Homework 4.2 **PRACTICE: Synthetic Division, Remainder & Factor Theorem. Solve given a zero**

Divide using Synthetic division:

1) $(2x^3 - 3x^2 - 4x + 5) \div (x + 1)$

$-1 \,|\, 2 \;\; -3 \;\; -4 \;\; 5$
$\quad\;\; -2 \;\; 5 \;\; -1$
$\quad 2 \;\; -5 \;\; 1 \;\; 4$

$2x^2 - 5x + 1 + \frac{4}{x+1}$

2) $(8x^2 - 26x - 9) \div (x - 7)$

$7 \,|\, 8 \;\; -26 \;\; -9$
$\quad\;\; 56 \;\; 210$
$\quad 8 \;\; 30 \;\; 201$

$8x + 30 + \frac{201}{x-7}$

3) $(9x^3 + 18x^2 - 4x - 10) \div (x + 2)$

$-2 \,|\, 9 \;\; 18 \;\; -4 \;\; -10$
$\quad\;\; -18 \;\; 0 \;\; 8$
$\quad 9 \;\; 0 \;\; -4 \;\; -2$

$9x^2 - 4 - \frac{2}{x+2}$

4) $(x^6 - 4x^3 - 42) \div (x - 1)$

$1 \,|\, 1 \;\; 0 \;\; 0 \;\; -4 \;\; 0 \;\; 0 \;\; -42$
$\quad\;\; 1 \;\; 1 \;\; 1 \;\; -3 \;\; -3 \;\; -3$
$\quad 1 \;\; 1 \;\; 1 \;\; -3 \;\; -3 \;\; -3 \;\; -45$

$x^5 + x^4 + x^3 - 3x^2 - 3x - 3 - \frac{45}{x-1}$

5) $(2x^4 - 5x^3 + 2x^2 + 5x - 10) \div (x - 2)$

$2 \,|\, 2 \;\; -5 \;\; 2 \;\; 5 \;\; -10$
$\quad\;\; 4 \;\; -2 \;\; 0 \;\; 10$
$\quad 2 \;\; -1 \;\; 0 \;\; 5 \;\; 0$

$2x^3 - x^2 + 5$

6) $(x^3 - 4x^2 + 9) \div (x - 3)$

$3 \,|\, 1 \;\; -4 \;\; 0 \;\; 9$
$\quad\;\; 3 \;\; -3 \;\; -9$
$\quad 1 \;\; -1 \;\; -3 \;\; 0$

$x^2 - x - 3$

7) $(x^4 - 2x^3 - 70x + 20) \div (x - 5)$

$5 \,|\, 1 \;\; -2 \;\; 0 \;\; -70 \;\; 20$
$\quad\;\; 5 \;\; 15 \;\; 75 \;\; 25$
$\quad 1 \;\; 3 \;\; 15 \;\; 5 \;\; 45$

$x^3 + 3x^2 + 15x + 5 + \frac{45}{x-5}$

8) $(4x^4 + 5x^3 + 2x^2 - 1) \div (x + 1)$

$-1 \,|\, 4 \;\; 5 \;\; 2 \;\; 0 \;\; -1$
$\quad\;\; -4 \;\; -1 \;\; -1 \;\; 1$
$\quad 4 \;\; 1 \;\; 1 \;\; -1 \;\; 0$

$4x^3 + x^2 + x - 1$

Use the Remainder & Factor Theorems:

1) What is the remainder when $3x^3 + 10x^2 + x - 6$ is divided by $x + 3$?

$P(-3) = 3(-3)^3 + 10(-3)^2 + (-3) - 6 =$

2) Is $(x - 2)$ a factor of $4x^2 + 13x + 10$? Explain how you know.

$P(2) = 4(2)^2 + 13(2) + 10 \neq 0$ so not a factor.

3) What is the remainder when $3x^3 + 10x^2 + x - 6$ is divided by $x - 1$?

$P(1) = 3(1)^3 + 10(1)^2 + (1) - 6 = 8$

4) Is $(x - 1)$ a factor of $x^3 + 2x^2 - 2x - 1$? Explain how you know.

$P(1) = (1)^3 + 2(1)^2 - 2(1) - 1 = 0$ so is a factor

5) Is $(x + 2)$ a factor of $4x^2 + 13x + 10$? Explain how you know.

$P(-2) = 4(-2)^2 + 13(-2) + 10 = 0$ So yes, factor

Find the zeros using the given information:

1) Find all the zeros of $f(x) = x^3 - 4x^2 + x + 6$ given that $x + 1$ is a factor.

$-1 \,|\, 1 \;\; -4 \;\; 1 \;\; 6$
$\quad\;\; -1 \;\; 5 \;\; -6$
$\quad 1 \;\; -5 \;\; 6 \;\; 0$

$(x+1)(x^2 - 5x + 6)$ factors into $(x+1)(x-2)(x-3)$. $\boxed{x = -1,\ x = 2,\ x = 3}$

2) Solve for all the solutions of $2x^3 - 5x^2 + x + 2 = 0$ given that 2 is a solution.

$2 \,|\, 2 \;\; -5 \;\; 1 \;\; 2$
$\quad\;\; 4 \;\; -2 \;\; -2$
$\quad 2 \;\; -1 \;\; -1 \;\; 0$

$(2x^2 - x - 1)$ factors into $(2x+1)(x-1)$ $\boxed{x = 2,\ x = -1/2,\ x = 1}$

3) Find all the zeros of $g(x) = 2x^3 + 3x^2 + 8x + 12$ if $-\frac{3}{2}$ is a root.

This is a mean question. But I'll solve it for you

1) Factor $2x^3 + 3x^2 + 8x + 12$ first.

$x^2(2x+3) + 4(2x+3)$

$(2x+3)(x^2+4)$

2) Set each $() = 0$ and solve.

$2x + 3 = 0$ $\quad x^2 + 4 = 0$ $\quad x^2 = -4$

$\boxed{x = -3/2}$ (we knew this one.) $\boxed{x = \pm 2i}$ remember imaginary numbers? No? Didn't think so. :)