# 5-2 Polynomials, Linear Factors, and Zeros


## A. Factor Completely (Remember to take out the GCF first.)

**1.** $2x^3 + 10x^2 + 12x$

**2.** $x^4 - x^3 - 6x^2$

**3.** $-3x^3 + 18x^2 - 27x$

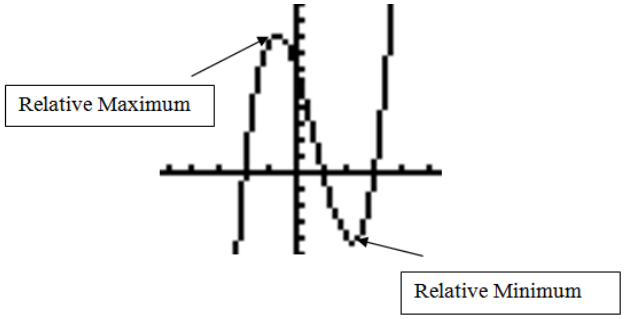
**4.** $x^3 - 2x^2 + x$

$$y = (x+2)(x-1)(x-3)$$

Zeros = X-Intercepts = Roots

$$0 = (x+2)(x-1)(x-3)$$

$$x = -2, 1, 3$$



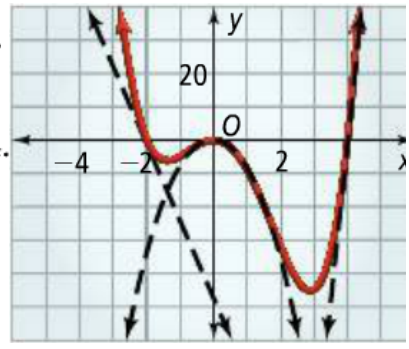

Multiplicity – the number representing the amount of times a zero repeats

$$f(x) = x^4 - 2x^3 - 8x^2$$
$$= x^2(x^2 - 2x - 8) \quad \text{Factor out the GCF, } x^2.$$
$$= x^2(x+2)(x-4) \quad \text{Factor } (x^2 - 2x - 8).$$

*Don't write.*

Since $x^2 = (x-0)^2$, the number 0 is a zero of multiplicity 2. The numbers $-2$ and 4 are zeros of multiplicity 1.

The graph looks close to linear at the $x$-intercepts $-2$ and 4. It resembles a parabola at the $x$-intercept 0.




*Write - When the multiplicity of a zero is:*

*even, the graph resembles a._____.*

*odd, the graph resembles a ____.*

B. Determine the zeros and their multiplicity.

1. $y = (x + 2)(x - 4)$

2. $y = (x + 3)(x - 1)^2$

3. $y = x^4$

4. $y = x^4 - 16x^2$

C. Write the polynomial in <u>standard form</u> with the given zeros.

1. 2, -1 with a multiplicity of 2

2. 5 with a multiplicity of 2, -3

3. -4, 0 with a multiplicity of 3

p. 293 #1-12, 19-34, 44 (44 must be attempted, or no credit.)

**Find the zeros of each function.**

1. $y = x(x - 6)$
2. $y = (x + 4)(x - 5)$
3. $y = (x + 12)(x - 9)(x - 7)$
4. Write a polynomial function in standard form with zeros $-1$, 1, and 0.

5. **Vocabulary** Write a polynomial function $h$ in standard form that has 3 and $-5$ as zeros of multiplicity 2.
6. **Error Analysis** Your friend says that to write a function that has zeros 3 and $-1$, you should multiply the two factors $(x + 3)$ and $(x - 1)$ to ge $f(x) = x^2 + 2x - 3$. Describe and correct your friend's error.

## Practice and Problem-Solving Exercises

MATHEMATICAL PRACTICES

### Practice

**Write each polynomial in factored form. Check by multiplication.** See Pro

7. $x^3 + 7x^2 + 10x$
8. $x^3 - 7x^2 - 18x$
9. $x^3 - 4x^2 - 21x$
10. $x^3 - 36x$
11. $x^3 + 8x^2 + 16x$
12. $9x^3 + 6x^2 - 3x$

**Write a polynomial function in standard form with the given zeros.** See Problem 3.

19. $x = 5, 6, 7$
20. $x = -2, 0, 1$
21. $x = -5, -5, 1$
22. $x = 3, 3, 3$
23. $x = 1, -1, -2$
24. $x = 0, 4, -\frac{1}{2}$
25. $x = 0, 0, 2, 3$
26. $x = -1, -2, -3, -4$

**Find the zeros of each function. State the multiplicity of multiple zeros.** See Problem 4.

27. $y = (x + 3)^3$
28. $y = x(x - 1)^3$
29. $y = 2x^3 + x^2 - x$
30. $y = 3x^3 - 3x$
31. $y = (x - 4)^2$
32. $y = (x - 2)^2(x - 1)$
33. $y = (2x + 3)(x - 1)^2$
34. $y = (x + 1)^2(x - 1)(x - 2)$

44. **Carpentry** A carpenter hollowed out the interior of a block of woo as shown at the right.
   a. Express the volume of the original block and the volume of the wood removed as polynomials in factored form.
   b. What polynomial represents the volume of the wood remaining