This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls Loueizeh - Baabda

# SE02 Exam

## 15DEC2025

Do NOT write in this box. Your MARK will be placed here.

| | |
|---|---|
| Subject : | A Level : Maths M1Pure |
| Class : | 11A and 12A |
| Teacher : | Mrs.Claudine Eid |
| Duration : | 1 hour 20 minutes |

Calculators are allowed

You are to answer the questions to this exam on : This exam paper

| | | |
|---|---|---|
| Your name : | | *Time taken to complete exam* |
| Your Class : | | |
| Exam Room : | | |
| How many sheets, including cover sheet : | | |

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

**Answer ALL questions. Write your answers in the space provided**

**(1)**

The line $l_1$ has equation

$$x - 2y + 25 = 0$$

The line $l_2$ passes through the origin and is perpendicular to $l_1$

(a) Find an equation for $l_2$

**(2)**

The lines $l_1$ and $l_2$ intersect at the point $P$.

(b) Use algebra to find the coordinates of $P$.

**(3)**

(c) Hence find the shortest distance from $l_1$ to the origin.

Write your answer as a fully simplified surd.

**(2)**

**(Total for Question 1 is 7 marks)**

**Continue 1**

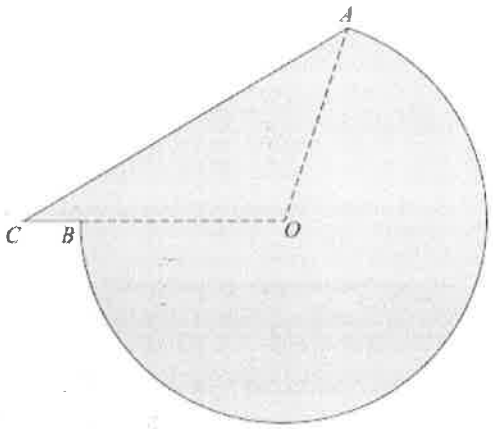
(2)

The shaded area in Figure 2 shows the plan view of a helicopter landing pad.

The area consists of the major sector $AOB$ of a circle centre $O$ joined to a triangle $AOC$.

Given that

- $AO = OB = 15\,\text{m}$
- $BC = 2\,\text{m}$
- $CBO$ is a straight line
- angle $ACO = 0.6$ radians




Not to scale

**Figure 2**

(a) show that angle $COA$ is 1.847 radians to 3 decimal places.

**(3)**

(b) Find the total area of the helicopter landing pad.
Give your answer in $\text{m}^2$ to 3 significant figures.

**(3)**

(c) Find the perimeter of the helicopter landing pad.
Give your answer in metres to 3 significant figures.

**(3)**

**(Total for Question 2 is 9 marks)**

**Continue 2**

(3)

Figure 3 shows a sketch of part of the curve $C_1$

Given that $C_1$

- has equation $y = f(x)$ where $f(x)$ is a cubic function
- touches the $x$-axis at the origin and cuts the $x$-axis at $x = 4$
- passes through the point (10, 120)

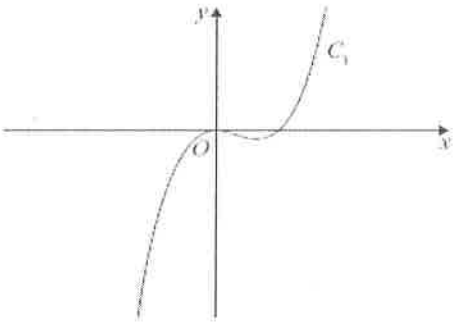



Figure 3

(a) find $f(x)$

**(3)**

The curve $C_2$ has equation $y = 1.2x(8 - x)$

On the following page there is a copy of Figure 3 called Diagram 1.

(b) On Diagram 1 sketch a graph of the curve $C_2$

**(2)**

(c) Use algebra to find the coordinates of the points where $C_1$ and $C_2$ intersect.

Show each stage of your working.

**(5)**

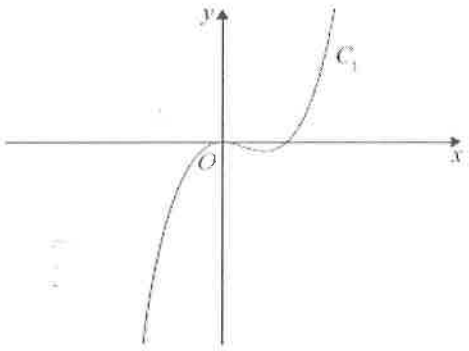



Diagram 1

**(Total for Question 3 is 10 marks)**

Continue 3

(4) Given that

- the point $A$ has coordinates $\left(-2\sqrt{3}, 5\right)$
- the point $B$ has coordinates $\left(7\sqrt{3}, 8\right)$
- the straight line $l_1$ passes through $A$ and $B$

(a) show that the gradient of $l_1$ is $p\sqrt{3}$, where $p$ is a rational constant to be found.
You must show each step of your working.

**(2)**

The straight line $l_2$ is perpendicular to $l_1$ and passes through $A$.

(b) Find the equation of $l_2$, giving your answer in the form $y = mx + c$, where $m$ and $c$ are constants.

**(3)**

**(Total for Question 4 is 5 marks)**

Continue 4

(5) **In this question you must show all stages of your working.**

**Solutions relying entirely on calculator technology are not acceptable.**

The curve $C$ has equation

$$y = \frac{2}{x} - k$$

where $k$ is a **positive** constant.

(a) Sketch the graph of $C$.

Show on your sketch

- the coordinates of any points of intersection of $C$ with the coordinate axes
- the equation of the horizontal asymptote to $C$

stating each in terms of $k$.

**(3)**

The line $l$ has equation $y = -kx - 6$

Given that $l$ intersects $C$ at 2 distinct points,

(b) find the range of possible values of $k$.

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**(Total for Question 5 is 8 marks )**

Continue 5

**(6)**

Figure 1 shows a sketch of a design for a badge.
The design consists of a triangle $OAB$ joined to a sector $OBC$ of a circle with centre $O$
In the design

- $OB = 3.4$ cm
- $AB = 1.9$ cm
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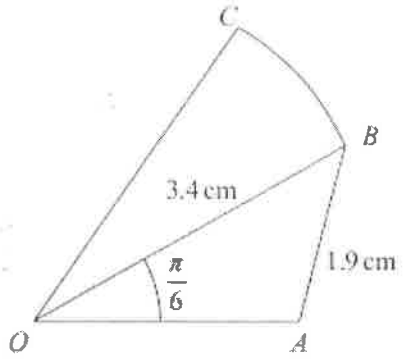



**Figure 1**

Making your method clear,

(a) find the size of angle $OAB$, giving your answer in radians to 4 significant figures,

**(3)**

(b) find the area of triangle $OAB$, in $cm^2$, giving your answer to 3 significant figures.

**(2)**

Given that the ratio of the area of sector $OBC$ to the area of triangle $OAB$ is 3 : 2

(c) show that angle $BOC$ is 0.462 radians to 3 significant figures.

**(3)**

(d) Hence find the perimeter of the badge, in cm, to the nearest integer.

**(5)**

**(Total for Question 6 is 13 marks )**

Continue 6

Continue 6

(7)

Figure 1 shows a sketch of part of the curves $C_1$ and $C_2$

Given that $C_1$

- has equation $y = f(x)$ where $f(x)$ is a quadratic function
- cuts the $x$-axis at the origin and at $x = 4$
- has a minimum turning point at $(2, -4.8)$

(a) find $f(x)$

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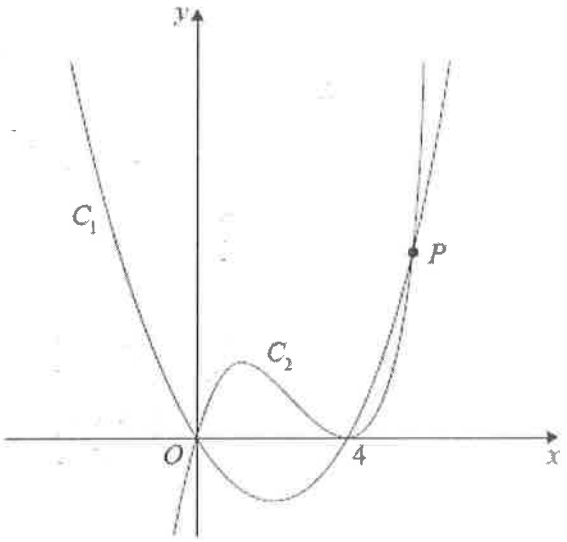



Figure 1

Given that $C_2$

- has equation $y = g(x)$ where $g(x)$ is a cubic function
- cuts the $x$-axis at the origin and meets the $x$-axis at $x = 4$
- passes through the point $(6, 7.2)$

(b) find $g(x)$

**(3)**

The curves $C_1$ and $C_2$ meet in the first quadrant at the point $P$, shown in Figure 1.

(c) Use algebra to find the coordinates of $P$.

**(4)**

**(Total for Question 7 is 10 marks)**

**Continue 7**

**Continue 7**

**TOTAL FOR PAPER IS 62 MARKS**

**Answer ALL questions. Write your answers in the space provided**

**(1)**

The line $l_1$ has equation

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The line $l_2$ passes through the origin and is perpendicular to $l_1$

(a) Find an equation for $l_2$

**(2)**

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**(3)**

(c) Hence find the shortest distance from $l_1$ to the origin.

Write your answer as a fully simplified surd.

**(2)**

**(Total for Question 1 is 7 marks)**

a) $(l_1)$: $x + 25 = 2y \Rightarrow \frac{2y}{2} = \frac{x+25}{2}$

$y = \frac{x+25}{2} \Rightarrow$ gradient $_{l_1} = \frac{1}{2}$ [1]

$\Rightarrow$ gradient $_{l_2} = -2$ since $-2\left(\frac{1}{2}\right) = -1$

$l_2$: $y = -2x$ [1] passes through origin

b) $y = y \Rightarrow -2x = \frac{x+25}{2} \Rightarrow -4x = x + 25$ [1]

$\Rightarrow -5x = 25 \Rightarrow x = -5$ [1] $\quad y = -2(-5) = 10$ [1]

$P(-5, 10)$

**Continue 1**

c] shortest distance from $l_1$ to origin

$OP = \sqrt{(-5)^2+(10)^2} = \sqrt{125} = 5\sqrt{5}$ units

[1] [1]

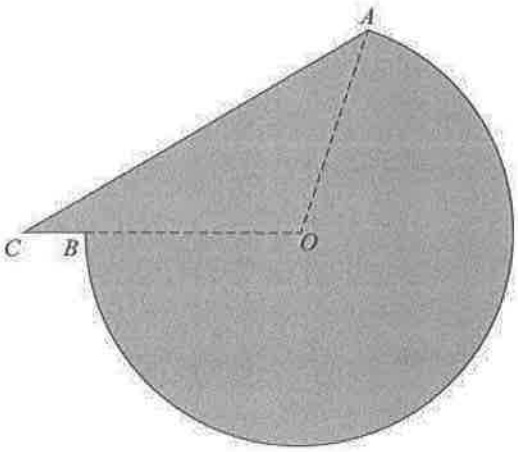
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**Figure 2**

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Give your answer in metres to 3 significant figures.

**(3)**

**(Total for Question 2 is 9 marks)**

a) $\frac{15}{\sin 0.6} = \frac{17}{\sin CAO}$ [1] $\Rightarrow \angle CAO = 0.6944\text{ rad}$ [1]

[1] $\angle COA = \pi - 0.6944 - 0.6 = 1.847\text{ rad}$

**Continue 2**

b] Area $= (2\pi - 1.847)\frac{1}{2}(15)^2 + \frac{1}{2}(15)(17)\sin 1.847$ [1] [1]

$= 499.07 + 122.7$

$= 621.77$ [1]

$= 622\ m^2$ (3sf)

c] $AC = \sqrt{15^2 + 17^2 - 2(15)(17)(\cos 1.847)}$

$AC = 25.6\ m$ [1]

[1]

Perimeter $= AC + 15(2\pi - 1.847) + 2$

$= 25.6 + 66.5 + 2$ [1]

$= 94.1\ m$

**(3)**

Figure 3 shows a sketch of part of the curve $C_1$

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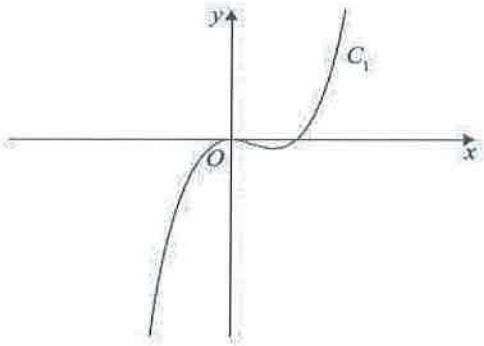



**Figure 3**

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(c) Use algebra to find the coordinates of the points where $C_1$ and $C_2$ intersect.

Show each stage of your working.

**(5)**

a) $F(x) = a(x-4)x^2$ [1]

$120 = a(10-4)(10)^2 \Rightarrow 120 = 600a$

$a = \frac{120}{600} = \frac{1}{5}$ [1]

$F(x) = \frac{1}{5}(x-4)x^2$ [1]

b) [1] Intercepts
[1] shape

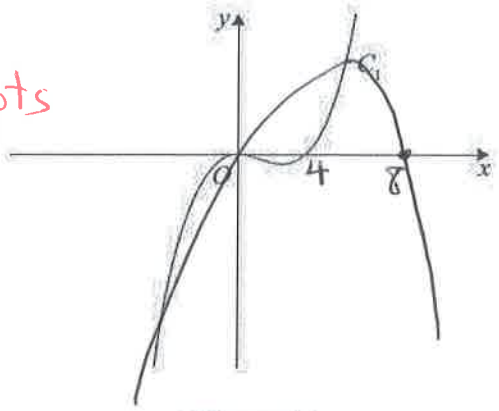



**Diagram 1**

**(Total for Question 3 is 10 marks)**

Continue 3

c) $\frac{1}{5}(x-4)x^2 = 1.2x(8-x)$ [1]

$x^3 - 4x^2 = 6x(8-x)$

$x^3 + 2x^2 - 48x = 0$ [1]

$x(x^2 + 2x - 48) = 0$

$x(x+8)(x-6) = 0$

$x = 0$ [1] $y = 0$

$x = -8$ [1] $y = 1.2(-8)(8+8)$

$y = -153.6$

$x = 6$ [1] $y = 1.2(6)(8-6)$

$y = 14.4$

(4) Given that

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**(3)**

**(Total for Question 4 is 5 marks)**

a) gradient $l_1 = \frac{8-5}{7\sqrt{3}+2\sqrt{3}} = \frac{3}{9\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{9}$ $p = \frac{1}{9}$ [1] [1]

b) gradient $l_2 = \frac{-9 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = -3\sqrt{3}$ [1]

$y = -3\sqrt{3}x + c$

$5 = -3\sqrt{3}\left(-2\sqrt{3}\right) + c$

$5 = 18 + c$ [1]

$c = -13$

$l_2$: $y = -3\sqrt{3}x - 13$ [1]

Continue 4

(5) **In this question you must show all stages of your working.**

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The curve $C$ has equation

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where $k$ is a **positive** constant.

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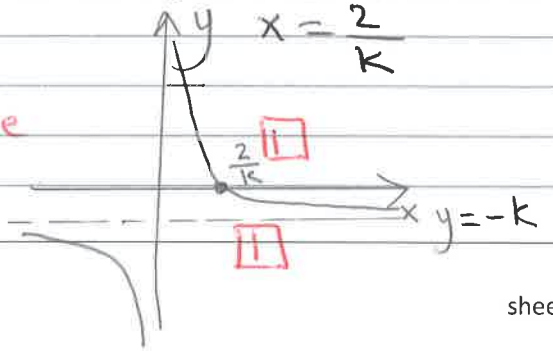
**(5)**

**(Total for Question 5 is 8 marks )**

a] $y = -k$ horizontal Asymptote

$X_{int}$ $y = 0 \Rightarrow \frac{2}{x} = k \Rightarrow xk = 2$

$x = \frac{2}{k}$




1 shape

1

1

Continue 5

b) $y = y$

$\frac{2}{x} - k = -kx - 6$ [1]

$2 - kx = -kx^2 - 6x$

$kx^2 - kx + 6x + 2 = 0$

$kx^2 + x(6-k) + 2 = 0$

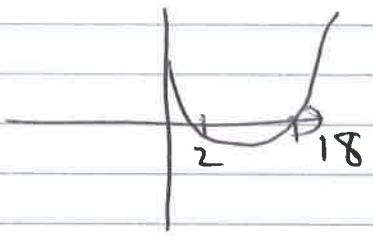
$\Delta > 0$ [1]

$(6-k)^2 - 4(2)(k) > 0$

$36 - 12k + k^2 - 8k > 0$

$k^2 - 20k + 36 > 0$

$(k-18)(k-2) > 0$ [1]




$k = 18$ or $k = 2$

$0 < k < 2$ or $k > 18$

[1] [1]

**(6)**

Figure 1 shows a sketch of a design for a badge.
The design consists of a triangle $OAB$ joined to a sector $OBC$ of a circle with centre $O$
In the design

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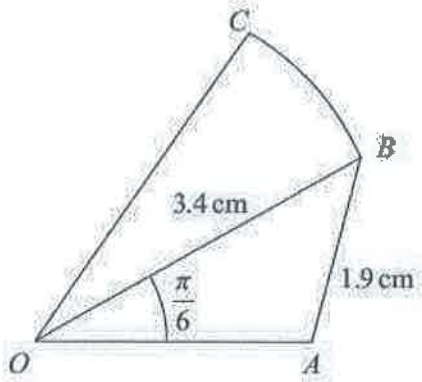



**Figure 1**

Making your method clear,

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Given that the ratio of the area of sector $OBC$ to the area of triangle $OAB$ is 3 : 2

(c) show that angle $BOC$ is 0.462 radians to 3 significant figures.

**(3)**

(d) Hence find the perimeter of the badge, in cm, to the nearest integer.

**(5)**

**(Total for Question 6 is 13 marks )**

a) $\frac{1.9}{\sin\frac{\pi}{6}} = \frac{3.4}{\sin OAB} \Rightarrow \angle OAB = 1.108$ rad rejected [1] [1]

$\angle OAB = \pi - 1.108 = 2.034$ rad accepted [1]

b) $\angle OBA = \pi - \frac{\pi}{6} - 2.034 = 0.5839 = 0.584$ rad [1]

Continue 6

$$\text{Area} = \frac{1}{2}(3.4)(1.9)\sin 0.584$$

$$= 1.78\,cm^2$$

c) $\dfrac{\text{Area sector OBC}}{\text{Area } \Delta OAB} = \dfrac{3}{2} \Rightarrow \dfrac{A_{Sector}}{1.78} = \dfrac{3}{2}$

$\Rightarrow \text{Area}_{\text{Sector}} = 2.67\,cm^2$ [1]

[1]

$$2.67 = \frac{1}{2}(3.4)^2 \angle COB) \Rightarrow \angle BOC = 0.462\,rad$$ [1]

Continue 6

d] length arc BC = $3,4\,(0,462) = 1,5708\,cm$ [1]

$OA = \sqrt{3,4^2 + 1,9^2 - 2(3,4)(1,9)\cos 0,584}$

$= 2,0955\,cm$ [1]

Perimeter = $3,4 + 1,9 + 1,5708 + 2,0955$ [1] [1]

$= 8,9\,cm$

$= 9\,cm$ [1]

(7)

Figure 1 shows a sketch of part of the curves $C_1$ and $C_2$

Given that $C_1$

- has equation $y = f(x)$ where $f(x)$ is a quadratic function
- cuts the $x$-axis at the origin and at $x = 4$
- has a minimum turning point at $(2, -4.8)$

(a) find $f(x)$

**(3)**

Given that $C_2$

- has equation $y = g(x)$ where $g(x)$ is a cubic function
- cuts the $x$-axis at the origin and meets the $x$-axis at $x = 4$
- passes through the point $(6, 7.2)$

(b) find $g(x)$

**(3)**

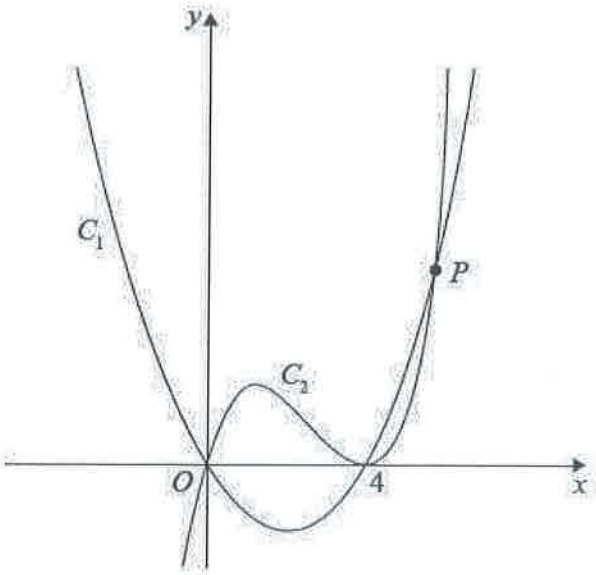



**Figure 1**

The curves $C_1$ and $C_2$ meet in the first quadrant at the point $P$, shown in Figure 1.

(c) Use algebra to find the coordinates of $P$.

**(4)**

**(Total for Question 7 is 10 marks)**

a) $f(x) = a(x)(x-4)$ $(2, -4.8)$ [1]

$-4.8 = a(2)(2-4)$

$-4.8 = -4a \Rightarrow a = \frac{-4.8}{-4} = \frac{6}{5}$ [1]

$f(x) = \frac{6}{5}(x)(x-4)$ [1]

**Continue 7**

b] $g(x) = a x (x-4)^2$ [1]

$7.2 = a(6)(6-4)^2$

$24a = 7.2$ [1]

$a = \frac{3}{10} \Rightarrow g(x) = \frac{3}{10} x (x-4)^2$ [1]

c] $f(x) = g(x)$

$\frac{6}{5} x (x-4) = \frac{3}{10} x (x-4)^2$ [1]

$4x(x-4) - x(x-4)^2 = 0$

$x(x-4)(4-x+4) = 0$

$x = 0$ or $x = 4$ or $x = 8$ [1]

$y = \frac{6}{5}(8)(8-4)$

$y = \frac{192}{5}$ [1]

$P(8, \frac{192}{5})$

**Continue 7**

**TOTAL FOR PAPER IS 62 MARKS**