DIFFERENT METHODS TO FACTORISE A CUBIC POLYNOMIAL (3RD DEGREE)	
METHOD AND DESCRIPTION OF STEPS	EXAMPLES
SUM AND DIFFERENCE OF CUBES	A) $f(x) = x^3 + 27$ $= (x + 3)(x^2 - 3x + 9)$ Cannot factorise further B) $f(x) = 8x^3 - 1$ $= (2x - 1)(4x^2 + 2x + 1)$ Cannot factorise further
FACTORISE BY GROUPING • **Group terms in two pairs** • **Take out common factor from each pair** • **Two sets of brackets now become common factor** • **Factorise bracket further if possible**	$f(x) = x^3 + 3x^2 - 4x - 12$ $= x^2(x + 3) - 4(x + 3)$ $= (x + 3)(x^2 - 4)$ $= (x + 3)(x + 2)(x - 2)$
FACTORISE BY INSPECTION • **Find one linear factor using factor theorem** • **Find other factor (quadratic expression) by inspection**	$f(x) = 2x^3 - 2x^2 - 10x - 6$ $f(-1) = 2(-1)^3 - 2(-1)^2 - 10(-1) - 6 = 0$ $\therefore (x + 1)$ is a factor $f(x) = (x + 1)(ax^2 + bx + c)$ Now find these coefficients Start with a and c: $1 \times a = 2 \ \therefore a = 2$ $1 \times c = -6 \therefore c = 6$ You now need to find b: Multiply the two brackets; the two x^2-terms need to give you $-2x^2$: $f(x) = (x + 1)(2x^2 + bx + 6)$ $bx^2 + 2x^2 = -2x^2 \quad \therefore b = -4$ $\therefore f(x) = (x + 1)(2x^2 - 4x + 6)$ $= (x + 1)(2x + 2)(x - 3)$
SYNTHETIC OR LONG DIVISION • **Find one linear factor using factor theorem** • **Find other factor (quadratic expression) by long division or synthetic division** **(SEE NEXT PAGE)**	$f(x) = 2x^3 - 2x^2 - 10x - 6$ $f(-1) = 2(-1)^3 - 2(-1)^2 - 10(-1) - 6 = 0$ $\therefore (x + 1)$ is a factor $f(x) = (x + 1)(ax^2 + bx + c)$ Find a, b, c using synthetic division