3.4 Equations and Graphs of Polynomial Functions

Without the help of a graphing calculator, a polynomial function can be sketched with the following characteristics:

a.) Degree

b.) Sign of leading coefficient

c.) In a factored form

- x-intercepts (zeros)
- multiplicity

d.) y-intercept

<u>Multiplicity</u>

The **multiplicity** of a function is the number of times a zero is repeated:

Example 1: Determine the zeros and the multiplicities of the corresponding zeros for the function. Then determine the degree.

$f(x) = (x-1)^2\,(x-5)(x+2)^3$

There are three types of multiplicities at $x = a$

Multiplicity of 1:

The graph passes through the point.

Even multiplicity:

The graph bounces at the point; the higher the multiplicity the wider it appears.

Odd multiplicity:

The graph passes through the point but is similar to a $y = x^3$ graph.

Example 2: Sketch the following:

State the

i.) Degree

ii.) Leading Coefficient

iii.) End behaviours

iv) zeros

v.) y-intercept

vi.) Regions where the graph is positive

vii.) Regions where the graph is negative

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

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

c.) $y = -2x^3 + 6x - 4$

d.) $y = x^4 - 3x^3 - 6x^2 + 28x - 24$

Example 2: Find a possible equation for the following graphs; determine the least possible degree.