Name: Key Date: 9/25/17

CC ALGEBRA 2 TROICI

## LESSON #1: MULTIPLICITY

Do Now: Given the following quadratic equations, answer the following questions:

I. $x^2 - x - 6 = 0$ (a m)

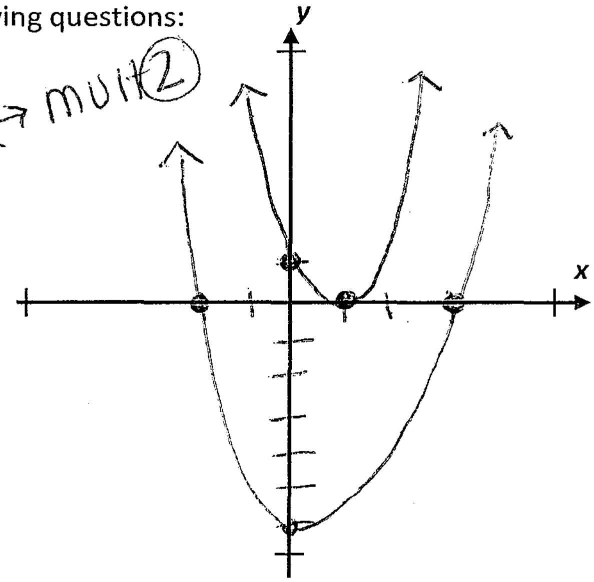
$(x-3)(x+2)$

$x=3$ | $x=-2$ → mult 1, mult 1

II. $x^2 - 2x + 1 = 0$ (a m)

$(x-1)(x-1)$ → mult 2

$x=1$ | $x=1$



a) What is the degree of each polynomial?

2

b) How many roots will you expect there to be?

2

c) What is the leading coefficient of the equations?

1

d) Find the roots of the quadratic equations algebraically and sketch **without** the use of a calculator.

↳ 2 roots + y intercept

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| WORD | DEFINITION |
|---|---|
| Multiplicity | The # of times a polynomial function has a root at a given point |

- When the multiplicity is EVEN, the graph will <u>bounce</u> at the root.
- When the multiplicity is ODD, the graph will <u>pass through</u> at the root.

For questions #1-2,

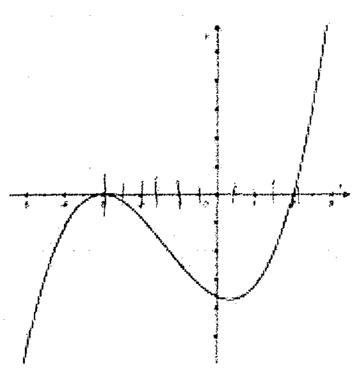
a) Find the zeros of the following polynomial functions.

b) State their multiplicities

c) State the degree of the polynomial.

d) Write the equation in factored form. → don't mult out

1)



a) $-5$, mult 2
$4$, mult 1

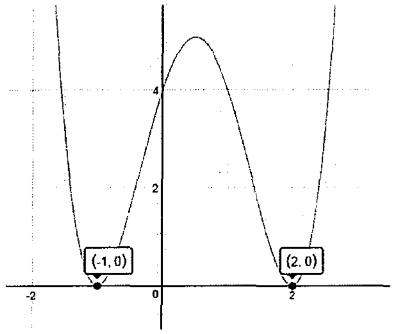
b) degree $= 3$

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

or

$\boxed{y = (x+5)^2(x-4)}$

2)




a) -1 mult 2
2 mult 2

b) Degree = 4

c) $\boxed{y = (x+1)^2(x-2)^2}$

3) State a polynomial that has the roots given {4, -5, 0} and 1 as the leading coefficient.

$y = (x-4)(x+5)(x+0)$

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

$y = (x^2-4x)(x+5)$

$y = x^3 + 5x^2 - 4x^2 - 20x$

$\boxed{y = x^3 + x^2 - 20x}$

**PRACTICE:**

4) Suppose we know that the polynomial equation has three real solutions and that one of the factors of $4x^3 - 12x^2 + 3x + 5 = 0$ is $(x - 1)$. Find all the solutions to the given equation.

① $x - 1 \overline{)4x^3 - 12x^2 + 3x + 5}$ quotient $4x^2 - 8x - 5$

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

$-8x^2 + 3x$

$+8x^2 - 8x$

$-5x + 5$

$+5x - 5$

$0$

② $4x^2 - 8x - 5$ (m: $-20$, a: $-8$)

$4x^2 + 2x - 10x - 5$

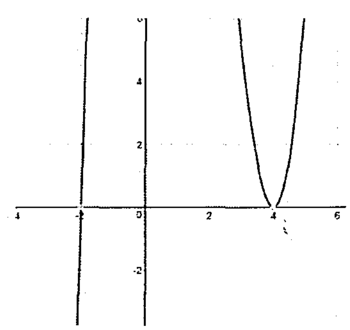
$2x(2x+1) - 5(2x+1)$

$(2x-5)(2x+1)$

$x = \frac{5}{2}$ | $x = -\frac{1}{2}$

③ $\{-\frac{1}{2}, 1, \frac{5}{2}\}$

5) Given the accompanying graph:




a) Find the degree of the equation.

3

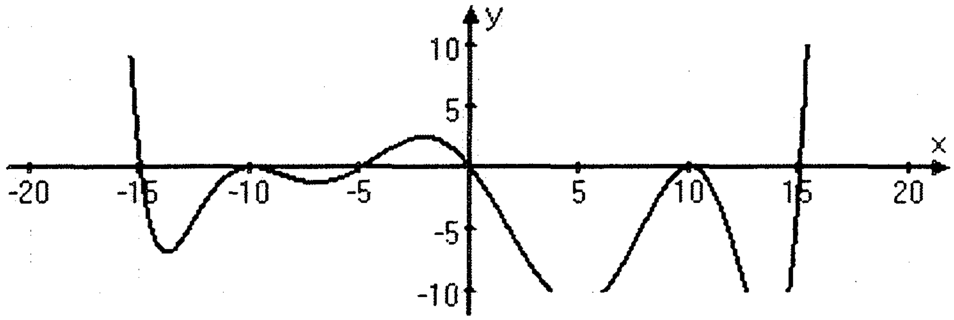
b) Find the zeroes of the graph.

-2, 4 mult 2

c) Identify the factors.

$(x+2)(x-4)^2$

6) The following graph shows an eighth-degree polynomial. List the polynomial's zeroes with their multiplicities (even or odd).




| Zeros | Multiplicity |
|---|---|
| -15 | odd |
| -10 | even |
| -5 | odd |
| 0 | odd |
| 10 | even |
| 15 | odd |

7) Extra Practice: Go back to question #5, and write the equation in standard form.

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

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

$x^2 - 4x - 4x + 16$

$(x^2 - 8x + 16)(x+2)$

| | $x^2$ | $-8x$ | $+16$ |
|---|---|---|---|
| $x$ | $x^3$ | $-8x^2$ | $+16x$ |
| $+2$ | $+2x^2$ | $-16x$ | $32$ |

$\boxed{y = x^3 - 6x^2 + 32}$

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**LAB #4**

For each of the following polynomial functions:

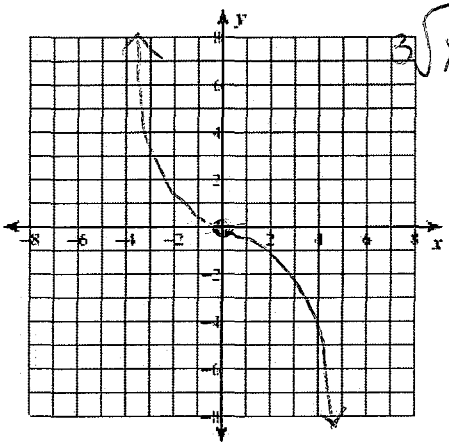
a. State the degree of the function
b. State all zeroes and their multiplicities
c. Sketch each graph.

1) $f(x) = -x^3$

$\frac{-x^3}{-1} = \frac{0}{-1}$

$\sqrt[3]{x^3} = \sqrt[3]{0}$

$x = 0$



a) deg = 3

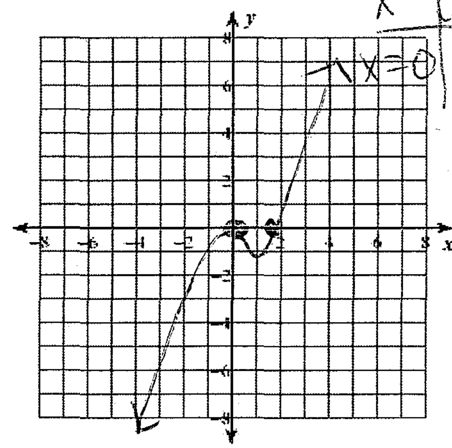
b) 0 mult 3

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

$2x^3 - 3x^2$

$x^2(2x-3) = 0$

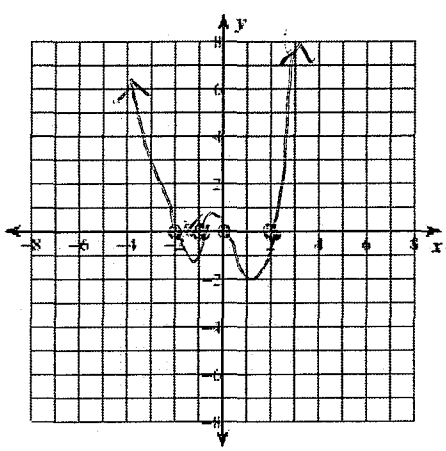
$x = 0$ | $x = \frac{3}{2}$



a) deg = 3

b) $\frac{3}{2}$ mult 1, 0 mult 2

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



a) deg = 4

b) $x^4 + x^3 - 4x^2 - 4x$

$x^3(x+1) - 4x(x+1)$

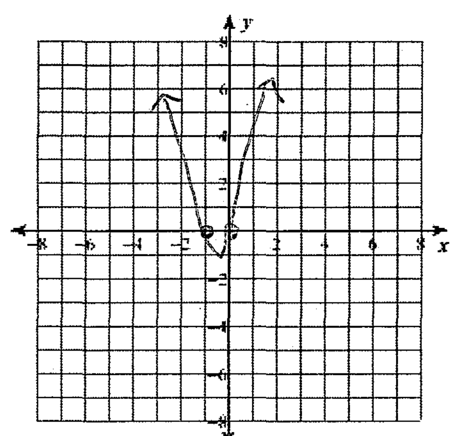
$(x^3 - 4x)(x+1)$

$x(x^2-4)(x+1)$

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

0 | -2 | 2 | -1 } mult 1

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



a) deg = 4

b) $x^4 + x^3$

$x^3(x+1)$

$x = 0$ mult 3 | $x = -1$ mult 1

5) Find all zeroes of the following functions with their multiplicities and state the degree:

| | |
|---|---|
| $f(x)=(x-4)(x+4)^3$<br>4 \| -4 mult 3<br>degree = 4 | $f(x)=(x-3)(x+1)$<br>3 \| -1<br>degree = 2 |
| $f(x)=(x-1)^2\cdot(x+3)^5$<br>1 \| -3<br>mult 2 \| mult 5<br>degree = 7 | $f(x)=x(x-2)(x+1)$<br>x=0 \| 2 \| -1<br>degree = 3 |

6) Suppose one of the factors of $x^3 - 10x^2 + 27x - 18$ is $(x-3)$, what are the other two *factors*?

① 
$$x^2-7x+6$$
$$x-3\,\overline{)\,x^3-10x^2+27x-18}$$
$$-x^3+3x^2$$
$$-7x^2+27x$$
$$+7x\,\ominus 21x$$
$$6x-18$$
$$-6x+18$$
$$0$$

② $x^2-7x+6$

$(x-6)(x-1)$

$\{(x-3)(x-6)(x-1)\}$

7) Suppose we know that the polynomial equation has three real solutions and that one of the roots of $x^3+3x^2-4x-12=0$ is x = -3. State all *solutions*.

① 
$$x^2+0x-4$$
$$x+3\,\overline{)\,x^3+3x^2-4x-12}$$
$$-x^3\ominus 3x^2$$
$$0x^2-4x$$
$$-0x^2\oplus 0x$$
$$-4x-12$$
$$+4x+12$$
$$0$$

② $x^2-4$

$(x+2)(x-2)$

-2 | 2

③ $\{-3,-2,2\}$

SOAP!

8) Factor: $125x^3 - 27$

$\sqrt[3]{125x^3} = 5x$

$\boxed{(5x-3)(25x^2+15x+9)}$

$\sqrt[3]{27} = 3$

9) Factor: $2x^2 - 5x - 12$

-24

-9

$2x^2 - 8x + 3x - 12$

$2x(x-4) + 3(x-4)$

$\boxed{(2x+3)(x-4)}$

10) Factor: $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$

$k^2(k^2-4)\ 8k(k^2-4) + 12(k^2-4)$

$(k^2 + \overset{a}{8}k + \overset{m}{12})(k^2-4)$

$\boxed{(k+6)(k+2)(k+2)(k-2)}$