Name_____ Name_____

Rally Coach: Take turns solving problems.

Simplify.

1) $(-2+7i)^2$

$(-2+7i)(-2+7i)$

$4-14i-14i+49i^2$

$4-28i+49(-1)$

$4-28i-49$

$\boxed{-45-28i}$

2) $(3-6i)^2$

$(3-6i)(3-6i)$

$9-18i-18i+36i^2$

$9-36i+36(-1)$

$9-36i-36$

$\boxed{-27-36i}$

3) $\dfrac{-3+6i}{6+3i}$

$= \dfrac{(-3+6i)(6-3i)}{(6+3i)(6-3i)}$

$= \dfrac{-18+36i+9i-18i^2}{36-18i+18i-9i^2}$

$= \dfrac{-18+45i-18(-1)}{36-9(-1)}$

$= \dfrac{-18+45i+18}{36+9}$

$= \dfrac{45i}{45}$

$= \boxed{i}$

4) $\dfrac{-4-i}{2+2i}$

$= \dfrac{(-4-i)(2-2i)}{(2+2i)(2-2i)}$

$= \dfrac{-8-2i+8i+2i^2}{4-4i+4i-4i^2}$

$= \dfrac{-8+6i+2(-1)}{4-4(-1)}$

$= \dfrac{-8+6i-2}{4+4}$

$= \dfrac{-10+6i}{8}$

$= \dfrac{-10}{8}+\dfrac{6}{8}i$

$= \boxed{\dfrac{-5}{4}+\dfrac{3}{4}i}$

Solve each equation with the quadratic formula.

5) $x^2+9=2x$

$x^2-2x+9=0$

$x = \dfrac{-(-2)\pm\sqrt{(-2)^2-4(1)(9)}}{2(1)}$

$= \dfrac{2\pm\sqrt{4-36}}{2}$

$= \dfrac{2\pm\sqrt{-32}}{2}$

$= \dfrac{2\pm\sqrt{16\cdot-2}}{2}$

$= \dfrac{2\pm 4i\sqrt{2}}{2}$

$= \dfrac{2}{2}\pm\dfrac{4i\sqrt{2}}{2} \rightarrow 1+2i\sqrt{2}$

$\boxed{x=1+2\sqrt{2}i,\ x=1-2\sqrt{2}i}$

6) $11n^2=-2-4n$

$11n^2+4n+2=0$

$x = \dfrac{-4\pm\sqrt{4^2-4(11)(2)}}{2(11)}$

$= \dfrac{-4\pm\sqrt{16-88}}{22}$

$= \dfrac{-4\pm\sqrt{-72}}{22}$

$= \dfrac{-4\pm\sqrt{-36\cdot 2}}{22}$

$= \dfrac{-4\pm 6i\sqrt{2}}{22}$

$= \dfrac{-4}{22}\pm\dfrac{6i\sqrt{2}}{22}$

$= \dfrac{-2}{11}\pm\dfrac{3i\sqrt{2}}{11}$

$\boxed{x=\dfrac{-2}{11}+\dfrac{3i\sqrt{2}}{11},\ x=\dfrac{-2}{11}-\dfrac{3i\sqrt{2}}{11}}$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

7) $-2i,\ 2i,\ 1-i$, $1+i$

$x=-2i,\ x=2i,\ x=1-i,\ x=1+i$

$x+2i=0 \quad x-2i=0 \quad x-1+i=0 \quad x-1-i=0$

$f(x)=(x+2i)(x-2i)(x-1+i)(x-1-i)$

$=(x^2+2ix-2ix-4i^2)(x^2-x-ix-x+1+i+ix-i-i^2)$

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

$=x^4-2x^3+2x^2+4x^2-8x+8$

$f(x)=x^4-2x^3+6x^2-8x+8$

8) $3+i,\ 3-i,\ -3i$, $3i$

$x=3+i,\ x=3-i,\ x=-3i,\ x=3i$

$x-3-i=0 \quad x-3+i=0 \quad x+3i=0 \quad x-3i=0$

$f(x)=(x-3-i)(x-3+i)(x+3i)(x-3i)$

$=(x^2-3x+ix-3x+9-3i-ix+3i-i^2)(x^2+3ix-3ix-9i^2)$

$=(x^2-6x+10)(x^2+9)$

$=x^4-6x^3+10x^2+9x^2-54x+90$

$=x^4-6x^3+19x^2-54x+90$

State the number of complex zeros and the possible rational zeros for each function. Then find all zeros.

9) $f(x)=x^3-3x^2+x-3$

NON-CALCULATOR WORK

degree: 3 $\therefore$, 3 complex zeros

possible rational zeros: $\frac{\pm1,\pm3}{\pm1} \Rightarrow \pm1,\pm3$

3	1	−3	1	−3
	↓	3	0	3
	1	0	1	0

$x^2+1=0$

$x^2=-1$

$x=\pm i$

zeros: $3, i, -i$

CALCULATOR

MENU, Algebra
Polynomial Tools
Complex Roots of Polynomials

cPolyRoots(x^3-3x^2+x-3, x)

$\{i,-i,3\}$

zeroes: $i,-i,3$

10) $f(x)=x^3+5x^2+x+5$

degree: 3 $\therefore$, 3 complex zeros

possible rational zeroes: $\frac{\pm1,\pm5}{\pm1} \Rightarrow \pm1,\pm5$

−5	1	5	1	5
	↓	−5	0	−5
	1	0	1	0

$x^2+1=0$

$x^2=-1$

$x=\pm i$

zeroes: $-5, i, -i$

see these steps

cpolyRoots(x^3+5x^2+x+5, x)

$\{-i, i, -5\}$

zeroes: $-i, i, -5$