MASSACHUSETTS MATHEMATICS LEAGUE
NOVEMBER 2003
ROUND 1: COMPLEX NUMBERS

ANSWERS

A) $-12/25$

B) $2\sqrt{3}$

C) $-1 \pm i$

A) Simplify and leave in a + bi form. $\frac{5}{4+3i}$, Calculate ab,

$$\frac{5}{4+3i}\,\frac{4-3i}{4-3i} = \frac{20-15i}{25} = \frac{4}{5} - \frac{3}{5}i,$$

$ab = -12/25$

B) Calculate the absolute value of: $\frac{-2\sqrt{3}+6i}{-\sqrt{2}-i\sqrt{2}}$ in simple radical form.

$$\frac{|-2\sqrt{3}+6i|}{|-\sqrt{2}-i\sqrt{2}|} = \frac{\sqrt{12+36}}{\sqrt{2+2}} = \frac{\sqrt{48}}{\sqrt{4}} = \sqrt{12} = 2\sqrt{3}$$

C) Find the imaginary roots of the equation $x^4 + x^3 - 6x^2 - 14x - 12 = 0$

	1	1	−6	−14	−12
3	1	4	6	4	0
−2	1	2	2	0	

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

$x^2 + 2x + 1 = -2 + 1$

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

$x = -1 \pm i$