This is a Class 1 exam

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 :	Maths
Class :	11SE
Teacher :	Mr. George Mouhayar
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. (4 points)

Using **Long Division** only, find the quotient and the remainder of the division of $P(x)$ by $D(x)$. Write its division algorithm.

$$P(x) = 2x^4 + 3x^3 - 2x + 1$$

$$D(x) = x + 2$$

II. (6 points)

1) Let $P(x) = 2x^3 - 3ax^2 + 4x + 2a + 9$

   Calculate a so that $(x + 1)$ is a factor of $P(x)$.

2) Given the polynomial $P(x) = 2x^3 - 9x^2 + 4x + 15$

   a) Show that -1 is a root of $P(x)$.

   b) $P(x) = (x + 1)Q(x)$. Determine $Q(x)$ using Horner's method.

   c) Factorize $P(x)$ completely.

III. (2 points)

Write the domain of definition in interval form of the following function.

$$f(x) = \frac{\sqrt{x} - 1}{x - 4}$$

IV. (11 points)

Calculate the limit of the following functions.

1) $\lim\limits_{x \to +\infty} \frac{-3x^4 + 5}{x^3 + 7x^2 + 10}$

2) $\lim\limits_{x \to -\infty} \frac{4}{2 + 3x^2}$

3) $\lim\limits_{x \to -3^-} \frac{x + 5}{x + 3}$

4) $\lim\limits_{x \to -1} \frac{2x^2 - x - 3}{x^2 - 1}$

5) $\lim\limits_{x \to 2} \frac{\sqrt{x + 7} - 3}{x - 2}$

V. (7 points)

Consider the function $f(x) = \frac{2x - 3}{x + 1}$

1) Write the domain of definition of $f(x)$ in an interval form.

2) Calculate the limits of $f(x)$ at the open bounds of its domain and deduce the horizontal and vertical asymptotes.

Solution : SE02 Class 1

11 SE Maths 2025/2026

I. $P(x) = 2x^4 + 3x^3 - 2x + 1$

$D(x) = x + 2$

$$\begin{array}{r|l} & 2x^3 - x^2 + 2x - 6 \\ x+2 & 2x^4 + 3x^3 + 0x^2 - 2x + 1 \\ \hline & \pm 2x^4 \mp 4x^3 \\ & \hline & -x^3 + 0x^2 \\ & \pm x^3 \mp 2x^2 \\ & \hline & 2x^2 - 2x \\ & \pm 2x^2 \mp 4x \\ & \hline & -6x + 1 \\ & \pm 6x \mp 12 \\ & \hline & 13 \end{array}$$ (1) (2)

$Q(x) = 2x^3 - x^2 + 2x - 6$

$R(x) = 13$ (1)

$2x^4 + 3x^3 - 2x + 1 = (x+2)(2x^3 - x^2 + 2x - 6) + 13$

II. $P(x) = 2x^3 - 3ax^2 + 4x + 2a + 9$

1) $(x+1)$ is a factor $\Rightarrow -1$ is a root

$P(-1) = 0$

$2(-1)^3 - 3a(-1)^2 + 4(-1) + 2a + 9 = 0$

$-2 - 3a - 4 + 2a + 9 = 0$

$-a + 3 = 0$

$\boxed{a = 3}$ (2)

2) a) $P(-1) = 2(-1)^3 - 9(-1)^2 + 4(-1) + 15$

$= -2 - 9 - 4 + 15$

$= 0$ (1)

$\Rightarrow -1$ is a root of $P(x)$

b) $P(x) = (x+1)\,Q(x)$

-1	2	-9	4	15
	↓	-2	11	-15
	2	-11	15	0

1.5

$Q(x) = 2x^2 - 11x + 15$

c) $P(x) = (x+1)\,Q(x)$

$Q(x) = 2x^2 - 11x + 15$

$2x^2 - 11x + 15 = 0$

$x_1 = 3 \quad x_2 = \frac{5}{2}$

$Q(x) = 2(x-3)\left(x-\frac{5}{2}\right)$ 1.5

$= (x-3)(2x-5)$

$\Rightarrow P(x) = (x+1)(x-3)(2x-5)$

III) $f(x) = \dfrac{\sqrt{x}-1}{x-4}$ (2)

$x - 4 \neq 0$

$x \neq 4$ and $x \geq 0$

$D_f = [0; 4[\cup]4; +\infty[$

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III

1) $\lim_{x \to +\infty} \frac{-3x^4 + 5}{x^3 + 7x^2 + 10} = \lim_{x \to +\infty} \frac{-3x^4}{x^3} = \lim_{x \to +\infty} -3x$

(2) $= -\infty$

2) $\lim_{x \to -\infty} \frac{4}{x + 3x^2} = \lim_{x \to -\infty} \frac{4}{3x^2}$

$= \lim_{x \to -\infty} \frac{4}{+\infty} = 0^+$

(1.5)

3) $\lim_{x \to -3^-} \frac{x + 5}{x + 3}$

$= \lim_{x \to -3^-} \frac{2}{0^-} = -\infty$ (1.5)

4) $\lim_{x \to -1} \frac{2x^2 - x - 3}{x^2 - 1} = \frac{0}{0}$ Indeterminate Form

$\lim_{x \to -1} \frac{(x+1)(2x-3)}{(x-1)(x+1)}$

$\lim_{x \to -1} \frac{2x - 3}{x - 1} = \frac{-5}{-2} = \frac{5}{2}$ (2.5)

5) $\lim_{x \to 2} \frac{\sqrt{x+7} - 3}{x - 2} = \frac{0}{0}$ Indeterminate Form

$\lim_{x \to 2} \frac{\sqrt{x+7} - 3}{x - 2} \times \frac{\sqrt{x+7} + 3}{\sqrt{x+7} + 3}$

$\lim_{x \to 2} \frac{x + 7 - 9}{(x-2)(\sqrt{x+7} + 3)}$ (3.5)

$\lim_{x \to 2} \frac{x - 2}{(x-2)(\sqrt{x+7} + 3)} = \lim_{x \to 2} \frac{1}{\sqrt{x+7} + 3} = \frac{1}{6}$

V. $f(x) = \dfrac{2x-3}{x+1}$

1) $x+1 \neq 0$

$x \neq -1$

$D_f =]-\infty ; -1[\cup]-1 , +\infty[$ (1)

2) $\lim\limits_{x \to -\infty} \dfrac{2x-3}{x+1} = \lim\limits_{x \to -\infty} \dfrac{2x}{x} = 2$ (1)

$\lim\limits_{x \to +\infty} \dfrac{2x-3}{x+1} = \lim\limits_{x \to +\infty} \dfrac{2x}{x} = 2$ (1)

$y = 2$ is a Horizontal asymptote (1)

$\lim\limits_{x \to -1^-} \dfrac{2x-3}{x+1} = \lim\limits_{x \to -1^-} \dfrac{-5}{0^-} = +\infty$ (1)

$\lim\limits_{x \to -1^+} \dfrac{2x-3}{x+1} = \lim\limits_{x \to -1^+} \dfrac{-5}{0^+} = -\infty$ (1)

$x = -1$ is a vertical asymptote (1)