This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Loueizeh - Baabda

SE01 Exam

10NOV2025

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

Subject :	Maths
Class :	11S1 and 11S2
Teacher :	Taline Hawatian
Duration :	1 hour
You are to answer the questions to this exam on : Squared 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.

I.- (12 points)

Consider the equation (E) of the second degree in x: $(3-m)x^2-2(m-4)x+2m=0$, where m is a real parameter and x_1 and x_2 its roots when they exist.

1) Determine m so that the equation has a single root. Calculate this root.
2) Show that the discriminant $\Delta'= 3m^2-14m+16$.
3) Discuss and study, according to the values of m, the existence of the roots of (E).
4) Calculate m , if possible, so that the roots are opposites.
5) Calculate m , if possible, so that the roots are distinct and positive.
6) Calculate m, so that $\frac{1}{x_1}+\frac{1}{x_2}\leq m-3$.
7) Find a relation independent of m that exists between x_1 and x_2.

II.- (8 points)

1) Solve the following system of inequalities: $\begin{cases} \frac{x^2-8x+5}{x}\geq 4-3x \\ \frac{2x^3+5x^2-23x+10}{x^2+4}>0 \end{cases}$

2) Solve the following equation: $x+2\sqrt{x^2-x}-1=0$.

SEO1/20252026/Maths/11S

I- $(E): (3-m)x^2 - 2(m-4)x + 2m = 0$

1) (E) has a single root. $\Rightarrow a=0$ $3-m=0$ $m=3$ 0.5

$-2(3-4)x + 2(3)=0$ $2x+6=0$ $x=-3$ 0.5

2) $\Delta' = (m-4)^2 - (3-m)(2m)$ 1.5

$= m^2 - 8m + 16 - 6m + 2m^2 = 3m^2 - 14m + 16$ verified

3) $\Delta'=0$ $3m^2-14m+16=0$ $\Delta'_m = 49-48=1$ $m_1=2$ $m_2=\frac{8}{3}$

m	$-\infty$		2		$8/3$		$+\infty$
Δ'		$+$	ϕ	$-$	ϕ	$+$	

0.5

$\Delta' < 0$ no real roots for $m \in]2; \frac{8}{3}[$ 0.5

$\Delta' = 0$ for $m=2$ and $m=\frac{8}{3}$ 0.5

$m=2$ $x_1 = x_2 = \frac{-b'}{a} = \frac{m-4}{3-m} = \frac{2-4}{3-2} = -2$ 1 double root

$m=\frac{8}{3}$ $x_1 = x_2 = \frac{8/3 - 4}{3-\frac{8}{3}} = -4$ 1 double root

} 2 double root 1

$\Delta' > 0$ 2 distinct real roots $x_1, x_2 = \frac{(m-4) \pm \sqrt{3m^2-14m+16}}{3-m}$ 0.5

for $m \in]-\infty; 2[\cup]\frac{8}{3}; +\infty[- \{3\}$ 0.5

4) The roots are opposites. $x_1 = -x_2$ $x_1 + x_2 = 0$ $S=0$

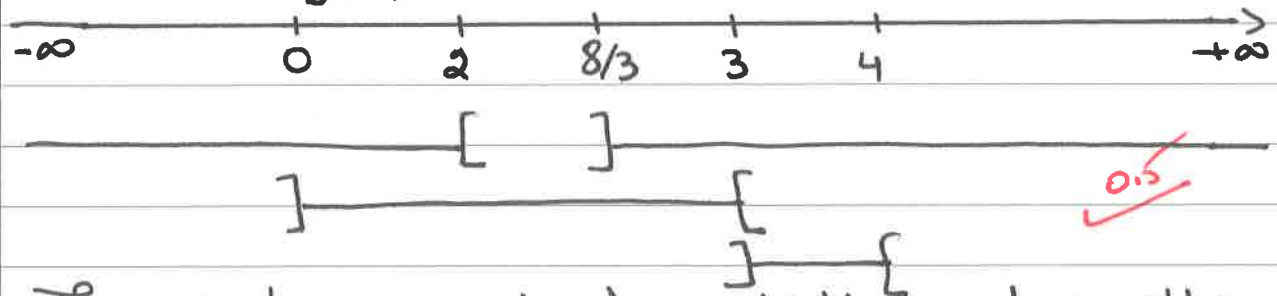
$S = \frac{-b}{a} = \frac{2(m-4)}{3-m} = \frac{2m-8}{3-m}$ $S=0$ $2m-8=0$ $m=4$ 1

5) The roots are distinct and positive. $\Delta' > 0, P > 0, S > 0$

$\Delta' > 0$ for m in $]-\infty; 2[\cup]\frac{8}{3}; +\infty[$

$P > 0$ $\frac{2m}{3-m} > 0$ for m in $]0; 3[$ 0.5

$S > 0$ $\frac{2(m-4)}{3-m} > 0$ for m in $]3; 4[$. 0.5



0.5

The roots cannot be distinct and positive.

6)

$$\frac{1}{x_1}+\frac{1}{x_2}\leq m-3$$

$$\frac{x_2+x_1}{x_1x_2}\leq m-3 \qquad \frac{S}{P}\leq m-3 \qquad m\neq 3 \quad (0.5)$$

$$\frac{\frac{2(m-4)}{3-m}}{\frac{2m}{3-m}}\leq m-3 \qquad \frac{2(m-4)}{2m}\leq m-3 \quad (0.5)$$

$$\frac{m-4}{m}-m+3\leq 0 \qquad \frac{m-4-m^2+3m}{m}\leq 0$$

$$\frac{-m^2+4m-4}{m}\leq 0 \qquad \frac{-(m-2)^2}{m}\leq 0 \qquad \frac{(m-2)^2}{m}\geq 0 \qquad m\neq 0$$

$(m-2)^2\geq 0$ for m in $\mathbb{R}$. $\qquad m>0$

$m>0$ and $m\in\,]-\infty;2]\cup[\frac{8}{3};+\infty[$ (1)

$S=\,]0;2]\cup[\frac{8}{3};+\infty[-\{3\}$

7) $S=\frac{2(m-4)}{3-m}$ $\qquad P=\frac{2m}{3-m}$

$3S-mS=2m-8$ $\qquad 3P-mP=2m$

$2m+mS=3S+8$ $\qquad 2m+mP=3P$

$m(S+2)=3S+8$ $\qquad m(2+P)=3P$

$m=\frac{3S+8}{S+2}$ $\qquad m=\frac{3P}{2+P}$

$$\frac{3S+8}{S+2}=\frac{3P}{2+P}$$

$$6S+3SP+16+8P=3SP+6P$$

$$6S+2P+16=0$$

$$3S+P+8=0 \quad (1.5)$$

$$3(x_1+x_2)+x_1x_2+8=0$$

II. 1) $\frac{x^2-8x+5}{x} \geq 4-3x$ ... ①

$\frac{2x^3+5x^2-23x+10}{x^2+4} > 0$ ... ②

① : $\frac{x^2-8x+5}{x} - 4+3x \geq 0$, $\frac{x^2-8x+5-4x+3x^2}{x} \geq 0$

$\frac{4x^2-12x+5}{x} \geq 0$ ✓0.5 $4x^2-12x+5=0$ $x_1=\frac{1}{2}$ $x_2=\frac{5}{2}$

x		0		$1/2$		$5/2$		$+\infty$
$4x^2-12x+5$	$+$		$+$	0	$-$	0	$+$	
x	$-$	‖	$+$		$+$		$+$	
$\frac{4x^2-12x+5}{x}$	$-$	‖	$+$	0	$-$	0	$+$	

✓1 $S_1=]0;\frac{1}{2}] \cup [\frac{5}{2};+\infty[$ ✓0.5

② $\frac{2x^3+5x^2-23x+10}{x^2+4} > 0$ $x^2+4>0$ for all x in $\mathbb{R}$

$P(2)=0$ $(x-2)$ is a factor of $P(x)$.

$P(x)=2x^3+5x^2-23x+10$

②

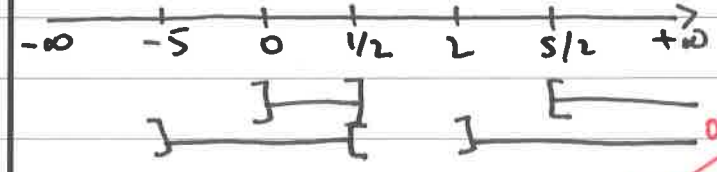
	2	5	-23	10
2		4	18	-10
	2	9	-5	0

$P(x)=(x-2)(2x^2+9x-5)$

$2x^2+9x-5=0$ $x_1=\frac{1}{2}$ $x_2=-5$

x	$-\infty$		-5		$1/2$		2		$+\infty$
$P(x)$	$-$	0	$+$	0	$-$	0	$+$		

✓0.5 ✓0.5 $S_2=]-5;\frac{1}{2}[\cup]2;+\infty[$



✓0.5 $S=]0;\frac{1}{2}[\cup [\frac{5}{2};+\infty[$ ✓1

2) $x+2\sqrt{x^2-x}-1=0$

$2\sqrt{x^2-x}=1-x$ square both sides ✓0.5

$4(x^2-x)=(1-x)^2$

$4x^2-4x=1-2x+x^2$ ✓0.5

$3x^2-2x-1=0$

$x_1=1$ acc. $x_2=-\frac{1}{3}$ acc. ✓1

$x^2-x \geq 0$

x	$-\infty$		0		1		$+\infty$
x^2-x	$+$	0	$-$	0	$+$		

$1-x \geq 0$

$x \leq 1$

$D=]-\infty;0] \cup \{1\}$ ✓0.5