(#12) $f(x) = x^3 + 49x$; $0, 7i, -7i$

$= x(x^2 + 49)$

$7i \mid 1 \quad 0 \quad 49 \quad 0$

$ \quad 7i \quad -49 \quad 0$

$\overline{ 1 \quad 7i \quad 0 \quad \boxed{0}}$

$x(x^2 + 49) = 0$

$\boxed{x = 0}$

$x^2 = -49$

$\boxed{x = \pm 7i}$

$-7i \mid 1 \quad 0 \quad 49 \quad 0$

$ \quad -7i \quad -49 \quad 0$

$\overline{ 1 \quad -7i \quad 0 \quad \boxed{0}}$

(#26) $h(x) = x^2 - 4x - 3$

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

$$\frac{4 \pm \sqrt{16 + 12}}{2} = \frac{4 \pm \sqrt{28}}{2}$$

$$= \frac{4 \pm 2\sqrt{7}}{2}$$

$$= \boxed{2 \pm \sqrt{7}}$$

#30 $f(x) = (3x^3 - 2x^2) + (75x - 50)$

$$= x^2(3x-2) + 25(3x-2).$$

$$f(x) = (3x-2)(x^2+25).$$

$$f(x) = 0 \therefore \quad x = \frac{2}{3}, \pm 5i \checkmark$$

34 $f(s) = 3s^3 - 4s^2 + 8s + 8.$

$$= (s-\frac{2}{3})(3s^2 - 6s + 12).$$

$\frac{p}{q} = \pm 1, \pm 2, \pm 4, \pm 8, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{4}{3}, \pm \frac{8}{3}.$

$\boxed{\frac{2}{3}}$

	3	−4	8	8
		2	−4/3	4/9
	3	−2	$\frac{20}{3}$	$\checkmark$

$-\frac{2}{3}$

	3	−4	8	8
		−2	4	−8
	3	−6	12	$\boxed{0}$.

$\frac{2 \pm \sqrt{-12}}{2}$

$\boxed{1 \pm i\sqrt{3}}$

$s^2 - 2s + 4 = 0 \quad \therefore \quad s = \dfrac{2 \pm \sqrt{4 - 4(1)(4)}}{2}$

(#40) $f(x) = (2x^3 - 5x^2) + (18x - 45)$

$$= x^2(2x - 5) + 9(2x - 5).$$

b) $f(x) = (x^2 + 9)(2x - 5).$

a) zeros $\pm 3i$, $5/2$.

c) X-int $x = 5/2$

(#54) degree 3, $f(x) = a(x - x_1)(x - x_2)(x - x_3)$

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

a) $f(x) = a(x + 2)((x - 2)^2 + 8).$

$f(-1) = -34$

$2 + 2\sqrt{2}i$

$2 - 2\sqrt{2}i$

$x^2 - (4)x + 12$

$-34 = a(1)(17).$ $\boxed{a = -2}$

a) $f(x) = -2(x + 2)(x^2 - 4x + 12).$

b) $\boxed{f(x) = -2x^3 + 4x^2 - 8x - 48}$

(64) $f(x) = x^3 + 4x^2 + 14x + 20.$

$x^2 - 5x + P$

$= (x+2)(x^2 + 2x + 10)$ ✓

$\boxed{\begin{array}{c} -1 - 3i \\ -1 + 3i \end{array}}$

$i = -2$

Sum

P = product.

$\left(x^2 - (-2)x + 10\right)$

$f(x) = \left(x - (-1 - 3i)\right)\left(x - (-1 + 3i)\right)$

$(x - c)$

$f(x) = \left((x+1)^2 + 9\right)(x - c).$

$x - c = \dfrac{f(x)}{x^2 + 2x + 10}$

$$\begin{array}{r} x + 2 \\ x^2+2x+10 \overline{\smash{\big)}\ x^3 + 4x^2 + 14x + 20} \\ \underline{-\ x^3 + 2x^2 + 10x} \\ 2x^2 + 4x + 20 \\ \underline{-\ 2x^2 + 4x + 20} \\ \boxed{0} \ \checkmark \end{array}$$