

Complete as many of the following problems as you can with your group. You do not have to go in order. Each person will be given two specific problems that they must complete and present to either Professor MG or to Stefanie before they leave.

(1) List all the possible rational roots of the following polynomials:

- (a) $x^3 + 5x^2 + 8x + 4$
- (b) $x^3 - x^2 - 2x + 2$
- (c) $3x^3 - 5x^2 + 7x + 3$
- (d) $2x^3 - 10x^2 + 15x - 9$

(2) Find all the roots of the polynomials:

- (a) $x^3 + 5x^2 + 8x + 4$ (Given that -1 is a root)
- (b) $x^3 - 4x^2 - 9x + 36$ (Given -3 is a root)
- (c) $3x^2 - 5x^2 - 16x + 12$ (Given -2 is a root)
- (d) $x^3 + x^2 - 7x + 5$ (Given 1 is a root)

(3) List all the roots along with their multiplicities. Then, try to sketch a graph of what you think the function will look like.

- (a) $y = (x + 2)^3(4 - x)(2x - 1)^2$
- (b) $f(x) = (x + 2)(x - 1)^2(x - 4)^3$
- (c) $f(x) = -\frac{1}{3}(x + 2)^2(x - 3)^3$

(4) Solve the following polynomial equations:

- (a) $x^3 + 3x^2 - x - 3 = 0$
- (b) $x^3 - 2x^2 = 3x - 6$
- (c) $2x^4 - 27x^2 = -3x^3$

Key:

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| (1) | (a) $\pm 1, \pm 2, \pm 4$ | (3) Use graphing utility to check your answers |
| | (b) $\pm 1, \pm 2$ | (a) -2 , mult: 3; $\frac{1}{2}$, mult: 2; 1, mult: 1 |
| | (c) $\pm 1, \pm 3, \pm \frac{1}{3}$ | (b) -2 , mult: 1; 1, mult: 2; 4, mult: 3 |
| | (d) $\pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}$ | (c) -2 , mult 2; 3, mult: 3 |
| (2) | (a) $-1, -2$ | (4) (a) $x = -3, -1, 1$ |
| | (b) $-3, 3, 4$ | (b) $x = 2, \sqrt{3}, -\sqrt{3}$ |
| | (c) $-2, \frac{2}{3}, 3$ | (c) $x = 0, 3, -\frac{9}{2}$ |
| | (d) $1, -1 \pm \sqrt{6}$ | |