Station One: Factoring All Types

1. $25x^2 - 100$

$(5x-10)(5x+10)$

OR GCF=25

$25(x^2-4)$

$\boxed{25(x-2)(x+2)}$

2. $x^4 - 8x^2 - 9$

$-9 \mid -8$

$-9, 1$

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

Keep going

$\boxed{(x-3)(x+3)(x^2+1)}$

Can't go further because + not −

3. $8x^3 + 27$ SOAP

$(2x+3)(4x^2 - 6x + 9)$

4. $3x^2 + x - 10$

$-30 \mid 1$

$6, -5$

$3x^2 + 6x - 5x - 10$

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

$\boxed{(3x-5)(x+2)}$

Station Two: Finding All Roots

1. $25x^2 - 100 = 0$

$(5x-10)(5x+10)=0$

$x = \frac{10}{5} = 2$ $\quad$ $x = \frac{-10}{5}$

$\boxed{x=2}$ $\quad$ $\boxed{x=-2}$

2. $(x-1)(3x+2)(x-5)=0$

$\boxed{x=1}$ $\boxed{x=\frac{-2}{3}}$ $\boxed{x=5}$

3. $x^3 = 216$

$x^3 - 216 = 0$

$(x-6)(x^2+6x+36)=0$

$\boxed{x=6}$ $\quad$ QF: $x = \frac{-6 \pm \sqrt{36-4(1)(36)}}{2}$

Simplify if you can!

$x = \frac{-6 \pm 6i\sqrt{3}}{2}$

$\boxed{x=-3\pm 3i\sqrt{3}}$

4. $x^2 + 10 = -7x$

$x^2 + 7x + 10 = 0$

$(x+5)(x+2)=0$

$\boxed{x=-5}$ $\boxed{x=-2}$

Station Three: Use Division to Determine Roots

1. $(x^2 - 8x + 12) \div (x-6)$

$$\begin{array}{r|rrr} 6 & 1 & -8 & 12 \\ & \downarrow & 6 & -12 \\ \hline & 1 & -2 & \boxed{0} \end{array}$$

$\boxed{x-2}$

yes it's a ~~root~~ factor!

2. $(3x^3 + 2x - 5) \div (x+5)$

missing x^2

$$\begin{array}{r|rrrr} -5 & 3 & 0 & 2 & -5 \\ & \downarrow & -15 & 75 & -385 \\ \hline & 3 & -15 & 77 & \boxed{-390} \end{array}$$

$3x^2 - 15x + 77 + \frac{-390}{x+5}$

No, $(x+5)$ is not a factor

3. $(x^3 + 4x^2 + x - 9) \div (x-3)$

$\boxed{x^2 + 7x + 22 + \frac{57}{x-3}}$

$$\begin{array}{r|rrrr} 3 & 1 & 4 & 1 & -9 \\ & \downarrow & 3 & 21 & 66 \\ \hline & 1 & 7 & 22 & \boxed{57} \end{array}$$

No, $(x-3)$ is not a factor.

4. $(x^2 + 6x + 5) \div (x+3)$

$$\begin{array}{r|rrr} -3 & 1 & 6 & 5 \\ & & -3 & -9 \\ \hline & 1 & 3 & \boxed{-4} \end{array}$$

$\boxed{x + 3 + \frac{-4}{x+3}}$

No, $(x+3)$ is not a factor

Station 4: Rational Root Theorem

Find all possible roots. Then determine which are actually roots.

1. $2x^3 + 4x^2 - 7x + 5$

All possible roots: $\dfrac{\pm 5, \pm 1}{\pm 2, \pm 1}$

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

Using calculator:

~~Only~~ None are Real Roots

2. $x^4 + 4x - 8$

Possible: $\pm 4, \pm 2, \pm 8, \pm 1$

Only -2 is an actual Root

Station 5: Writing Equations

Write the equations for the polynomials with the given roots in standard form.

1. $x = 0, 9, 9$

$(x-0)(x-9)(x-9)$

$x(x-9)(x-9)$

$x(x^2-18x+81)$

$\boxed{y = x^3 - 18x^2 + 81x}$

2. $x = 2i, 3$

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

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

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

$\boxed{y = x^3-3x^2+4x-12}$