Mastery Checklist
Polynomials

In order to prove Mastery for this concept you must be able complete the following all by **yourself.** No help from Notes, Partners or Teacher. Use all other problems to practice and test yourself with the following:

- ☒ Complete #11 on "LT: 3A Factored Equation to Graph"
- ☒ Complete one Level* problem & the Level ** problem "LT:3A From Graph to Factored Form"
- ☐ Complete 4 problems from between 40 -60 on "Worksheet 12 General Factoring Problems"
- ☐ Complete 2 Level ** problems from "Remainder Theorem"
- ☐ Complete 2 Level ** problems from "Fundamental Theorem of Algebra"
- ☐ Create a Mind Map from the concepts of a Polynomial

LT: 3A Factored Equation to Graph

Sketch the graph of each function.

7. $f(x) = (x + 1)(x - 2)(x - 4)$

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

9. $f(x) = -x(x + 5)^2(x + 3)$

**10. $f(x) = x^5 - 3x^4 - x^3 + 3x^2$

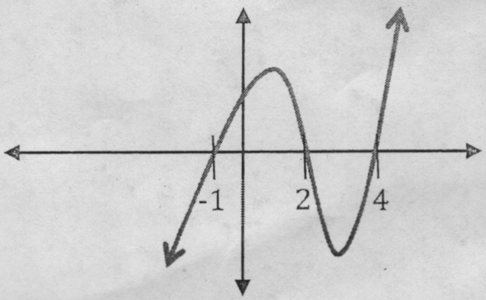
**11. $f(x) = -x^5 + 4x^4 - 4x^3$

12. $f(x) = x^2(x - 1)^2(2 + x)$

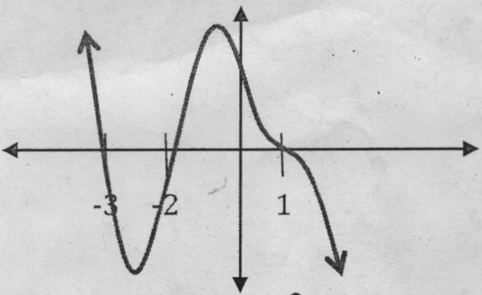
LT: 3A Factored Equation to Graph

Sketch the graph of each function.

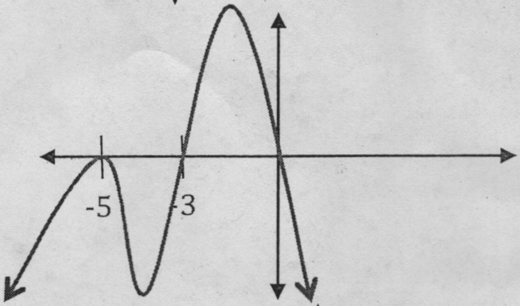
7. $f(x) = (x + 1)(x - 2)(x - 4)$



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

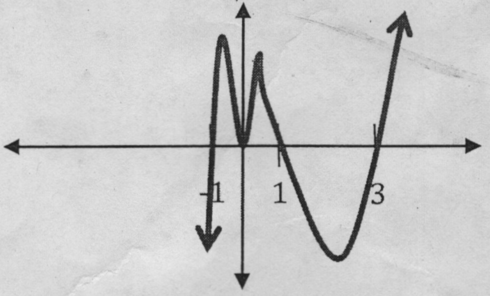


9. $f(x) = -x(x + 5)^2(x + 3)$



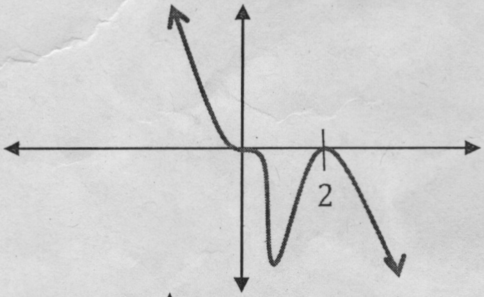
**10. $f(x) = x^5 - 3x^4 - x^3 + 3x^2$

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

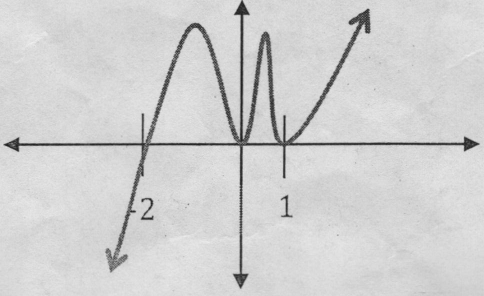


**11. $f(x) = -x^5 + 4x^4 - 4x^3$

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



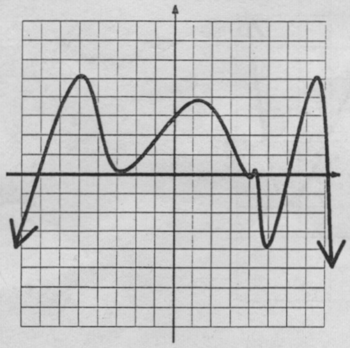
12. $f(x) = x^2(x - 1)^2(2 + x)$

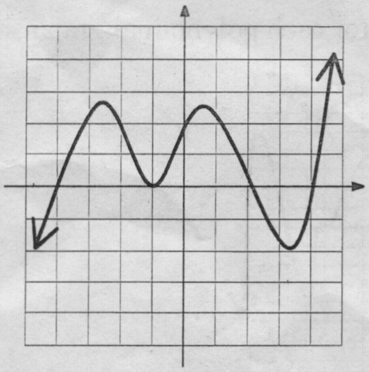


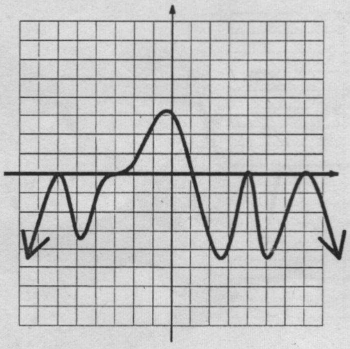
LT: 3A From Graph – to – Factored Form

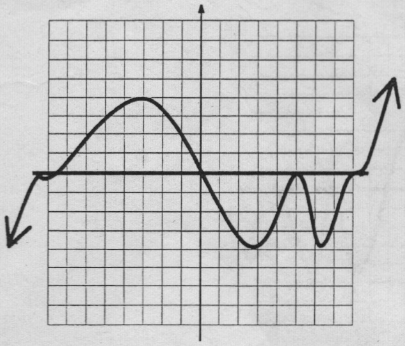
Level *

Write the equation for each polynomial graph shown.









5

LEVEL **

Sketch the graph of the equation with a double root at –2, a single root at 5, a triple root at 0 and a double root at 2. Assume the leading coefficient is negative. Write the equation of the function that describes the graph.

Equation: ______________________________

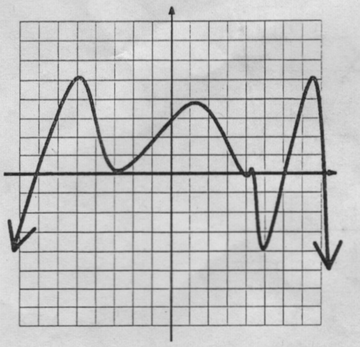
LEVEL ***

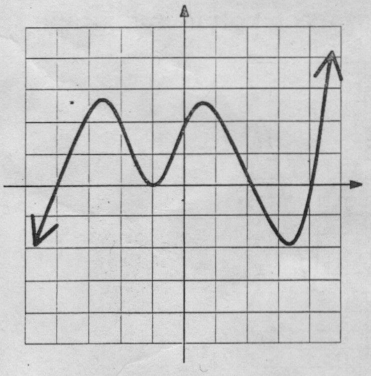
After factoring, sketch the graph of the equation $y = -x^3+2x^2-x$

LT: 3A From Graph – to – Factored Form

Level *

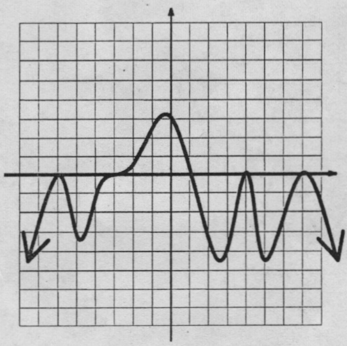
Write the equation for each polynomial graph shown.

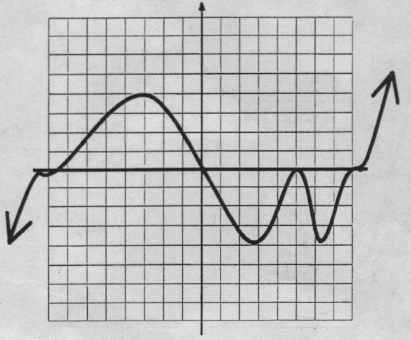




3. $\mathbf{y = -(x+7)(x+3)^2(x-4)^3(x-6)(x-8)}$

4. $\mathbf{y = (x+4)(x+1)^2(x-2)(x-4)}$





5. $\mathbf{y = -(x+6)^2(x+3)^3(x-1)(x-4)^2(x-7)^2}$

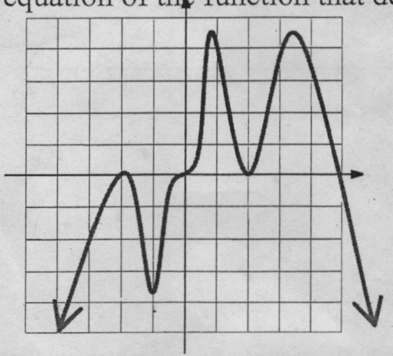
6. $\mathbf{y = x(x+8)^3(x-5)^2(x-8)^3}$

LEVEL **

Sketch the graph of the equation with a double root at –2, a single root at 5, a triple root at 0 and a double root at 2. Assume the leading coefficient is negative. Write the equation of the function that describes the graph.

Equation: ______________________________

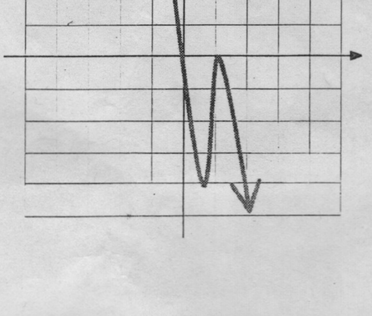
$\mathbf{y= -x^3(x+2)^2(x-2)^2(x-5)}$



LEVEL ***

After factoring, sketch the graph of the equation $y = -x^3+2x^2-x$

$\mathbf{y= -x(x-1)^2}$



LT:3B

Worksheet #12—General Factoring Problems

E. White

Fall 2004

Completely factor each of the following.

(1) $x^2 + x$

(2) $3x^2 - 6x - 9$

(3) $x^2 - 6x + 9$

(4) $4x^2 - 9$

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

(6) $3ay^2 - 12axy + 12ax^2$

(7) $4y^2 - 12y + 9$

(8) $6x^3 - 10x^2 + 4x$

(9) $2y^2 - xy - x^2$

(10) $-2ay^2 + 2ax^2$

(11) $6x^2 - 21x + 9$

(12) $4a^2 - 4a - 3$

(13) $x^2 - ax - 2a^2$

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

(15) $-9x^3y^4 - 3x^2y^4 + 6x^4y^3$

(16) $4x^3 - 4x^2 + x$

(17) $6x^2 + 5x - 6$

(18) $4x^2 - 4x + 1$

(19) $-6xy^3 + 3x^2y^2 + 3x^3y$

(20) $7x^2 - 23x + 6$

(21) $4x^4 - 12x^2 + 9$

(22) $x^2 - x - 6$

(23) $\frac{2x^2}{5} + \frac{x}{5} - \frac{6}{5}$

(24) $2x^2y - 8y - 3x^2 + 12$

(25) $x^2 - 5x - 14$

(26) $-x^2 - 3x + 10$

(27) $36x^2y + 42xy - 30y$

(28) $2bx + ax - 2b - a$

(29) $3x^4 - x^2 - 2$

(30) $3x^5 - x^3 - 2x$

(31) $2y^2 - 13y + 20$

(32) $(x^2 - (y+2)^2$

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

(34) $2x^4 - 9x^3 + 9x^2$

(35) $\frac{a^2}{2} + \frac{a}{4} - \frac{1}{4}$

(36) $-4b^2 + 3ab + a^2$

(37) $2x^2 + 3x - 2$

(38) $-y^2 + x^2$

(39) $4abx + 8bx - 12ax - 24x$

(40) $(x+1)^2 - y^2$

(41) $x^3 - 27$

(42) $8x^3 - 1$

(43) $x^4 - 81$

(44) $\frac{x^2}{3} - \frac{7x}{3} + \frac{10}{3}$

(45) $2y^2 - 2y - 12$

(46) $12y^4 - 7x^2y^2 + x^4$

(47) $3x^3 - 6x^2 - 15x$

(48) $-y^2 - y + 6$

(49) $4x^2 + 4x - a^2 + 1$

(50) $\frac{x^2}{5} - \frac{4x}{5} + \frac{4}{5}$

(51) $2x^2 - 2x - 4$

(52) $2x^2 + x - 1$

(53) $(x+1)^2 - y^2$

(54) $2ax + 2x + 3a + 3$

(55) $a^2x + 2ax + x$

(56) $x^{\frac{2}{3}} + x^{\frac{1}{3}} - 6$

(57) $-y^2 - 2y + x^2 + 4x + 3$

(58) $a^2 - (y-1)^2$

(59) $2x^4 - 13x^2 + 20$

(60) $54a^4 - 16a$

Answers: (1) $x\,(x+1)$ (2) $3\,(x+1)\,(x-3)$ (3) $(x-3)^2$ (4) $(2x-3)\,(2x+3)$

(5) $(x-2y)^2$ (6) $3a\,(2x-y)^2$ (7) $(2y-3)^2$ (8) $2x\,(3x-2)\,(x-1)$

(9) $-(x-y)\,(x+2y)$ (10) $2a\,(x-y)\,(x+y)$ (11) $3\,(x-3)\,(2x-1)$ (12) $(2a+1)\,(2a-3)$

(13) $(x-2a)\,(x+a)$ (14) $(x+2)^2$ (15) $3x^2y^3\,(2x^2-y-3xy)$ (16) $x\,(2x-1)^2$

(17) $(3x-2)\,(2x+3)$ (18) $(2x-1)^2$ (19) $3xy\,(x-y)\,(x+2y)$ (20) $(7x-2)\,(x-3)$

(21) $\left(2x^2-3\right)^2$ (22) $(x-3)\,(x+2)$ (23) $\frac{1}{5}(2x-3)(x+2)$ (24) $(2y-3)\,(x-2)\,(x+2)$

(25) $(x-7)\,(x+2)$ (26) $-(x-2)\,(x+5)$ (27) $6y\,(2x-1)\,(3x+5)$ (28) $(x-1)\,(a+2b)$

(29) $(x-1)\,(x+1)\,\left(3x^2+2\right)$ (30) $x\,(x-1)\,(x+1)\,\left(3x^2+2\right)$ (31) $(y-4)\,(2y-5)$

(32) $(x-y-2)\,(x+y+2)$ (33) $x\,(y-1)^2\,(y+1)^2$ (34) $x^2\,(x-3)\,(2x-3)$

(35) $\frac{1}{4}(2a+1)(a+1)$ (36) $(a-b)\,(a+4b)$ (37) $(2x-1)\,(x+2)$ (38) $(x+y)\,(x-y)$

(39) $4x\,(a+2)\,(b-3)$ (40) $(x+1-y)\,(x+1+y)$ (41) $(x-3)\,\left(x^2+3x+9\right)$

(42) $(2x-1)\,\left(4x^2+2x+1\right)$ (43) $(x-3)\,(x+3)\,\left(x^2+9\right)$ (44) $\frac{1}{3}\,(x-2)\,(x-5)$

(45) $2\,(y+2)\,(y-3)$ (46) $(x-2y)\,(x+2y)\,\left(x^2-3y^2\right)$ (47) $3x\,\left(x^2-2x-5\right)$

(48) $-(y-2)\,(y+3)$ (49) $(2x+1-a)\,(2x+1+a)$ (50) $\frac{1}{5}\,(x-2)^2$ (51) $2\,(x+1)\,(x-2)$

(52) $(2x-1)\,(x+1)$ (53) $(x+1-y)\,(x+1+y)$ (54) $(2x+3)\,(a+1)$ (55) $x\,(a+1)^2$

(56) $\left(x^{\frac{1}{3}}-2\right)\left(x^{\frac{1}{3}}+3\right)$ (57) $(x-y+1)\,(x+y+3)$ (58) $(a-y-1)\,(a-y+1)$

(59) $(x-2)\,(x+2)\,\left(2x^2-5\right)$ (60) $2a\,(3a-2)\,\left(9a^2+6a+4\right)$

Remainder Theorem(Long Division) (LT: 3C)

Level *: Decide if the following are factors of the given polynomial.

1.) f(x) = $x^3 + 8x^2 - 20x$; x-2
2.) f(x) = $x^3 + 3x^2 - 5x - 4$; x+4
3.) f(x) = $3x^5 + 5x^4 + x + 5; x + 2$
4.) f(x)=$x^3 + 3x^2 - 7x - 21; x + 3$
5.) f(x) = $x^3 - 3x^2 + x - 3$; $x^2 + 1$

Level **: Decide if the following is a factor of the given polynomial. If it is find all the other factors.

1.) f(x) = $x^3 + 2x^2 - x - 2; x - 1$
2.) f(x)= $2x^3 - 5x^2 - 28x + 15; x - 5$
3.) f(x)= $3x^3 + 10x^2 - x - 12 ; x + 3$
4.) f(x)= $x^3 - 6x^2 + 11x - 6 ; x - 2$
5.) f(x)=$2x^3 + 7x^2 + 53x - 28; 2x + 1$

Level ***: Use the factors from 1 through 3 above and to graph the polynomial.

Level**:

1.) Check to see x-1 is a factor first
$f(1) = (1)^3 + 2(1)^2 - 1 - 2$
$f(1) = 1 + 2 - 1 - 2 = 0$ ∴ x-1 is a factor of f(x)

factor this

$x^2+3x+2 \leftarrow$
$x-1\,\overline{)\,x^3+2x^2-x-2}$
$-x^3+x^2$
$3x^2-x$
$-3x^2+3y$
$2x-2$
$-2x+2$
0

↑ factor①

x^2+3x+2
$\underline{x^2+2x}+x+2$
$x(x+2)+1(x+2)$
$(x+2)(x+1)$
factor ②+③

$2x^2$
$\wedge$
$2x+x$

$f(x)=(x-1)(x+2)(x+1)$ ← factored form.

2.) Check to see if x-5 is a factor
$f(5)=2(5)^3-5(5)^2-28(5)+15$
$f(5)=250-125-140+15$
$f(5)=265-265=0$ ∴ x-5 is a factor of f(x)

$2x^2+5x-3$ → factor
$x-5\,\overline{)\,2x^3-5x^2-28x+15}$
$-2x^3+10x^2$ ↓
$5x^2-28x$ ↓
$-5x^2+25x$
$-3x+15$
$+3x+^-15$
0

$2x^2+5x-3$
$\underline{2x^2+6x}, -x-3$
$2x(x+3)-1(x+3)$
$(x+3)(2x-1)$
factors ②+③

$-6x^2$
$\wedge$
$6x-x$

$f(x)=(x-5)(x+3)(2x-1)$ factored form

3) Check to see if x+3 is a factor
$f(-3)=3(-3)^3+10(-3)^2-(-3)-12$
$f(-3)=-81+90+3-12$
$f(-3)=-93+93=0$ ∴ x+3 is a factor of f(x)

$3x^2+x-4$ →
$x+3\,\overline{)\,3x^3+10x^2-x-12}$
$-3x^3+^-9x^2$
x^2-x
$-x^2+^-3x$
$-4x-12$
$+4x+12$
0

$3x^2+x-4$
$\underline{3x^2+4x, -3x-4}$
$x(3x+4)-1(3x+4)$
$(3x+4)(x-1)$

$-12x^2$
$\wedge$
$4x-3x$

factors
$f(x)=(x+3)(x-1)(3x+4)$

Level *:
The Remainder Theorem says that if x-a is divided into f(x) then f(a)=Remainder.

1.) x-2 = x-a   a=2

$f(x)=x^3+8x^2-20x$
$f(a)=f(2)=2^3+8(2)^2-20(2)$
$f(2)=8+32-40$
$f(2)=40-40=0$
$f(2)=0$ = Remaind ∴ x-2 is a factor of f(x)

2.) x+4=x-a   a=-4
$f(x)=x^3+3x^2-5x-4$
$f(-4)=(-4)^3+3(-4)^2-5(-4)-4$
$f(-4)=-64+3(16)+20-4$
$f(-4)=-64+48+16$
$f(-4)=-64+64=0$ ∴ x+4 is a factor of f(x)

3) x+2=x-a   a=-2
$f(x)=3x^5+5x^4+x+5$
$f(-2)=3(-2)^5+5(-2)^4+(-2)+5$
$f(-2)=-32+80-2+5$
$f(-2)=-34+85=5!$ ∴ x+2 is not a factor of f(x)

4) x+3 =x-a   a=-3
$f(x)=x^3+3x^2-7x-21$
$f(-3)=(-3)^3+3(-3)^2-7(-3)-21$
$f(-3)=-27+27+21-21$
$f(-3)=0+0=0$ ∴ x+3 is a factor of f(x)

5) $x^2+1 \neq x-a$ since it is squared I will have to use long division

$x-3$
$x^2+0x+1\,\overline{)\,x^3-3x^2+x-3}$
$-x^3+^-0x^2+^-x$ ↓
$-3x^2+0-3$
$+3x^2+0+3$
0

∴ x^2+1 is a factor of f(x)

4) Check to see if x-2 is a factor of f(x)
$f(2)=(2)^3-6(2)^2+11(2)-6$
$f(2)=8-24+22-6$
$f(2)=30-30=0$ ∴ x-2 is a factor of f(x)

x^2-4x+3 →
$x-2\,\overline{)\,x^3-6x^2+11x-6}$
$-x^3+2x^2$
$-4x^2+11x$
$+4x^2+^-8x$
$3x-6$
$+^-3x+6$
0

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

$3x^2$
$\wedge$
$-3x-x$

$f(x)=(x-2)(x-3)(x-1)$

5) Check to see if 2x+1 is a factor of f(x)

$x^2+3x+28$ → $x^2-3x+28$
$2x+1\,\overline{)\,2x^3+7x^2+53x-28}$
$-2x^3+^-x^2$
$+6x^2+53x$
$-6x^2+^+3x$
$56x-28$
$-56x+28$
0

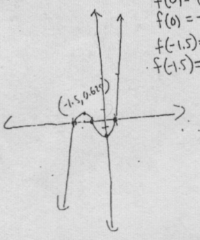
should be $6x^2$ so 2x+1 isnt factor

28
$\wedge$
$7x+4x$

not factorable

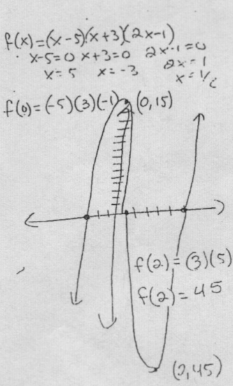
Level ***

1.) $f(x)=(x-1)(x+2)(x+1)$
$f(0)=(-1)(2)(1)$
$f(0)=-2$
$f(-1.5)=(-2.5)(0.5)(-0.5)$
$f(-1.5)=0.625$



2.) $f(x)=(x-5)(x+3)(2x-1)$
$x-5=0$ $x+3=0$ $2x-1=0$
$x=5$ $x=-3$ $2x=1$
$x=1/2$

$f(0)=(-5)(3)(-1)$



$f(2)=(3)(5)(3)$
$f(2)=45$

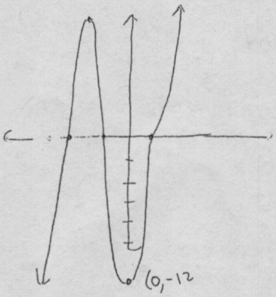
3.)

$f(x) = (x+3)(x-1)(3x+4)$

$x+3=0 \quad x-1=0 \quad 3x+4=0$

$x=-3 \quad x=1 \quad 3x=-4$

$x=\frac{-4}{3}$



$f(0)=(3)(-1)(4)$

$f(0)=-12$

$f(-2)=(1)(-3)(-2)$

$f(-2)=6$

Fundamental Theorem of Algebra: Imaginary and Irrational Root Theorems

Level *

6. State the Fundamental Theorem of Algebra:

A polynomial function with rational coefficients has the follow zeros. Find all additional zeros.

7) $-5,\ i$

8) $-1+i,\ \sqrt{5}$

9) $-3+\sqrt{5},\ -i$

10) $2,\ -2+\sqrt{10}$

11) $-1,\ 5,\ -2+\sqrt{5}$

12) $2-2i,\ 1-2i,\ 1+2i$

Level **

Write a polynomial function of least degree with integral coefficients that has the given zeros.

15) $0,\ 2,\ \sqrt{3}$

16) $-5,\ \sqrt{3}$

17) $-1,\ 2i$

18) $2i,\ -2i,\ 2+2i$

19) $-2i,\ 2+2\sqrt{2}$

20) $\sqrt{6},\ -3+\sqrt{5}$

Critical thinking questions:

21) Write a polynomial function of fifth degree with integral coefficients that has $2i$ as a zero.

22) True or False: A polynomial function of third degree with integral coefficients can have 2 and $2i$ as zeros.

6. The Polynomial of Degree "n" will have "n" complex roots.

A polynomial function with rational coefficients has the follow zeros. Find all additional zeros.

7) $-5,\ i$

$-i$

8) $-1+i,\ \sqrt{5}$

$-1-i,\ -\sqrt{5}$

9) $-3+\sqrt{5},\ -i$

$-3-\sqrt{5},\ i$

10) $2,\ -2+\sqrt{10}$

$-2-\sqrt{10}$

11) $-1,\ 5,\ -2+\sqrt{5}$

$-2-\sqrt{5}$

12) $2-2i,\ 1-2i,\ 1+2i$

$2+2i$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

15) $0,\ 2,\ \sqrt{3}$

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

16) $-5,\ \sqrt{3}$

$f(x) = x^3 + 5x^2 - 3x - 15$

17) $-1,\ 2i$

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

18) $2i,\ -2i,\ 2+2i$

$f(x) = x^4 - 4x^3 + 12x^2 - 16x + 32$

19) $-2i,\ 2+2\sqrt{2}$

$f(x) = x^4 - 4x^3 - 16x - 16$

20) $\sqrt{6},\ -3+\sqrt{5}$

$f(x) = x^4 + 6x^3 - 2x^2 - 36x - 24$

Critical thinking questions:

21) Write a polynomial function of fifth degree with integral coefficients that has $2i$ as a zero.

Many answers. Ex: $f(x) = x^5 + 4x^3$

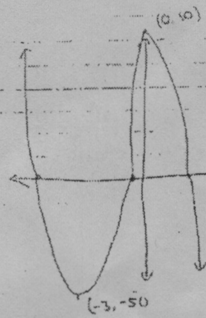
22) True or False: A polynomial function of third degree with integral coefficients can have 2 and $2i$ as zeros.

True

Learning Target 3C: Factors of Polynomials and Long Division PLAYER B

SUPER Genius: Level ***	Graph the following polynomial. $F(x)=2x^3+11x^2+18x+9$ $2x+3$ is a factor of $f(x)$
Genius: Level ***	Check to see if $3x+3$ is a factor of $f(x)=12x^3+27x^2+75x+65$ if it is graph the polynomial
Advanced: Level **	What are all the roots of $f(x)=16x^3+44x^2-40x+7$, if $2x+7$ is a factor.
Baller: Level **	Is $5x$ a favctor of $f(x)=30x^3+50x$ (Hint: If you are missing a term make sure to put a place holder under the division sign) $5x\,\overline{)\,30x^3+0x^2+50x+0}$
Proficient: Level **	Is $x+2$ a factor of $f(x)=3x^3+11x^2+9x-5$ why? Or why not?
Novice: Level *	Is $x+3$ a factor of $f(x)=x^2+6x+9$, How do you know?
Rookie: Level *	Which of the following expressions are factors of $f(x)$? explain your reasoning. $f(x)=x^3+9x^2+x+9$ a.) $x+9$ b.) $x-9$
START HERE: Level *	How do you know an expression is a factor of a Polynomial? Explain your reasoning

Player A's Answers



$f(0)=-(-2)(5)(1)$
$f(0)=10$

$f(-3)=-(-5)(2)(-5)$
$f(-3)=-50$

SUPER Genius:

$-x^2-3x+10$
$2x+1\overline{)-2x^3-7x^2+17x+10}$
$+2x^3+x^2$ ↓
$-6x^2+17x$
$+6x^2+3x$ ↓
$20x+10$
$20x+10$
0

$-x^2-3x+10$
$-x^2+2x-5x+10$
$-x(x-2)-5(x-2)$
$(x-2)(-x-5)$
$-(x-2)(x+5)$
All factors $-(x-2)(x+5)(2x+1)$
$2x+1=0$
$-2x=-1$
$x=\frac{-1}{2}$

$-10x^2$
$\wedge$
$-2x+5x$
$\boxed{2x-5x}$

Genius:

$3x+1\overline{)3x^3-5x^2+10x-3}$
$-3x^2-x^2$
$-6x^2+10x$
$+6x^2+2x$
$12x-3$
$-12x-4$
-7

Remainder $\neq 0$
not a factor
can't graph yet not enough info.

Advanced:

$6x^2-7x+2$
$x-2\overline{)6x^3-19x^2+16x-4}$
$-6x^3+12x^2$ ↓
$-7x^2+16x$
$+7x^2+14x$ ↓
$2x-4$
$-2x+4$
0

is a factor

$6x^2-7x+2$
$6x^2-3x-4x+2$
$3x(2x-1)-2(2x-1)$
$(3x-2)(2x-1)$

$6x^2\cdot 2=12x^2$
$-3x$ $-4x$

Factors are $(x-2)(2x-1)(3x-2)$
Roots are $x-2=0$ $\boxed{x=2}$ $2x-1=0$ $2x=1$ $x=1/2$ $3x-2=0$ $3x=2$ $x=2/3$

Baller:

$9x^2+0x+4$
$3x\overline{)27x^3+0x^2+12x+0}$
$-27x^3$ ↓
$0+0x^2$
$0x^2$ ↓
$0+12x$
$+12x$ ↓
$0+0$
0

answer is $9x^2+4$
with Remainder of 0
so 3x is a factor

Proficient:

x^2-2x-2
$x-2\overline{)x^3-4x^2+2x+5}$
$-x^3+2x^2$ ↓
$-2x^2+2x$
$+2x^2+4x$ ↓
$-2x+5$
$+2x-4$
1

Not a factor
because when dividing, x-2 into f(x) the remainder is 1

Novice:

$x+6$
$x-9\overline{)x^2-3x-54}$
$-x^2+9x$ ↓
$6x-54$
$-6x+54$
0

yes x-9 is a factor because when divided into f(x) it has a remainder of 0.

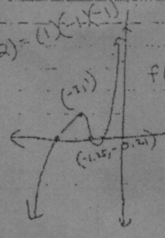
Rookie: B. is a factor of f(x) because when 4x +3 divides evenly into f(x) and has a remainder of 0.

START HERE: An expression is a factor of a polynomial if it divides evenly into the polynomial or has a remainder of 0. If you convert the factor into a root (ex Factor (X-3) has the root x=3) and plug root into the polynomial and it equals 0. (ex. F(3)=0

Learning Target 3C: Factors of Polynomials and Long Division PLAYER A

SUPER Genius: Level ***	Graph the following polynomial. F(x)= $-2x^3-7x^2+17x+10$ $2x+1$ is a factor of f(x)
Genius: Level ***	Check to see if $3x+1$ is a factor of f(x)= $3x^3-5x^2+10x-3$ if it is graph the polynomial
Advanced: Level **	What are all the roots of f(x)= $6x^3-19x^2+16x-4$, if $x-2$ is a factor.
Baller: Level **	Is 3x a factor of f(x)= $27x^3+12x$ (Hint: If you are missing a term make sure to put a place holder under the division sign) $3x\,\overline{)\,27x^3+0x^2+12x+0}$
Proficient: Level **	Is x-2 a factor of f(x)= x^3-4x^2+2x+5 why? Or why not?
Novice: Level *	Is x- 9 a factor of f(x)= $x^2-3x-54$, How do you know?
Rookie: Level *	Which of the following expressions are factors of f(x)? explain your reasoning. f(x)= $12x^3-11x^2+9x+18$
	a.) 3x +4 b.) 4x +3
START HERE: Level *	How do you know an expression is a factor of a Polynomial? Explain your reasoning

Player B's Answers



$f(-2) = (1)(-1)(-1)$

$f(-\frac{5}{4}) = (-\frac{5}{4} + \frac{12}{4})(-\frac{5}{4} + \frac{4}{4})(-\frac{10}{4} + \frac{12}{4})$

$f(-\frac{5}{4}) = (\frac{7}{4})(-\frac{1}{4})(\frac{2}{4}) = -\frac{14}{64}$

$f(-\frac{5}{4}) = -0.21$

(-1.25, -0.21)

SUPER Genius:	$2x+3 \overline{)2x^3+11x^2+18x+9}$ quotient x^2+4x+3 $-2x^3 \mp 3x^2$ $8x^2+18x$ $-8x^2 \mp 12x$ $6x+9$ $6x+9$ 0 x^2+4x+3 $x^2+3x+x+3$ $x(x+3)+1(x+3)$ $3x^2$ $3x+x$ $f(x) = (x+3)(x+1)(2x+3)$ All the factors $2x+3=0$ $2x=-3$ $x = \frac{-3}{2} = -1\frac{1}{2}$ roots $-3, -1, -3/2$ $4 = 1$
Genius:	$3x+3 \overline{)12x^3+27x^2+75x+65}$ quotient $4x^2+5x+20$ $-12x^3 \mp 12x^2$ $15x^2+75x$ $-15x^2 \mp 15x$ $60x+65$ $60x+60$ $+5$ 3x+3 is not a factor of f(x) becouse the remainder is +5 Can't graph w/ info I have so far.
Advanced:	$2x+7 \overline{)16x^3+44x^2-40x+7}$ quotient $8x^2-6x+1$ $-16x^3 \mp 56x^2$ $-12x^2-40x$ $+12x^2+42x$ $2x+7$ $2x+7$ 0 $\longrightarrow$ $8x^2-6x+1$ $8x^2-2x-4x+1$ $2x(4x-1)-1(4x-1)$ $(4x-1)(2x-1)$ $8x^2$ $2x+4x$ $-2x-4x$ All factors: $(4x-1)(2x-1)(2x+7)$ All Roots $4x=1$ $2x-1=0$ $2x+7=0$ $x=1/4$ $2x=1$, $x=1/2$ $x=-7/2$ $x=1/4$ $x=1/2$ $x=-7/2$
Baller:	$5x \overline{)30x^3+0x^2+50x+0}$ quotient $6x^2+0x+10$ $-30x^3$ $0+0x^2$ $0x^2$ $0+50x$ $\mp 50x$ $0+0$ 5x is a factor of $30x^3+50x$ with remainder 0 $6x^2+10$ is the other factor.
Proficient:	$x+2 \overline{)3x^3+11x^2+9x-5}$ quotient $3x^2+5x-1$ $-3x^3 \mp 6x^2$ $5x^2+9x$ $-5x^2+10x$ $-x-5$ $+x+2$ -3 x+2 is not a factor because there is a remainder of -3.
Novice:	$x+3 \overline{)x^2+6x+9}$ quotient $x+3$ $-x^2 \mp 3x$ $3x+9$ $3x+9$ 0 x+3 is a factor of f(x) because it divides evenly in and has a remainder of 0
Rookie:	A. is a factor of f(x) because when x+9 divides evenly into f(x) and has a remainder of 0.
START HERE:	An expression is a factor of a polynomial if it divides evenly into the polynomial or has a remainder of 0. If you convert the factor into a root (ex Factor (X-3) has the root x=3) and plug root into the polynomial and it equals 0. (ex. F(3)=0