

Lesson #12 D: Understanding Roots of Polynomials and Finding the Roots of Higher Order Polynomials (Reference: Lesson #62, #65, #66, #76, #85, #95 & #106 in book)**Problem**

1. **Determine whether each of the following are roots or factors of the given polynomial. (HINT: Synthetic Division may help you in determining this.) (SHOW ALL OF YOUR WORK!!)**

1. Is $(x + 2)$ a factor of $f(x) = x^4 - 4x^3 - 18x^2 + 108x - 135$.

2. Is $x = -4$ a root of $f(x) = x^7 + 10x^6 + 27x^5 - 57x^3 - 30x^2 + 29x + 20$.

3. Is $(x - 1)$ a factor of $f(x) = 5x^5 - 20x^4 + 5x^3 + 50x^2 - 20x - 40$.

4. Is $x = -4$ a root of $f(x) = x^4 + 2x^3 + 10x^2 + 18x + 9$.

5. Is $(2x + 1)$ a factor of $f(x) = 2x^4 - x^3 + 7x^2 - 4x - 4$.

6. Is $x = 4$ a root of $f(x) = x^8 + 2x^7 - 29x^6 - 76x^5 + 199x^4 + 722x^3 + 261x^2 - 648x - 432$.

7. **Determine all the roots of the following polynomial functions. Express all of the roots (REAL or IMAGINARY) in your final answer. (HINT: Fully factor each function to help find all of the roots.)**

7. $f(x) = x^4 - 7x^3 + 17x^2 - 17x + 6$

8. $f(x) = 12x^3 - 41x^2 - 38x + 40$

9. $f(x) = x^3 + 8x^2 - 23x + 6$

10. $f(x) = x^6 - 3x^5 - 6x^4 + 10x^3 + 21x^2 + 9x$

11. $f(x) = x^3 + 4x^2 + 25x + 100$

12. $f(x) = 2x^4 + x^3 + 3x^2 + 3x - 9$

13. $f(x) = x^5 - x^4 + x^3 - x^2 - 12x + 12$

14. $f(x) = 3x^4 + 5x^3 + 25x^2 + 45x - 18$

15. $f(x) = 3x^5 - 375x^2$

16. $f(x) = x^8 + 2x^7 + 4x^6 + 8x^5 - x^4 - 2x^3 - 4x^2 - 8x$