7.)

$$
\begin{array}{r}
3x + 8 \\
x^2 + x + 0 \overline{\big) 3x^3 + 11x^2 + 4x + 1} \\
-3x^3 \mp 3x^2 \\
\hline
8x^2 + 4x + 1 \\
-8x^2 \mp 8x \mp 0 \\
\hline
-4x + 1
\end{array}
$$

$$3x + 8 + \frac{-4x+1}{x^2+x}$$

9.) $x^2+2x-4 \overline{\big)\, 5x^4-2x^3-7x^2+0-39}$

$$
\begin{array}{r}
5x^2-12x+37 \\
\hline
-5x^4+10x^3+20x^2 \\
\hline
-12x^3+13x^2+0 \\
+12x^3+24x^2-48x \\
\hline
37x^2-48x-39 \\
-37x^2-74x+148 \\
\hline
-122x+109
\end{array}
$$

4)

$$
\begin{array}{r|rrrrr}
\sqrt{2} & 1 & 0 & -6 & 0 & 8 \\
 & & \sqrt{2} & 2 & -4\sqrt{2} & -8 \\
\hline
 & 1 & \sqrt{2} & -4 & -4\sqrt{2} & 0
\end{array}
$$

$$x^3 + \sqrt{2}x^2 - 4x - 4\sqrt{2}$$

2.6: Rational Zero Theorem

<u>The Rational Zero Theorem</u>

If $f(x)$ is a polynomial then every rational zero of $f(x)$ comes in the form of...

$$\frac{\text{factors of constant term}}{\text{factors of leading coeff.}}$$

Day 4:

ADDITIONAL HW PAGE 142: 25 - 29 ODD

ex: List the possible rational zeros.

a) $f(x) = 2x^3 - 7x^2 + 9$

factors of constant term : $\pm 1, \pm 3, \pm 9$

factors of lead. coeff : $\pm 1, \pm 2$

$$\frac{\pm 1, \pm 3, \pm 9}{\pm 1, \pm 2} = \pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}$$

ex: List the possible rational zeros.

b) $f(x) = \overset{q}{4}x^4 - x^3 - 7x^2 + 4x - \overset{p}{2}$

constant term : $\pm 1, \pm 2$

lead. coeff : $\pm 1, \pm 2, \pm 4$

$$\frac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 4} = \pm 1, \pm 2, \pm \frac{1}{2}, \pm \frac{1}{4}$$

Complex Conjugate & Irrational Conjugate Theorem

Imaginary and irrational roots always come in conjugate pairs.

$3i, -3i$

$2+\sqrt{6}, 2-\sqrt{6}$

$-2+\sqrt{6}, -2-\sqrt{6}$

$\sqrt{10}, -\sqrt{10}$

ex: Write a polynomial equation in standard form with integral coefficients and the given solutions.

b) $1 \pm \sqrt{2}$

$1+\sqrt{2},\ 1-\sqrt{2}$

Sum : 2

product : -1

$(1-\sqrt{2})(1+\sqrt{2})$

$1-2$

-1

$$\boxed{y = x^2 - 2x - 1}$$

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

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

$\pm\sqrt{2} = x - 1\ ;\ x = 1 \pm \sqrt{2}$

ex: Write a polynomial function in standard form with integral coefficients and the given roots.

a) $-\frac{2}{5}$, $3i$, $-3i$

$$y = (5x+2)(x-3i)(x+3i)$$

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

$$\boxed{y = 5x^3+2x^2+45x+18}$$

"Sum and Product Trick" - FOR QUADRATICS ONLY

$y = ax^2 + bx + c$

$y = x^2 + 5x + 6$

$y = (x + 2)(x + 3)$

Roots: -2 | -3

Sum of roots = -2 + -3 = -5

Product of roots = -2 • -3 = 6

3, -7

Sum: -4

Product: -21

$x^2 + 4x - 21 = y$

What to know...

Sum of Roots: $-b$

Product of Roots: c

ex: Write a polynomial equation in standard form with integral coefficients and the given solutions.

d) $3 \pm i$, 2

Sum: $3+i+3-i=6$

product $(3+i)(3-i)=10$

$9-i^2$

Sum: 6

product: 10

$(x^2-6x+10)(x-2)=0$

ex: Write a polynomial function in standard form with integral coefficients and the given roots.

b) 0 multiplicity 5, $1-\sqrt{3}$

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

$y = x^7 - 2x^6 - 2x^5$

$(1 \pm \sqrt{3})$

Sum: 2

product: -2

$(1+\sqrt{3})(1-\sqrt{3})$

$1-3$

-2