

③ $f(x) = x^4 + 3x^3 - 13x^2 - 15x$

$f(x) = (x-3)(x^3 + 6x^2 + 5x)$

$f(x) = (x-3)(x)(x^2 + 6x + 5)$

$f(x) = (x-3)(x)(x+5)(x+1)$

$x = 3, 0, -5, -1$

3	1	3	-13	-15	0
	↓	3	18	15	0
	1	6	5	0	0

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⑤  $f(x) = x^3 - 7x^2 + 2x + 40$

$f(x) = (x-5)(x^2 - 2x - 8)$

$f(x) = (x-5)(x-4)(x+2)$

$x = 5, 4, -2$

|   |   |    |     |     |
|---|---|----|-----|-----|
| 5 | 1 | -7 | 2   | 40  |
|   | ↓ | 5  | -10 | -40 |
|   | 1 | -2 | -8  | 0   |

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$$\textcircled{9} \quad f(x) = 5x^3 + 21x^2 - 21x - 5$$

$$f(x) = (x+5)(5x^2 - 4x - 1)$$

$$f(x) = (x+5)(5x+1)(x-1)$$

$$x = -5, -\frac{1}{5}, 1$$

|    |   |     |     |    |
|----|---|-----|-----|----|
| -5 | 5 | 21  | -21 | -5 |
|    | ↓ | -25 | 20  | 5  |
|    | 5 | -4  | -1  | 0  |

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$$\textcircled{6} \quad f(x) = x^3 - 3x^2 - 9x + 27$$

$$f(x) = (x-3)(x^2 - 9)$$

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

$$x = 3, 3$$

|   |   |    |    |     |
|---|---|----|----|-----|
| 3 | 1 | -3 | -9 | 27  |
|   | ↓ | 3  | 0  | -27 |
|   | 1 | 0  | -9 | 0   |

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⑧  $f(x) = 25x^3 + 150x^2 + 131x + 30$   
 $f(x) = (5x+3)(25x^2 + 135x + 50)$   
 $(5x+3)(5)(5x^2 + 27x + 10)$   
 $f(x) = (5x+3)(5)(x+5)(5x+2)$

$5x+3=0$   
 $\frac{5x}{5} = \frac{-3}{5}$   
 $x = -\frac{3}{5}$

|    |     |     |     |
|----|-----|-----|-----|
| 25 | 150 | 131 | 30  |
|    | -15 | -81 | -36 |
| 25 | 135 | 50  | 0   |

$x = -\frac{3}{5}, -5, -\frac{2}{5}$

⑨  $x^2 + 27x + 10$   
 $x^2 + 27x + 50$   
 $(x + \frac{25}{5})(x + \frac{2}{5})$   
 $(x+5)(5x+2)$

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## Rational Root Theorem

$$0 = ax^n + bx^{n-1} + cx^{n-2} \dots \dots \dots Z$$

real roots must be

any combination of the factors of Z

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any combination of the factors of a

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ex) ⑪  $f(x) = 5x^3 + 9x^2 - 26x - 24$

$5 \cdot 1$  (circled)

Factors of 24:  $\begin{matrix} 1 & 24 \\ 2 & 12 \\ 3 & 8 \\ 4 & 6 \end{matrix}$  (circled)

± 24, ± 12, ± 8, ± 6, ± 4, ± 3, ± 2, ± 1, ± 1/2, ± 1/3, ± 1/4, ± 1/6, ± 1/8, ± 1/12, ± 1/24

± 1, ± 1/5

1 | 5 9 -26 -24

↓

5

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Determine all the zeroes of  $P(x) = x^4 - 7x^3 + 17x^2 - 17x + 6$

Possible roots: ± 6, ± 3, ± 2, ± 1

$(x-2) \rightarrow x=2$

2 | 1 -7 17 -17 6

↓

2 -10 14 -6

1 -5 7 -3 0

$P(x) = (x-2)(x^3 - 5x^2 + 7x - 3)$

3 | 1 -5 7 -3

↓

3 -6 3

1 -2 1 0 ✓

$P(x) = (x-2)(x-3)(x^2 - 2x + 1)$

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

$P(x) = x^4 - 7x^3 + 17x^2 - 17x + 6 = (x-1)^2(x-2)(x-3)$

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