Continue w/ Polynomials

Ex: ① Show that $(x+3)$ is a factor of $f(x) = x^4 + 3x^3 - x - 3$, then factor completely + solve.

$+0x^2$

$$\begin{array}{r|rrrrr} -3 & 1 & 3 & 0 & -1 & -3 \\ & \downarrow & -3 & 0 & 0 & 3 \\ \hline & 1 & 0 & 0 & -1 & \boxed{0} \end{array}$$

-3 is a root, which means $(x+3)$ is a factor b/c when divided into $f(x)$, there is no remainder.

OR plug in $x=-3$

$f(-3)=0$ $(-3, 0)$ is a root

$x^4+3x^3-x-3=0$

$x^3(x+3)-1(x+3)=0$

diff. of cubes

$(x+3)(\sqrt[3]{x^3}-\sqrt[3]{1})=0$

$(x+3)^1 \mid (x-1)^1 \mid (x^2+1x+1)=0$

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$x=-3$ $x=1$ $x=\frac{-1\pm\sqrt{1^2-(4\cdot1\cdot1)}}{2(1)}$

C C

$x=\frac{-1\pm\sqrt{-3}}{2}=\frac{-1\pm i\sqrt{3}}{2}$

② Find the zeros of:

$g(x) = x^5+4x^4+x^3-14x^2-20x-8$

$x^5+4x^4+x^3-14x^2-20x-8=0$

Calc: $x=2$

2	1	4	1	-14	-20	-8
	↓	2	12	26	24	8
	1	6	13	12	4	0

Calc:

$X=-1$

-1	1	6	13	12	4
	↓	-1	-5	-8	-4
	1	5	8	4	0

x^3+5x^2+8x+4

calc:

-2	1	5	8	4
	↓	-2	-6	-4
	1	3	2	0

$x^2+3x+2=0$

$(x+2)(x+1)=0$

$-2 \quad -1$

-1	1	3	2
	↓	-1	-2
	1	2	0

-2	1	2
	↓	-2
	1	0

Roots: $-2, -1, 2$

B B C

③ $x^4 - 4x^3 + 3x^2 + 4x - 4 = 0$

-1	1	-4	3	4	-4
	↓	-1	5	-8	4
2	1	-5	8	-4	0
	↓	2	-6	4	
	1	-3	2	0	

$x^2 - 3x + 2 = 0$

$(x-2)(x-1) = 0$

$x = 2 \quad | \quad x = 1$

roots: $\pm 1, 2$

C, C B

④ $x^3 - 8x^2 = 9x - 72$

$-9x + 72 \quad -9x + 72$

$x^3 - 8x^2 - 9x + 72 = 0$

$x^2(x-8) - 9(x-8) = 0$

$(x-8)(x^2 - 9) = 0$

→ ROOTS

$(x-8)(x+3)(x-3) = 0$

8 | -3 | 3

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