

p 179 # 1, 3, 9, 11, 13, 23, 29, 65, 71

①  $x(x-6)^2$

zeros:  $0, 6$

③  $g(x) = (x-2)(x+4)^3$  zeros:  $2, -4$

⑨  $f(x) = 2x^4 - 17x^3 + 35x^2 + 9x - 45$

p:  $\pm 45, \pm 15, \pm 9, \pm 5, \pm 3, \pm 1$

q:  $\pm 2, \pm 1$

$\pm 45, \pm \frac{45}{2}, \pm 15, \pm \frac{15}{2},$   
 $\pm 9, \pm \frac{9}{2}, \pm 3, \pm \frac{3}{2}, \pm 1$

⑪  $f(x) = x^3 - 6x^2 + 11x - 6$

p:  $\pm 6, \pm 3, \pm 2, \pm 1$

q:  $\pm 1$

11	1	-6	11	-6	
		1	-5	6	
		1	-5	6	yes!

$(x-1)(x^2 - 5x + 6)$

$(x-1)(x-3)(x-2)$

zeros:  $1, 3, 2$

⑬  $g(x) = x^3 - 4x^2 - x + 4$

p:  $\pm 4, \pm 2, \pm 1$

q:  $\pm 1$

11	1	-4	-1	4	
		1	-3	-4	
		1	-3	-4	yes!

$(x-1)(x^2 - 3x - 4)$

$(x-1)(x-4)(x+1)$

$x=1, x=4, x=-1$

23

$$2y^4 + 7y^3 - 2by^2 + 23y - 6 = 0$$

$p: \pm 6, \pm 3, \pm 2, \pm 1 \rightarrow \pm 6, \pm 3, \pm \frac{3}{2}, \pm 2, \pm 1, \pm \frac{1}{2}$   
 $q: \pm 1, \pm 2$

1	2	7	-26	23	-6
		9	-17	6	0
	2	9	-17	6	0

$$(x-1)(2x^3 + 9x^2 - 17x + 6)$$

$$(x-1)(x+6)(2x^2 - 3x + 1)$$

-6	2	9	-17	6
	-12	18	-6	0
	2	-3	1	0

$$(x-1)(x+6)(2x-1)(x-1)$$

zeros: 1, -6,  $\frac{1}{2}$

29

$$f(x) = -2x^4 + 13x^3 - 21x^2 + 2x + 8$$

$p: \pm 8, \pm 4, \pm 2, \pm 1 \rightarrow \pm 8, \pm 4, \pm 2, \pm 1, \pm \frac{1}{2}$   
 $q: \pm 2, \pm 1$

$-\frac{1}{2}, 1, 2, 4$

65

$$h(x) = x^3 - x + 6$$

$\pm 6, \pm 3, \pm 2, \pm 1$

-2	1	0	-1	6
	-2	4	-6	0
	1	-2	3	0

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

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

$$\frac{-(-2) \pm \sqrt{4 - 4(3)}}{2} = -1 \pm \frac{\sqrt{8}}{2} = -1 \pm \frac{2i\sqrt{2}}{2} = -1 \pm i\sqrt{2}$$

71)  $f(x) = x^4 + 10x^2 + 9$

$\pm 9, \pm 3, \pm 1$

$$\begin{array}{r|rrrrr} 1 & 1 & 0 & 10 & 0 & 9 \\ & & 1 & 1 & 11 & 11 \\ \hline & 1 & 1 & 11 & 11 & x \end{array}$$

$$\begin{array}{r|rrrrr} -1 & 1 & 0 & 10 & 0 & 9 \\ & & -1 & 1 & -11 & 11 \\ \hline & 1 & -1 & 11 & -11 & \end{array}$$

$$\begin{array}{r|rrrrr} 3 & 1 & 0 & 10 & 0 & 9 \\ & & 3 & 9 & 57 & \\ \hline & 1 & 3 & 19 & 57 & \end{array}$$

$$\begin{array}{r|rrrrr} -3 & 1 & 0 & 10 & 0 & 9 \\ & & -3 & 9 & -57 & \\ \hline & 1 & -3 & 19 & -57 & \end{array}$$

$$\begin{array}{r|rrrrr} 9 & 1 & 0 & 10 & 0 & 9 \\ & & 9 & 81 & 729 & \\ \hline & 1 & 9 & 91 & & \end{array}$$

$$\begin{array}{r|rrrrr} -9 & 1 & 0 & 10 & 0 & 9 \\ & & -9 & -81 & -639 & \\ \hline & 1 & -9 & 71 & -639 & \end{array}$$

$$x^4 + 10x^2 + 9 = (x^2 + 9)(x^2 + 1)$$

$$x^2 = -9 \quad x^2 = -1$$

$$x = \pm 3i \quad x = \pm i$$

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

