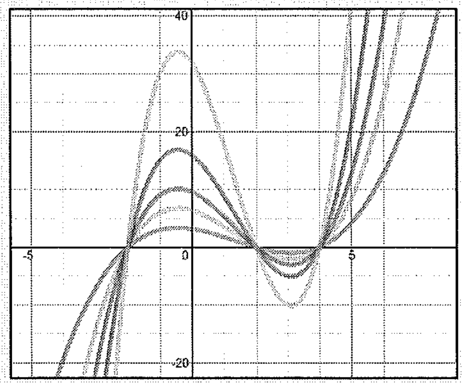
Day 6: 2.4 – *Families of Polynomial Functions*

A family of polynomial functions refers to all polynomial functions that share some characteristic.

Polynomial functions are said to belong to the same family if they have:

- **the same degree**
- **the same zeros of the same order**



A family of polynomial functions may be represented in:

Factored General form:

$$f(x) = k(x - x_1)(x - x_2)\dots(x - x_n)$$

Simplified General Form:

$$f(x) = k(x^n + b_{n-1}x^{n-1} + \dots + b_1x + b_0)$$

Example One- The zeros for a cubic function are -4, 0, and 5

a) Write a **general factored equation for** the family of functions

b) Write the specific family member that goes through the point $(-1,14)$ in **simplified general form.**

$y = a(x+4)(x)(x-5)$

$\left.\begin{matrix} x = -1 \\ y = 14 \end{matrix}\right\}$ $14 = a(-1+4)(-1)(-1-5)$

$14 = a(3)(6)$

$14 = 18a$

$a = \frac{14}{18}$

$a = \frac{7}{9}$

$\therefore y = \frac{7}{9}(x+4)(x)(x-5)$

Example Two - Determine the equation of the parabola in **general simplified form** that passes through the point (5,6) and has roots of $\pm\sqrt{3}$.

$$y = a(x+\sqrt{3})(x-\sqrt{3})$$

$$y = a(x^2-9)$$

$$6 = a(25-9)$$

$$6 = 16a$$

$$a = \frac{3}{8}$$

$$\therefore\ y = \frac{3}{8}(x^2-9)$$

Example Three- A quartic function has zeros ±2 and $3 \pm \sqrt{2}$

a) Write a general simplified equation for the family of functions

b) Determine an equation of the member passing through $(1, -4)$

a) $y = a(x+2)(x-2)(x-3-\sqrt{2})(x-3+\sqrt{2})$

$= a(x^2-4)((x-3)^2-2) = a(x^2-4)(x^2-6x+7)$

b) sub $x=1$ $y=-4$

$$-4 = a(1-4)(1-6+7)$$

$$-4 = a(-3)(2)$$

$$a = \frac{-4}{-6} = \frac{2}{3}$$

$$\therefore\ y = \frac{2}{3}(x^2-4)(x^2-6x+7)$$