The method: The factor theorem

If P(c) = 0, then x − c is a factor. Divide it out, then factor the quadratic that is left.

$x^3 + x^2 - 10x + 8$; x + 4 is a factor → $(x + 4)(x - 2)(x - 1)$

−4	1	1	−10	8
		−4	12	−8
	1	−3	2	0

divide by x + 4: the remainder 0 shows it is a factor

$x^3 + x^2 - 10x + 8 = (x + 4)(x^2 - 3x + 2)$ the bottom row is the other factor

$(x + 4)(x^2 - 3x + 2) = (x + 4)(x - 2)(x - 1)$ factor the quadratic

$2x^3 - 20x^2 + 62x - 60$; x − 2 is a factor → $2(x - 2)(x - 5)(x - 3)$

2	2	−20	62	−60
		4	−32	60
	2	−16	30	0

divide by x − 2: the remainder 0 shows it is a factor

$2x^3 - 20x^2 + 62x - 60 = (x - 2)(2x^2 - 16x + 30)$

the bottom row is the other factor

$(x - 2)(2x^2 - 16x + 30) = 2(x - 2)(x - 5)(x - 3)$

factor the quadratic (take out 2 first)

Problems 1 and 2 worked out · Version 0A

$2x^3 - 8x^2 - 34x + 120$; x − 5 is a factor → $2(x - 5)(x + 4)(x - 3)$

5	2	−8	−34	120
		10	10	−120
	2	2	−24	0

divide by x − 5: the remainder 0 shows it is a factor

$2x^3 - 8x^2 - 34x + 120 = (x - 5)(2x^2 + 2x - 24)$ the bottom row is the other factor

$(x - 5)(2x^2 + 2x - 24) = 2(x - 5)(x + 4)(x - 3)$

factor the quadratic (take out 2 first)

$x^3 - 21x - 20$; x − 5 is a factor → $(x - 5)(x + 4)(x + 1)$

5	1	0	−21	−20
		5	25	20
	1	5	4	0

divide by x − 5: the remainder 0 shows it is a factor

$x^3 - 21x - 20 = (x - 5)(x^2 + 5x + 4)$ the bottom row is the other factor

$(x - 5)(x^2 + 5x + 4) = (x - 5)(x + 4)(x + 1)$ factor the quadratic

The factor theorem · Version 0A

1) $2(x - 5)(x + 4)(x - 3)$ 2) $(x - 5)(x + 4)(x + 1)$
3) $2(x + 2)(x)(x - 4)$ 4) $(x + 1)(x - 5)(x + 5)$

Answer key

5) $2(x + 5)(x - 1)(x + 2)$ 6) $(x - 1)(x + 2)(x + 4)$
7) $(x - 1)(x + 3)(x + 2)$ 8) $2(x + 5)(x - 5)(x - 2)$
9) $(x - 4)(x + 1)(x - 2)$ 10) $(x + 3)(x - 3)(x - 5)$
11) $(x - 2)(x + 1)(x - 3)$ 12) $(x - 3)(x + 2)(x + 1)$
13) $(x - 4)(x - 2)(x - 1)$ 14) $(x - 3)(x)(x - 4)$