AA7 Complex Numbers

Questions	Notes

How do I use the Quadratic Formula to find REAL and COMPLEX roots?

- $x^2 + 10x + 30 = 0$

$x = \frac{-10 \pm \sqrt{10^2 - 4(1)(30)}}{2(1)} = \frac{-10 \pm \sqrt{100 - 120}}{2}$ → $\frac{-10 \pm \sqrt{-20}}{2}$ → $\frac{-10 \pm 4.47i}{2}$ → $-5 \pm 2.235i$ → $-5 - 2.235i$

- $2x^2 - 10x + 30 = 0$

$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(2)(30)}}{2(2)}$ → $\frac{10 \pm \sqrt{100 - 240}}{4}$ → $\frac{10 \pm \sqrt{-140}}{4}$ → $\frac{10 \pm 11.83i}{4}$ → $2.5 \pm 2.96i$ → $2.5 - 2.96i$

- $-x^2 + 10x = 30$ (−30 −30)

$-x^2 + 10x - 30 = 0$

$x = \frac{-10 \pm \sqrt{10^2 - 4(-1)(-30)}}{2(-1)} = \frac{-10 \pm \sqrt{100 - 120}}{-2} = 5 \pm 2.235i$

$5 - 2.235i$

- Find the REAL and COMPLEX Roots of $g(x) = (x+2)(x^2 + 3x + 10)$

$x = -2$. $x = \frac{-3 \pm \sqrt{3^2 - 4(1)(10)}}{2(1)} = \frac{-3 \pm \sqrt{9 - 40}}{2} = \frac{-3 \pm \sqrt{-31}}{2} = \frac{-3 \pm 5.57i}{2}$

- Find the REAL and COMPLEX Roots of $h(x) = (x^2 + 4)(x^2 + 3x + 2)(x^2 - 4)(x^2 + 2x + 3)$

$x = \pm 2i$ $x = -2$ $x = -1$ $x = 2$ $x = 2$ $x = \frac{-2 \pm \sqrt{2^2 - 4(1)(3)}}{2(1)}$

$x = \frac{-2 \pm \sqrt{4 - 12}}{2}$

$x = \frac{-2 \pm \sqrt{-8}}{2}$

$x = \frac{-2 \pm 2.83i}{2}$

How do I use the Quadratic Formula (and the discriminant $b^2 - 4ac$ and vertex $x = \frac{-b}{2a}$) to graph parabolas?

- Graph $f(x) = x^2 + 5x + 4$ and $g(x) = -x^2 + 4x + 5$. Label the x-intercepts and vertex for each parabola

$f(x)$: $\frac{-b}{2a} = \frac{-5}{2(1)} = -2.5$

$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(4)}}{2(1)} = \frac{-5 \pm \sqrt{25 - 16}}{2} = \frac{-5 \pm \sqrt{9}}{2}$

$\frac{-8}{2} = -4$ $-2 = -1$

$g(x)$: $\frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{4}{-2} = -2$

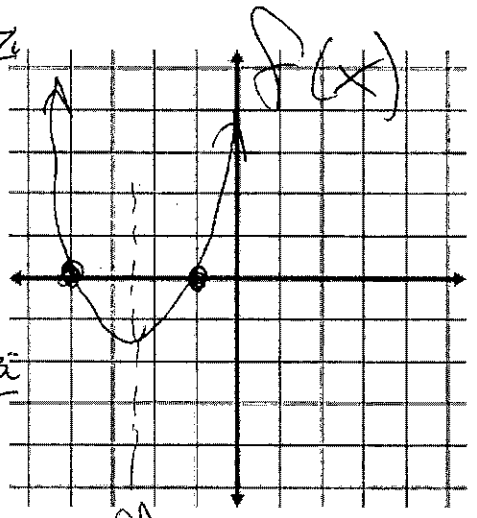
$x = \frac{-4 \pm \sqrt{4^2 - 4(-1)(5)}}{2(-1)} = \frac{-4 \pm \sqrt{16 + 20}}{-2} = \frac{-4 \pm \sqrt{36}}{-2}$

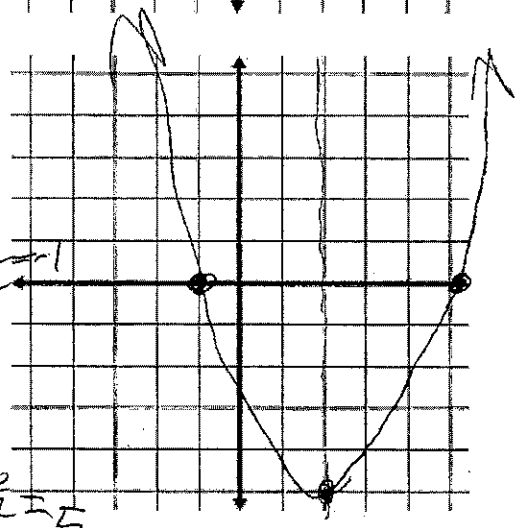
$\frac{2}{-2} = -1$ $\frac{-10}{-2} = 5$

Notes

1) Make sure EQ = 0.
2) Identify a, b, c
3) Set up $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
4) Calculate $b^2 - 4ac$ ← use i if complex
5) Calculate $\sqrt{b^2 - 4ac}$
6) Split into 2 pieces & do $-b + \sqrt{b^2 - 4ac}$, $-b - \sqrt{b^2 - 4ac}$
7) Divide by 2a.

Set = 0. Use QF if necessary.





How do I use REAL and COMPLEX roots to write the polynomial in Standard Form?

- Given a polynomial has roots at $x = 3,\ x = 2\ and\ x = -2$, write the polynomial in Standard form.

$(x-3)(x-2)(x+2)$

$(x^2-5x+6)(x+2)$

$x^3-3x^2-4x+12$

- Given a polynomial has roots at $x = 3,\ x = 2+i\ and\ x = 2-i$, write the polynomial in Standard form.

$(x-3)(x-(2+i))(x-(2-i))$

$(x-3)(x-2-i)(x-2+i)$

If $x=r$ is a root then $(x-r)$ is a factor. Distribute (use a box) to convert to standard form. Combine imaginary parts first.

	x	-2	$+i$
x	x^2	$-2x$	$-ix$
-2	$-2x$	4	$2i$
$+i$	ix	$-2i$	$-i^2$

$= x^2-4x+4-i^2$

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

x^2-4x+5

$(x-3)(x^2-4x+5)$

$x^3-7x^2-7x-15$

- Given a polynomial has roots at $x = 0,\ x = -5+3i\ and\ x = -5-3i$, write the polynomial in Standard form.

$(x-0)(x-(-5+3i))(x-(-5-3i))$

$x(x+5-3i)(x+5+3i)$

	x	5	$-3i$
x	x^2	$5x$	$-3ix$
5	$5x$	25	$-15i$
$3i$	$3ix$	$15i$	$-9i^2$

$= x^2+10x+25-9i^2$

$x^2+10x+25-9(-1)$

$x^2+10x+25+9$

$x^2+10x+34$

So $x(x^2+10x+34) = x^3+10x^2+34x$

How do I ADD, SUBTRACT and MULTIPLY Complex Numbers?

Like Terms Box

- $(10-2i)+(3-i)$

$13-3i$

- $(10-2i)-(3-i)$

$7-i$

- $(10-2i)(3-i)$

	3	$-i$
10	30	$-10i$
$-2i$	$-6i$	$2i^2$

$= 30-10i+2i^2$

$30-10i+2(-1)$

$30-10i-2$

$28-10i$

- $(10-2i)(10+2i)$

	10	$2i$
10	100	$-20i$
$2i$	$20i$	$-4i^2$

$= 100-4i^2$

$100-4(-1)$

$100+4$

104

- $(a+bi)+(a-bi)$

$2a$

- $(a+bi)-(a-bi)$

$2bi$

- $(a+bi)(a-bi)$

	a	bi
a	a^2	abi
$-bi$	$-abi$	$-b^2i^2$

$= a^2-b^2i^2$

$a^2-b^2(-1)$

a^2+b^2