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Semnul funcţiei de gradul I:

$$f : R \to R$$
$$f(x) = ax + b$$
$$a \neq 0$$

x	$-\infty$	$-\frac{b}{a}$	$+\infty$
$ax+b$	semn contrar lui a	0	semnul lui a

Inecuaţii de gradul I şi de gradul al II-lea

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Semnul funcţiei de gradul al II-lea: $f : R \to R$, $f(x) = ax^2 + bx + c$, $a \neq 0$

$\Delta > 0$

x	$-\infty$		x_1		x_2		$+\infty$
$ax^2 + bx + c$	semnul lui a		0	semn contrar lui a		0	semnul lui a

$\Delta = 0$

x	$-\infty$		$x_1 = x_2$		$+\infty$
$ax^2 + bx + c$	semnul lui a		0	semnul lui a	

$\Delta = 0$

x	$-\infty$		$+\infty$
$ax^2 + bx + c$	semnul lui a		

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Ex.1 Să se rezolve inecuaţia: $x^2-5x+2\geq 0$

$x^2-5x+2\geq 0$

$\Delta=5^2-4\cdot 1\cdot 2=25-8=17$

$x_{1,2}=\dfrac{5\pm\sqrt{17}}{2}$

x	$-\infty$			$\frac{5-\sqrt{17}}{2}$			$\frac{5+\sqrt{17}}{2}$			$+\infty$
x^2-5x+2	+	+	+	0	-	-	0	+	+	+

$$x\in(-\infty;\frac{5-\sqrt{17}}{2}]\cup[\frac{5+\sqrt{17}}{2};+\infty)$$

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Ex.2 Să se rezolve inecuaţia: $\frac{2x^2-x}{x-1}\le 2$

$\frac{2x^2-x}{x-1}\le 2$

$\frac{2x^2-x}{x-1}-2\le 0$

$\frac{2x^2-x-2x+2}{x-1}\le 0$

$\frac{2x^2-3x+2}{x-1}\le 0$

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

$\Delta=b^2-4ac=9-16=-7$

$x-1=0$

$x=1$

x	$-\infty$		1		$+\infty$
$2x^2-3x+2$	+	+	+	+	+
$x-1$	-	-	0	+	+
$\frac{2x^2-3x+2}{x-1}$	-	-	|	+	+

$x\in(-\infty;1)$

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Ex.3 Să se rezolve inecuaţia: $\dfrac{x^2-8x+7}{x^2-12x+20}<0$

$$\frac{x^2-8x+7}{x^2-12x+20}<0$$

$$x^2-8x+7=0$$

$$x_{1,2}=\frac{8\pm\sqrt{64-28}}{2}=\frac{8\pm 6}{2}$$

$$x_1=7$$

$$x_2=1$$

$$x^2-12x+20=0$$

$$x_{1,2}=\frac{12\pm\sqrt{144-80}}{2}=\frac{12\pm 8}{2}$$

$$x_1=10$$

$$x_2=2$$

x	$-\infty$		1		2		7		10		$+\infty$
x^2-8x+7	+	+	0	-	-	-	0	+	+	+	+
$x^2-12x+20$	+	+	+	+	0	-	-	-	0	+	+
$\dfrac{x^2-8x+7}{x^2-12x+20}$	+	+	0	-	|	+	0	-	|	+	+

$$x\in(1;2)\cup(7;10)$$

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Ex.4 Să se rezolve inecuaţia: $\frac{2x^2-6x-36}{-x^2-x+2}\le 0$

$$\frac{2x^2-6x-36}{-x^2-x+2}\le 0$$

$$\frac{x^2-3x-18}{-x^2-x+2}\le 0$$

$$x^2-3x-18=0$$

$$x_{1,2}=\frac{3\pm\sqrt{9+72}}{2}=\frac{3\pm 9}{2}$$

$$x_1=6$$

$$x_2=-3$$

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

$$x_{1,2}=\frac{1\pm\sqrt{1+8}}{-2}=\frac{1\pm 3}{-2}$$

$$x_1=-2$$

$$x_2=1$$

x	$-\infty$		-3		-2		1		6		$+\infty$
$x^2-3x-18$	+	+	0	-	-	-	-	-	0	+	+
$-x^2-x+2$	-	-	-	-	0	+	0	-	-	-	-
$\frac{x^2-3x-18}{-x^2-x+2}$	-	-	0	+	|	-	|	+	0	-	-

$$x\in(-\infty;-3]\cup(-2;-1)\cup[6;+\infty)$$

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Ex.5 Să se rezolve inecuaţia: $\frac{x^2-16}{x^2-2x-24} \le 0$

$$\frac{x^2-16}{x^2-2x-24} \le 0$$

$$x^2-16=0$$
$$x^2=16$$
$$x_{1,2}=\pm 4$$

$$x^2-2x-24=0$$
$$\Delta = 4+96=100$$
$$x_{1,2}=\frac{2\pm 10}{2}$$
$$x_1=6$$
$$x_2=-4$$

x	$-\infty$		-4			4		6		$+\infty$
x^2-16	+	+	0	-	-	0	+	+	+	+
$x^2-2x-24$	+	+	0	-	-	-	-	0	+	+
$\frac{x^2-16}{x^2-2x-24}$	+	+	|	+	+	0	-	|	+	+

$$x \in [4;6)$$

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Ex.6 Să se rezolve inecuaţia: $\frac{2x^2+x-15}{-x^2+15x-50}\geq 0$

$\frac{2x^2+x-15}{-x^2+15x-50}\geq 0$

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

$x_{1,2}=\frac{-1\pm\sqrt{1+120}}{4}=\frac{-1\pm 11}{4}$

$x_1=\frac{10}{4}=\frac{5}{2}$

$x_2=\frac{-12}{4}=-3$

$-x^2+15x-50=0$

$\Delta=225-200=25$

$x_{1,2}=\frac{-15\pm 5}{-2}$

$x_1=5$

$x_2=10$

x	$-\infty$		-3		$\frac{5}{2}$		5		10		$+\infty$
$2x^2+x-15$	+	+	0	-	0	+	+	+	+	+	+
$-x^2+15x-50$	-	-	-	-	-	-	0	+	0	-	-
$\frac{2x^2+x-15}{-x^2+15x-50}$	-	-	0	+	0	-	|	+	|	-	-

$$x\in[-3;\frac{5}{2}]\cup(5;10)$$

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Ex.7 Să se rezolve inecuaţia: $\dfrac{x^2-8x+15}{x^2-3x-4}<0$

$\dfrac{x^2-8x+15}{x^2-3x-4}<0$

$x^2-8x+15=0$

$\Delta=64-60=4$

$x_{1,2}=\dfrac{8\pm 2}{2}$

$x_1=5$

$x_2=3$

$x^2-3x-4=0$

$\Delta=9+16=25$

$x_{1,2}=\dfrac{3\pm 5}{2}$

$x_1=4$

$x_2=-1$

x	$-\infty$		-1		3		4		5		$+\infty$
$x^2-8x+15$	+	+	+	+	0	-	-	-	0	+	+
x^2-3x-4	+	+	0	-	-	-	0	+	+	+	+
$\dfrac{x^2-8x+15}{x^2-3x-4}$	+	+	|	-	0	+	|	-	0	+	+

$x\in(-1;3)\cup(4;5)$

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Ex.8 Să se rezolve inecuaţia: $\dfrac{x^2-7x+15}{x^2+7x-18}\le 0$

$\dfrac{x^2-7x+15}{x^2+7x-18}\le 0$

$x^2-7x+15=0$

$\Delta = 49-60=-11<0$

$x^2+7x-18=0$

$\Delta = 49+72=121$

$x_{1,2}=\dfrac{-7\pm 11}{2}$

$x_1=\dfrac{4}{2}=2$

$x_2=\dfrac{-18}{2}=-9$

x	$-\infty$		-9				2		$+\infty$
$x^2-7x+15$	+	+	+	+	+	+	+	+	+
$x^2+7x-18$	+	+	0	-	-	-	0	+	+
$\dfrac{x^2-7x+15}{x^2+7x-18}$	+	+	|	-	-	-	|	+	+

$x\in(-9;2)$

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Ex.9 Să se rezolve inecuaţia: $\frac{x^2-x-6}{x^2-x-2}\geq 0$

$\frac{x^2-x-6}{x^2-x-2}\geq 0$

$x^2-x-6=0$

$\Delta=1+24=25$

$x_{1,2}=\frac{1\pm 5}{2}$

$x_1=3$

$x_2=-2$

$x^2-x-2=0$

$\Delta=1+8=9$

$x_{1,2}=\frac{1\pm 3}{2}$

$x_1=2$

$x_2=-1$

x	$-\infty$		-2		-1		2		3		$+\infty$
x^2-x-6	+	+	0	-	-	-	-	-	0	+	+
x^2-x-2	+	+	+	+	0	-	0	+	+	+	+
$\frac{x^2-x-6}{x^2-x-2}$	+	+	0	-	|	+	|	-	0	+	+

$x\in(-\infty;-2]\cup(-1;2)\cup[3;+\infty)$

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Ex.10 Să se rezolve inecuaţia: $\dfrac{-x^2+3x+18}{x-4}>0$

$\dfrac{-x^2+3x+18}{x-4}>0$

$-x^2+3x+18=0$

$\Delta=9+72=81$

$x_{1,2}=\dfrac{-3\pm\sqrt{81}}{-2}=\dfrac{-3\pm 9}{-2}$

$x_1=\dfrac{6}{-2}=-3$

$x_2=\dfrac{-12}{-2}=6$

$x-4=0$

$x=4$

x	$-\infty$		-3		4		6			$+\infty$
$-x^2+3x+18$	-	-	0	+	+	+	0	-	-	-
$x-4$	-	-	-	-	0	+	+	+	+	+
$\dfrac{-x^2+3x+18}{x-4}$	+	+	0	-	|	+	0	-	-	-

$x\in(-\infty;-3)\cup(4;6)$

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Ex11 Să se rezolve inecuaţia: $\dfrac{-x^4+4x^2-4}{x^3-4x}\le 0$

$\dfrac{-x^4+4x^2-4}{x^3-4x}\le 0$

$\dfrac{x^4-4x^2+4}{x^3-4x}\ge 0$

$\dfrac{(x^2-2)^2}{x(x^2-4)}\ge 0$

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

$x^2-2=0$

$x^2=2$

$x_1=x_2=\sqrt{2}$

$x_3=x_4=-\sqrt{2}$

$x=0$

$x^2-4=0$

$x^2=4$

$x_{1,2}=\pm 2$

x	$-\infty$		-2		$-\sqrt{2}$		0		$\sqrt{2}$		2		$+\infty$
$(x^2-2)^2$	+	+	+	+	0	+	+	+	0	+	+	+	+
x	-	-	-	-	-	-	0	+	+	+	+	+	+
x^2-4	+	+	0	-	-	-	-	-	-	-	0	+	+
$\dfrac{(x^2-2)^2}{x(x^2-4)}$	-	-	|	+	0	+	|	-	0	-	|	+	+

$$x\in(-2;0)\cup\{\sqrt{2}\}\cup(2;+\infty)$$