{R}$

(a) What is the *average hight* (or $y-$shift) of the curve of equation $y = f(x)$? [1]

(b) $-$What is the *maximal value* of $f(x)$? [1]

$-$What is the *minimal value* of $f(x)$? [1]

(c) What is its amplitude ? [1]

(d) What is the *period* of $f(x)$? [1]

(e) What is the *domain* of $f(x)$? [1]

(f) The *Range* of $f(x)$ is define as the set of the possible values y such that $y = f(x)$
Based on your answer to (c):

– Give an example of value y that is <u>not</u> in the *range* of $f(x)$ [1]

– What is the range of $f(x)$? [1]

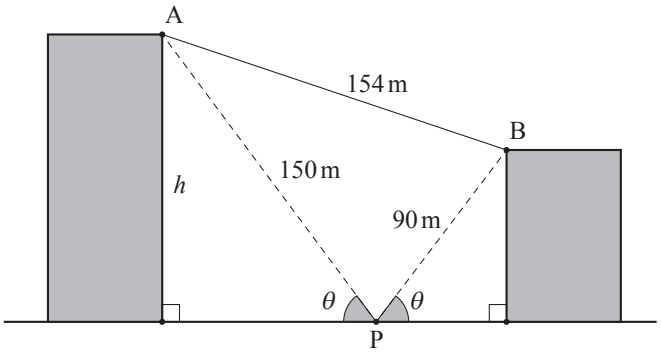
(g) Let $g(x) = 5f(2x)$. The function g can be written in the form $g(x) = 10\sin(bx) + c$
Find the values of b and c. [1]

Problem 3 *[/6 marks]*

The following diagram shows two buildings situated on level ground.

From point P on the ground directly between the two buildings, the angle of elevation to the top of each building is θ.

diagram not to scale



The distance from point P to point A at the top of the taller building is 150 metres.

The distance from point P to point B at the top of the shorter building is 90 metres.

The distance between A and B is 154 metres.

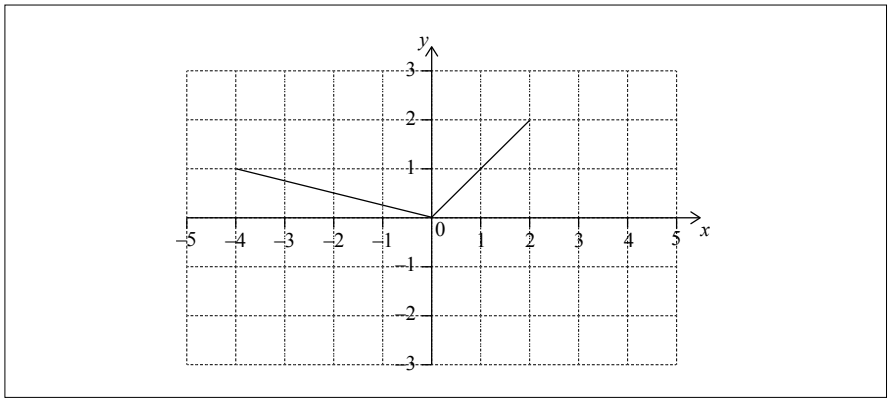
(a) Find the measure of $\hat{APB}$. [3]

(b) Find the height, h, of the taller building. [3]

Problem 4

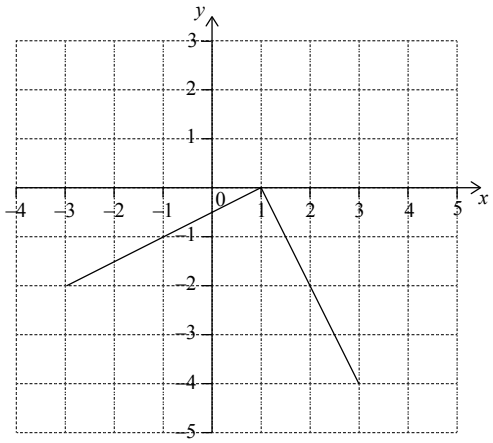
[/6 marks]

The following diagram shows the graph of a function f, for $-4 \le x \le 2$.



(a) On the same axes, sketch the graph of $f(-x)$. [2]

(b) Another function, g, can be written in the form $g(x) = a \times f(x+b)$. The following diagram shows the graph of g.



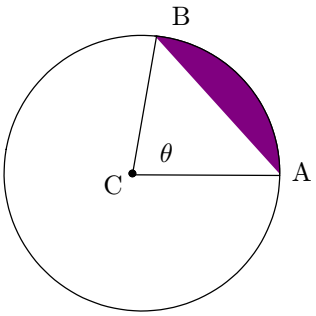
Write down the value of a and of b. [4]

Problem 5

[/8 marks]

1) Show that the area of the shaded region is given by the formula

$\mathcal{A} = \frac{1}{2}r^2(\theta - \sin(\theta))$ [4]



where $\theta = \widehat{\text{ACB}}$ in rad
C is the center of the circle or r
$r =$ 2cm.

2) Using *solve* (), find the value of θ (in radian and in degree) for having $\mathcal{A} = 3.4\text{cm}^2$ [4]

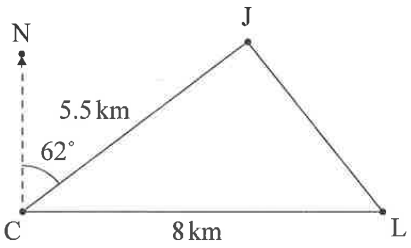
Problem 6 *[/9 marks]*

A lighthouse, L, is located 8 kilometres due East of a coastguard station, C, on a straight stretch of coastline.

The coastguard station sees a Jet Ski, J, on a bearing of 062° and at a distance of 5.5 kilometres. This is shown on the following diagram.

La estación de guardacostas ve una moto acuática J
沿岸警備隊がジェットスキーを発見。
С поста береговой охраны виден гидроцикл (J)

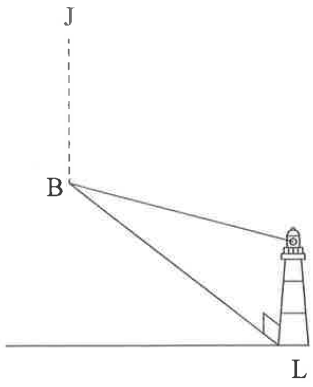
diagram not to scale



(a) Find JL. [4]

While travelling due South, the Jet Ski breaks down at point B, before it reaches the coastline. The position of the Jet Ski at B and the lighthouse are shown in the following diagram.

diagram not to scale



From the top of the 60-metre-tall lighthouse, the angle of depression to the Jet Ski at B, is measured to be 0.94°.

(b) Find BL. [3]

The bearing from the Jet Ski at B to the lighthouse is 121°.

(c) Find the bearing from L to B. [2]

Problem 7 *[/8 marks]*

Let $f(x) = \frac{x-2}{2x+1}$ and $g(x) = 1 + \frac{2}{x}$

(a) Find the *domain* of f and the *domain* of g [1]

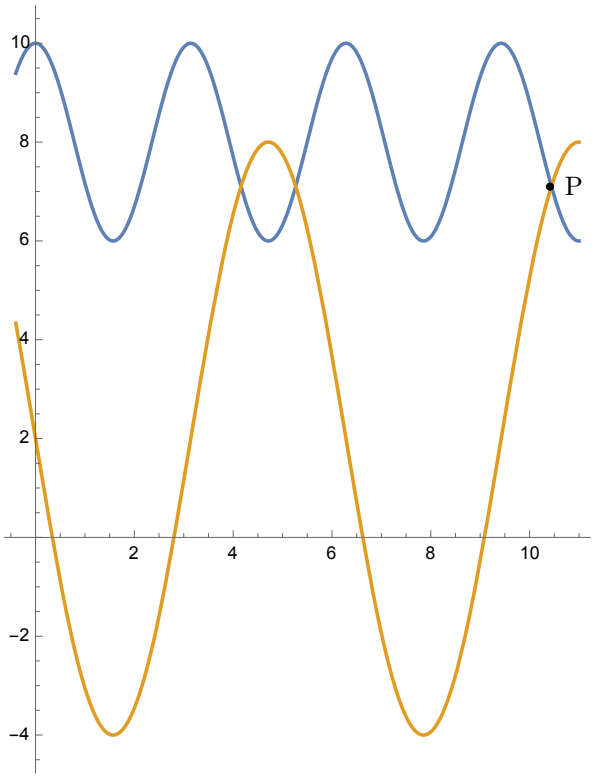
(b) Give the expression of $(f \circ g)(x)$ [3]

(c) Give the expression of $(g \circ f)(x)$ [2]

(b) Solve $(f \circ g)(x) = (g \circ f)(x)$ [2]

Bonus: [max +8]

The picture below show two curves
One has equation $y = \pm A\cos(kx) + h$ (where $A, k,$ and h are *integers*)
The other one has equation $y = \pm B\cos(nx) + j$ (where $B, n,$ and j are *integers*)



1) For each curve, find the *minimum*, the *maximum* ,the *range* and the *period*. [+2]

2) Give the values of A, B, k, n, h and j [+3]

3) Give the *equation* of each curve.

4) Using *solve* (), find the x-coordinate of P the point of intersection shown on the picture. (you will have chose a smart *guess value*) [+3]