This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 05

Monday 09MAY2022

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

Subject :	Maths	
Class :	10B and 10C	
Teacher :	Taline Hawatian	
Duration :	1 hour	
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.- (16 pts)

Choose the correct answer. Justify your answer showing all the steps.

1) The solution of the inequality $(4x^2 + 1)(-2x + 4) \geq 0$ is:

   a) $x \geq 2$ b) $x \leq 2$ c) $x \geq 0$

2) The solution of the inequality $\frac{-x+3}{x^2} \leq 0$ is:

   a) $x \geq 3$ b) $x \leq 3$ c) $0 < x \leq 3$

3) The solution of the inequality $|x + 3| \leq 4$ is:

   a) $]-7; 1[$ b) $[-7; 1]$ c) $]-\infty; 1]$

4) If $3 < \frac{1}{x}$, then:

   a) $x < \frac{1}{3}$ b) $x > \frac{1}{3}$ c) $0 < x < \frac{1}{3}$

5) Given in an orthonormal system $(O; \vec{\imath}; \vec{\jmath})$, the points A$(-1; 3)$, B$(2; 0)$, and C$(x; 4)$. If A, B, C are collinear then $x =$

   a) -8 b) 8 c) -2

6) Consider the points A(2; 1), B(-3; m), and M$(-2;$ m-1). Triangle ABM is right angled at M, then m=

   a) -3 b) 0 c) -2

7) Given in an orthonormal system $(O; \vec{\imath}; \vec{\jmath})$, the two vectors $\vec{u} = -3\vec{\imath} + 2\vec{\jmath}$ and $\vec{v} = 2\vec{\imath} + 3\vec{\jmath}$. $\vec{u}$ and $\vec{v}$ are:

   a) collinear b) opposite c) perpendicular

8) If $\overrightarrow{AB} = 3\vec{\imath} - 3\vec{\jmath}$, then $\overrightarrow{AB}^2 =$

   a) 18 b) $9\vec{\imath} + 9\vec{\jmath}$ c) 0

II.- (8 pts)

Solve the following system of inequalities:

$$\begin{cases} (-9 - 2x)(x^2 + 16) > 0 \\ \left|\frac{3x+14}{2x-1}\right| \leq 1 \end{cases}$$

III.- (6 pts)

Solve the following inequality and write the solution set as an interval if possible.

$$\frac{x^2+20x}{x(7-x)} \geq 4$$

IV.- (10 pts)

Given in an orthonormal system $(O;\ \vec{\imath};\ \vec{\jmath})$, the points E(2; 3), F(1; −2), and K(−1; 1.5) and the vector $\vec{u} = -3\vec{\imath} + \vec{\jmath}$.

1) Calculate the coordinates of the centroid G of triangle EFK.
2) Consider the point A$(x; y)$. Find a relation between x and y so that vectors $\overrightarrow{AF}$ and $\vec{v}$ are collinear.
3) M is a point defined by $\overrightarrow{EM} = 2\overrightarrow{EF} + 3\overrightarrow{MF}$. Determine the coordinates of M.
4) Calculate $\|\overrightarrow{EF}\|;\ \|\overrightarrow{EK}\|, \|\overrightarrow{FK}\|$.
5) Determine the angle $\widehat{EFK}$.
6) Determine the coordinates of point K in the system $(F;\ \vec{\imath};\ \vec{\jmath})$.

SE05/ 2021 2022/ Maths/ 10 BC

Answer Key

I- 1) b (0.5) $(4x^2+1)(-2x+4) \geq 0$

$4x^2+1 > 0$ for all x in $\mathbb{R}$. (sum of squares) (1.5)

$-2x+4 \geq 0 \quad -2x \geq -4 \quad x \leq 2$

2) a (0.5) $\frac{-x+3}{x^2} \leq 0 \quad x^2 \geq 0$ for all x in $\mathbb{R}$

$x \neq 0$ (1.5)

$-x+3 \leq 0 \quad -x \leq -3 \quad x \geq 3$

3) b (0.5) $|x+3| \leq 4 \quad -4 \leq x+3 \leq 4$ (1.5)

$-7 \leq x \leq 1$

4) c (0.5) $3 < \frac{1}{x} \quad 3 - \frac{1}{x} < 0 \quad \frac{3x-1}{x} < 0$ (1.5)

x	$-\infty$		0		$\frac{1}{3}$		$+\infty$
$3x-1$		$-$		$-$	0	$+$	
x		$-$	‖	$+$		$+$	
$\frac{3x-1}{x}$		$+$	‖	$-$	0	$+$	

$S =]0; \frac{1}{3}[$

5) c (0.5) $A(-1;3) \quad B(2;0) \quad C(x;4) \quad \overrightarrow{AB}(3;-3) \quad \overrightarrow{AC}(x+1;1)$

$3(1) - (-3)(x+1) = 0$ (1.5)

$3 + 3x + 3 = 0 \quad 3x = -6 \quad x = -2$

6) c (0.5) $A(2;1) \quad B(-3;m) \quad M(-2;m-1)$

$\overrightarrow{MA}(-4;m-2) \quad \overrightarrow{MB}(-1;+1)$

$\overrightarrow{MA} \cdot \overrightarrow{MB} = 0 \quad (-4)(1) + (m-2)(-1) = 0$ (1.5)

$-4 - m + 2 = 0 \quad m = -2$

7) c (0.5) $\vec{u} = -3\vec{i} + 2\vec{j} \quad \vec{v} = 2\vec{i} + 3\vec{j}$

$\vec{u} \cdot \vec{v} = (-3)(2) + 2(3) = -6 + 6 = 0$ (1.5)

$\vec{u}$ and $\vec{v}$ are perpendicular.

8) a (0.5) $\overrightarrow{AB} = 3\vec{i} - 3\vec{j}$ (1.5)

$\overrightarrow{AB}^2 = 3^2 + (-3)^2 = 18$

II. $\begin{cases} (-9-2x)(x^2+16)>0 & \dots (1) \\ \left|\frac{3x+14}{2x-1}\right| \le 1 & \dots (2) \end{cases}$

(1): $x^2+16>0$ for all x in $\mathbb{R}$ 1 0.5

$-9-2x>0$ 0.5 $-2x>9$ $x<-\frac{9}{2}$ 0.5 $S_1=]-\infty;-\frac{9}{2}[$

(2): $\left|\frac{3x+14}{2x-1}\right| \le 1$ $x \neq \frac{1}{2}$

$\frac{|3x+14|}{|2x-1|} \le 1 \iff |3x+14| \le |2x-1|$ 0.5 0.5

$(3x+14)^2 \le (2x-1)^2$ 0.5

$(3x+14)^2-(2x-1)^2 \le 0$ 0.5

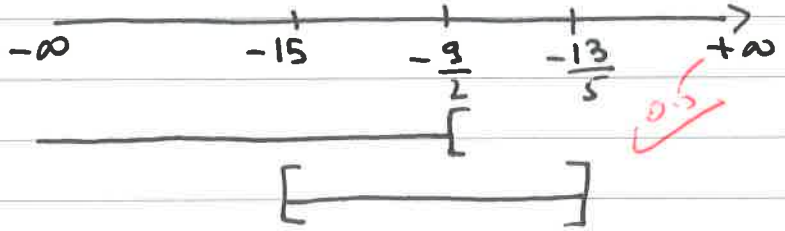
$(3x+14-2x+1)(3x+14+2x-1) \le 0$ 0.5

$(x+15)(5x+13) \le 0$ 0.5 $x \neq \frac{1}{2}$ 0.5

x	$-\infty$		-15		$-13/5$		$+\infty$
$(x+15)(5x+13)$		$+$	0	$-$	0	$+$	

0.5

$S_2=[-15;-\frac{13}{5}]$ 0.5



0.5

$S=[-15;-\frac{9}{2}[$ 0.5

III. $\frac{x^2+20x}{x(7-x)} \ge 4$ $x \neq 0$ $x \neq 7$ 1

$\frac{x^2+20x}{x(7-x)}-4 \ge 0$ 1

$\frac{x^2+20x-4x(7-x)}{x(7-x)} \ge 0$

$\frac{x^2+20x-28x+4x^2}{x(7-x)} \ge 0$

$\frac{5x^2-8x}{x(7-x)} \ge 0$ 1

$\frac{x(5x-8)}{x(7-x)} \ge 0$ 1

$\frac{5x-8}{7-x} \ge 0$ $x \neq 7$ $x \neq 0$ 1

x	$-\infty$		$8/5$		7		$+\infty$
$\frac{5x-8}{7-x}$		$-$	0	$+$	$\|\|$	$-$	

1

$S=[\frac{8}{5};7[$ 1

IV. $E(2;3)$ $F(1;-2)$ $K(-1;1.5)$ $\vec{u} = -3\vec{i} + \vec{j}$.

1) $x_G = \frac{x_E + x_F + x_K}{3} = \frac{2+1-1}{3} = \frac{2}{3}$ 0.5

$y_G = \frac{y_E + y_F + y_K}{2} = \frac{3-2+1.5}{3} = \frac{2.5}{3} = \frac{5}{6}$ 0.5

$G\left(\frac{2}{3}; \frac{5}{6}\right)$

2) $\vec{AF}(1-x; -2-y)$ $\vec{u}(-3;1)$ 1.5

$(1-x)(1) - (-2-y)(-3) = 0$

$1 - x - 6 - 3y = 0$ $\quad x + 3y + 5 = 0$

3) $\vec{EM} = 2\vec{EF} + 3\vec{MF}$

$\vec{OM} - \vec{OE} = 2(\vec{OF} - \vec{OE}) + 3(\vec{OF} - \vec{OM})$

$\vec{OM} - \vec{OE} = 2\vec{OF} - 2\vec{OE} + 3\vec{OF} - 3\vec{OM}$

$4\vec{OM} = 5\vec{OF} - \vec{OE}$

$4\vec{OM} = 5(\vec{i} - 2\vec{j}) - 2\vec{i} - 3\vec{j}$ 2.5

$4\vec{OM} = 5\vec{i} - 10\vec{j} - 2\vec{i} - 3\vec{j}$

$\vec{OM} = \frac{3}{4}\vec{i} - \frac{13}{4}\vec{j}$ $\quad M\left(\frac{3}{4}; -\frac{13}{4}\right)$

4) $\|\vec{EF}\| = \sqrt{(x_F - x_E)^2 + (y_F - y_E)^2} = \sqrt{(1-2)^2 + (-2-3)^2}$

$= \sqrt{1+25} = \sqrt{26}$ u 0.5

$\|\vec{EK}\| = \sqrt{9 + 2.25} = \sqrt{11.25}$ u 0.5

$\|\vec{FK}\| = \sqrt{4 + 12.25} = \sqrt{16.25}$ u 0.5

5) $\cos(\vec{FE}; \vec{FK}) = \frac{\vec{FE} \cdot \vec{FK}}{EF \times EK}$ 0.5 1.5

$= \frac{1(-2) + 5(3.5}{\sqrt{26} \times \sqrt{16.25}} = 0.754$

$\widehat{EFK} = 41°$ 0.5

6) $x_K = x_K - x_F = -1 - 1 = -2$ 0.5

$y_K = y_K - y_F = 1.5 + 2 = 3.5$ 0.5

$K(-2; 3.5)$