Date: _____

3.4

Graphing Polynomials

Date: _____

R12

Chapter 3: POLYNOMIAL FUNCTIONS
3.4 – Equations and Graphs of Polynomial Functions

Example #1

a) Determine the **zeroes** of the following cubic function (x intercepts)

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

$0 = x^3 - x^2 - 4x + 4$

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

xints: 1, 2, -2

b) Determine the **y – intercept** of the function

Set $x = 0$

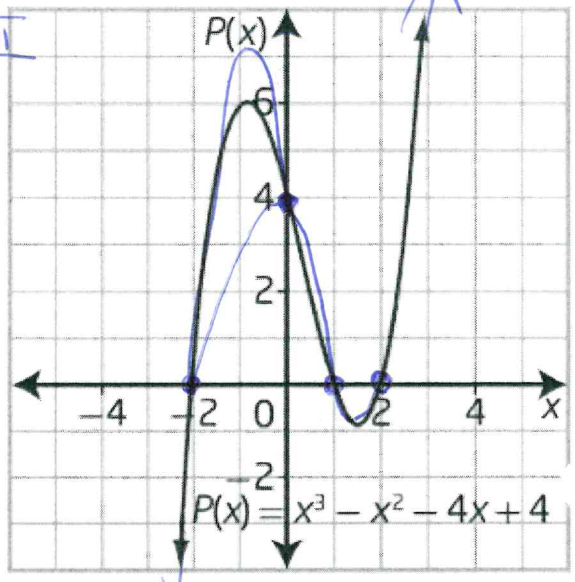
$f(0) = 0^3 - 0^2 - 4(0) + 4$

$= 4$

c) Summarize what we know about this function

Degree	3
Leading Coefficient	1
End Behaviour	up into QI down into QIII
Zeroes	1, 2, -2
y – Intercept	4
Intervals (sign Diagram)	

d) Look at the sketch of the polynomial function.



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Multiplicity of a Zero

If $P(x)$ has a factor $(x-a)$ that is repeated n times, we say that $x=a$ is a zero of multiplicity n.

For example:

$$y=(x+1)^2(x-2)(x-4)^3$$

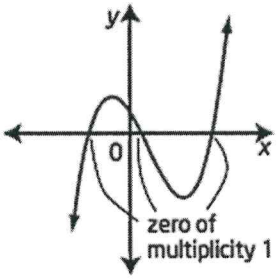
$x=-1$ is a zero of multiplicity 2

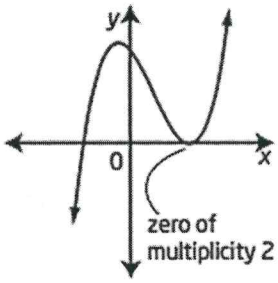
$x=2$ is a zero of multiplicity 1

$x=4$ is a zero of multiplplcity 3

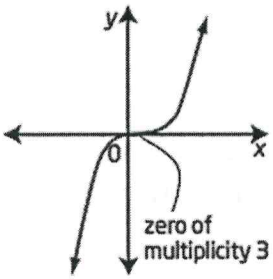
Multiplicity is the number of times the zero of a polynomial occurs. (The number of times a factor is repeated)

The shape of the graph of a function close to a zero (x – intercept) depends on its multiplicity.





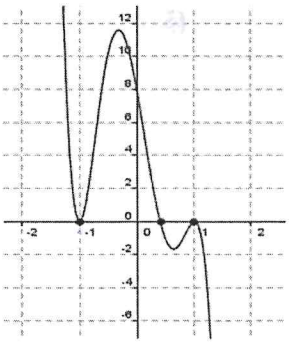
$(x-1)^2$



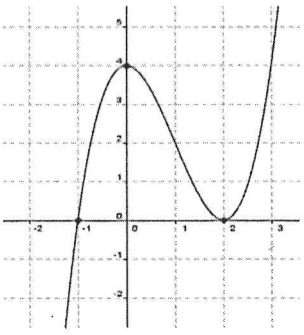
Example #2

Determine the **zeroes** of each polynomial function and their **multiplicities** from the given graphs.

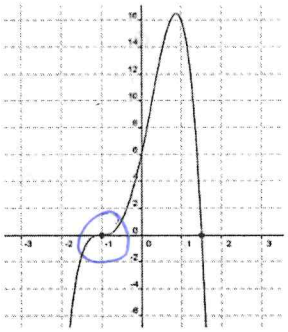
a)



b)



c)



Zero	Multiplicity
-1	2
0.5	1
1	2

Zero	Multiplicity

Zero	Multiplicity
-1	3

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Example #3

Sketch the following graphs:

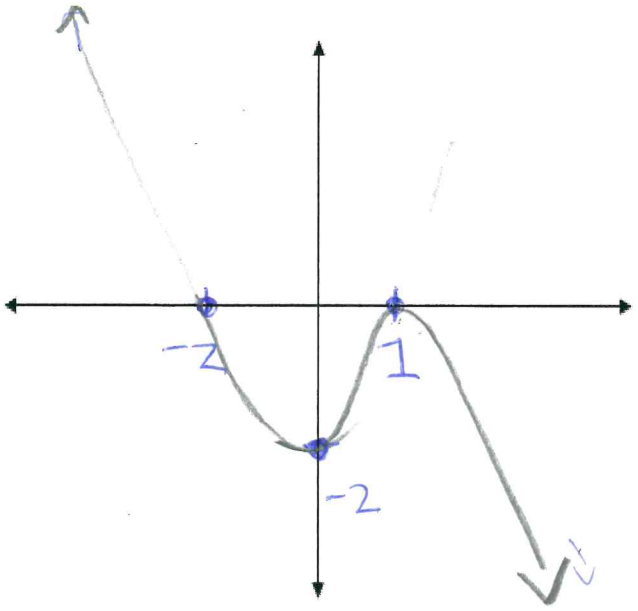
a) $y = -(x-1)^2(x+2)$

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

Degree	3
Leading Coefficient	← negative
End Behaviour	up into Q II down into Q IV
Zeroes	1 and −2
y – intercept	
Intervals (Sign Diagram)	

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

Degree	4
Leading Coefficient	positive
End Behaviour	up into Q I and Q II
Zeroes	−2 and 0
y – intercept	
Intervals (Sign Diagram)	

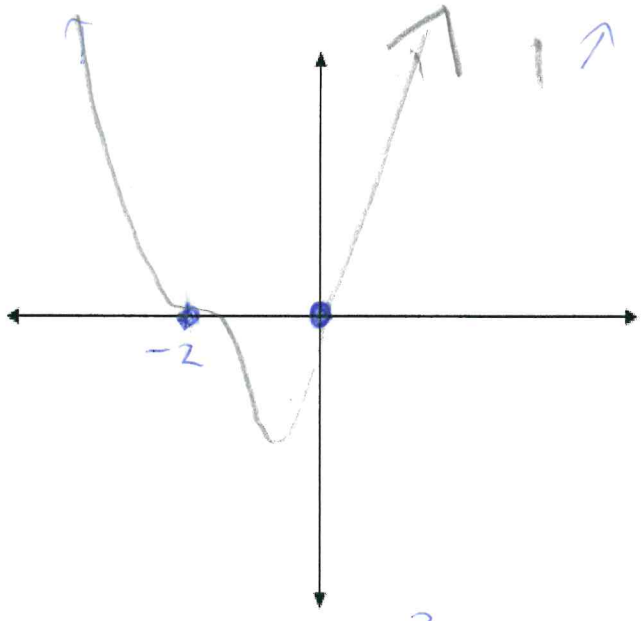


y int:

$y = -(0-1)^2(0+2)$

$y = -(1)(2)$

$y = -2$



$y = x(x+2)^3$

$y = 0(0+2)^3$

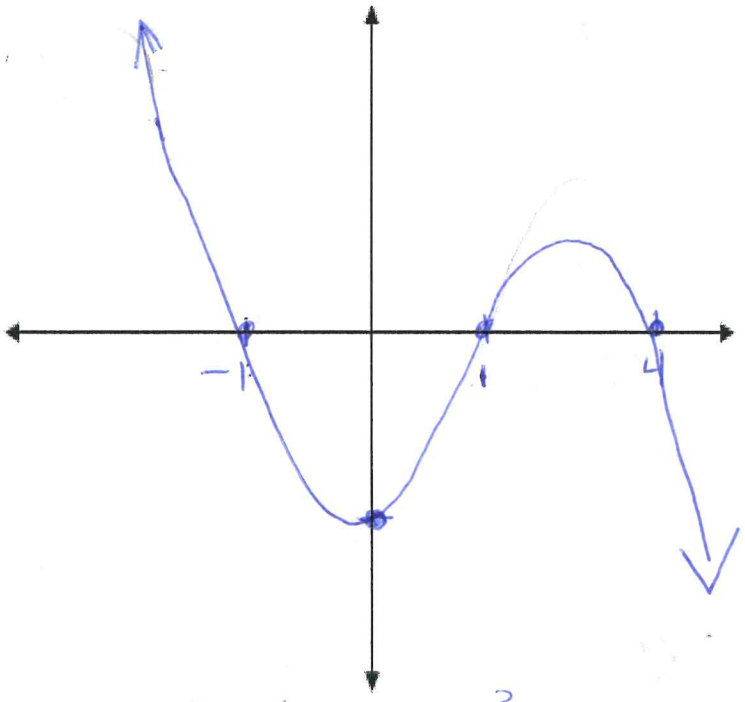
$y = 0$

Example #4

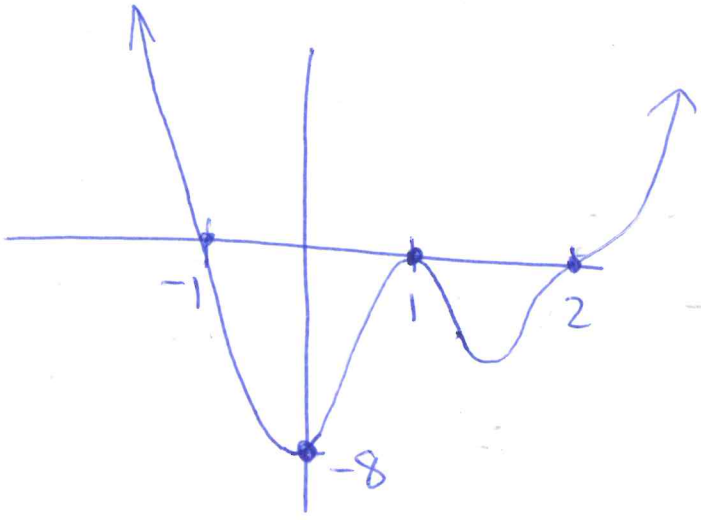
Sketch the graph of $P(x) = -x^3 + 4x^2 + x - 4$

$P(0) = -1((-4)(-1)(1)$

a) $P(x) = -(x-4)(x-1)(x+1)$



b) $P(x) = (x-1)^2(x+1)(x-2)^3$



$P(0) = (-1)^2(1)(-2)^3$

$= 1(1)(-8)$

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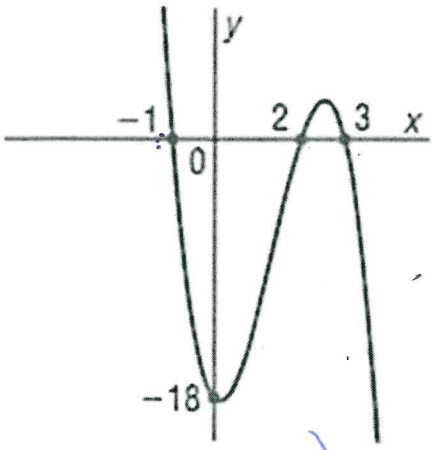
Example #5

Determine the **equation** for the following polynomial function given the graph below.



(0, -18)

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

$-18 = a(0+1)(0-2)(0-3)$

$-18 = a(1)(-2)(-3)$

$-18 = a(6)$

$-3 = a$

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

Example #6

The zeroes of a quartic function are at –2, –1, and 3, with multiplicities of 1, 1, and 2 respectively.

Determine the **equation** of the function that satisfies this condition and passes through the point (1, 24).

x, y

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

$24 = a(1+2)(1+1)(1-3)^2$

$24 = a(3)(2)(4)$

$24 = 24a$

$1 = a$

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