Questions?

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37,

$5-\sqrt{-12}$

$=5-i\cdot 2\sqrt{3}$

$=5-2i\sqrt{3}$

$=5-2\sqrt{3}\,i$

$2\,\underline{|\,12}$
$2\,\underline{|\,6}$
3

$\sqrt{12}=2\sqrt{3}$

$(-3+\sqrt{-8})+(5-\sqrt{-56})$

$-3+2\sqrt{2}\,i+5-2\sqrt{14}\,i$

$=2+(2\sqrt{2}-2\sqrt{14})i$

$2\,\underline{|\,8}$
$2\,\underline{|\,4}$
2

$\sqrt{8}=2\sqrt{2}$

$2\,\underline{|\,56}$
$2\,\underline{|\,28}$
$2\,\underline{|\,14}$
7

$2\sqrt{14}=\sqrt{56}$

$18i(1-9i)=18i-162i^2$

$=162+18i$

$\begin{array}{r} {}^{7}18 \\ 9 \\ \hline 162 \end{array}$

$(\sqrt{3}+2i)(\sqrt{3}-2i)=\sqrt{3}^2+2^2=3+4=7$

$z=a+bi$

$\bar{z}=a-bi$

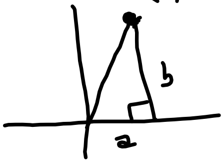
$z\bar{z}=a^2+b^2$

$(a+bi)(a-bi)=a^2-(bi)^2=a^2-b^2i^2=a^2+b^2$

$=|z|^2$

$|z|=\sqrt{a^2+b^2}$

(a,b) or a+bi



$|a+bi|=\sqrt{a^2+b^2}$

$5-\sqrt{-63}$

$=5-3\sqrt{7}\,i$

$$\begin{array}{r|l} 3 & 63 \\ 3 & 21 \\ & 7 \end{array}$$

$(a+b)^2 = a^2+2ab+b^2$

$(a+bi)^2 = a^2+2abi+(bi)^2$

$=a^2+2abi-b^2$

$(bi)^2 = b^2i^2 = -b^2$

$(5+8i)^2 = 5^2+80i+64i^2$

$=25+80i-64$

$=-39+80i$

$$\begin{array}{r} 64 \\ -25 \\ \hline 39 \end{array}$$

$\frac{7}{i}\cdot\frac{-i}{-i} = \frac{-7i}{-i^2} = \frac{-7i}{1} = -7i$

$\left(\frac{4+i}{4-i}\right)\left(\frac{4+i}{4+i}\right) = \frac{4^2+8i+i^2}{4^2+1^2} = \frac{16+8i-1}{17} = \frac{15}{17}+\frac{8}{17}i$

$\frac{6+i}{6-i} = \frac{6^2+12i+i^2}{6^2+1^2} = \frac{35+12i}{37}$ New p

$$\frac{2}{1+i} - \frac{3}{1-i}$$

$$= \left(\frac{2}{1+i}\right)\left(\frac{1-i}{1-i}\right) - \left(\frac{3}{1-i}\right)\left(\frac{1+i}{1+i}\right)$$

$$= \frac{2-2i-(3+3i)}{1^2+1^2} = \frac{2-2i-3-3i}{2} = \frac{-1-5i}{2} = -\frac{1}{2}-\frac{5}{2}i$$

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

$$= (x-1)^2+1 = 0 \Rightarrow$$

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

$$x-1 = \pm\sqrt{-1} = \pm i \Rightarrow$$

$$x = 1 \pm i$$

$$\frac{3}{2}x^2 - 6x + 9 = 0$$

$$\Rightarrow 3x^2 - 12x + 18 = 0$$

$a=3,\ b=-12,\ c=18$

$$b^2-4ac = 12^2-4(3)(18)$$

$$= 144 - 216 = -72$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$= \frac{12 \pm 6\sqrt{2}\,i}{2(3)} =$$

$$= \frac{6(2 \pm \sqrt{2}\,i)}{6} = 2 \pm \sqrt{2}\,i$$

$$\begin{array}{r|l} 2 & 72 \\ 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ & 3 \end{array}$$

$$2 \cdot 3\sqrt{2} = 6\sqrt{2}$$

$$\begin{array}{r} 18 \\ \times 12 \\ \hline 36 \\ 180 \\ \hline 216 \end{array} \qquad \begin{array}{r} 216 \\ -144 \\ \hline 72 \end{array}$$

Conjugate Pairs Theorem:

The nonreal zeros of a polynomial with real coefficients come in conjugate pairs. f(a + bi) = 0 implies f(a - bi) = 0

zeros $-1+\sqrt{2}i$ & -5

$(x-(-1+\sqrt{2}i))(x-(-1-\sqrt{2}i))(x+5)$

$(x+1-\sqrt{2}i)(x+1+\sqrt{2}i)(x+5)$

$=(x+5)(x^2+x+\sqrt{2}ix+x+1+\sqrt{2}i-\sqrt{2}ix-\sqrt{2}i+2)$

$=(x+5)(x^2+x+3)$ $= x^3+x^2+3x$
$5x^2+5x+15$
$x^3+6x^2+8x+15$

$(x+1+\sqrt{2}i)(x+1-\sqrt{2}i) = x^2+x-\sqrt{2}ix+x+1+\sqrt{2}i+\sqrt{2}ix+\sqrt{2}i+2$

$= x^2+2x+3$

$(x+5)(x^2+2x+3) = x^3+2x^2+3x$
$5x^2+10x+15$
$x^3+7x^2+13x+15$

$2x^3 - x^2 + 16x - 8$

$= x^2(2x-1) + 8(2x-1)$

$= (2x-1)(x^2+8)$

$= (2x-1)(x^2 - (2\sqrt{2}i)^2)$

$= (2x-1)(x^2 - (-8))$

$= (2x-1)(x^2 - (2\sqrt{2}i)^2)$

$= (2x-1)(x - 2\sqrt{2}i)(x + 2\sqrt{2}i)$

$\sqrt{8} = 2\sqrt{2}$

$2x-1=0$ OR $x^2+8=0$

$2x=1$ $\quad$ $x^2=-8$

$x=\frac{1}{2}$ $\quad$ $x=\pm\sqrt{-8}=\pm 2i\sqrt{2}$

$2(x-\frac{1}{2})(x-2\sqrt{2}i)(x+2\sqrt{2}i)$

$$\begin{array}{r} 72 \\ 4 \\ \hline 288 \end{array}$$

$x^2 - x + 72 = x^2 - x + \left(\frac{1}{2}\right)^2 - \frac{1}{4} + \frac{72}{1}\cdot\frac{4}{4}$

$= \left(x-\frac{1}{2}\right)^2 + \frac{287}{4} \overset{\text{SET}}{=} 0$

$x - \frac{1}{2} = \pm\frac{\sqrt{287}}{2}i$

$x = \frac{1 \pm \sqrt{287}i}{2}$

$a=1,\ b=-1,\ c=72$

$b^2-4ac = 1^2 - 4(1)(72)$

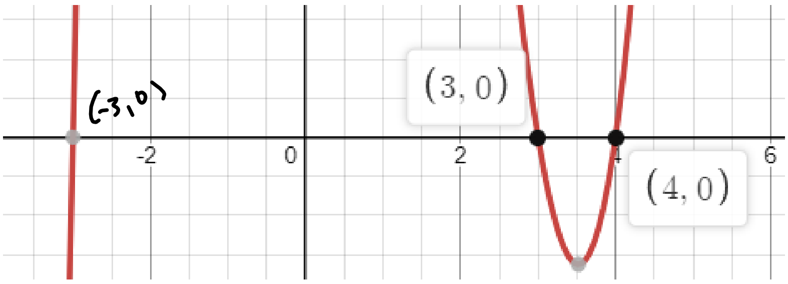
$= 1 - 288 = -287$

$x = \frac{1 \pm \sqrt{287}i}{2}$

Consider the function.

$f(x) = x^3 - 4x^2 - 9x + 36$

Find all zeros and split into a product of linear factors.



$f(x) = x^3 - 4x^2 - 9x + 36 = (x+3)(x-3)(x-4)$

Just off $x = -3$:

$$\begin{array}{r|rrrr} -3 & 1 & -4 & -9 & 36 \\ & & -3 & 21 & -36 \\ \hline & 1 & -7 & 12 & 0 \end{array}$$

This says $f(x) = (x+3)(x^2 - 7x + 12)$

$x^2 - 7x + 12 = (x-4)(x-3) \Rightarrow$

$f(x) = (x-4)(x-3)(x+3)$