Name ______________________________ Writing Cubic Models

$$Y = ax^3 + bx^2 + cx + d$$

1. When the x-intercepts are given in the table:

1. identify "a"

Cubic $a = \frac{3rd\ difference}{3!} = \frac{24}{3 \cdot 2 \cdot 1} = \frac{24}{6} = 4$

2. write the factored form of the equation. *include "a"

3. re-write in standard form

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

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

	x^2	$+4x$	$+3$
x	x^3	$4x^2$	$3x$
-2	$-2x^2$	$-8x$	-6

$4(x^3+2x^2-5x-6) = 4x^3+8x^2-20x-24$

x	y	not linear	not quadratic	cubic
-3	0			
-2	16	16		
-1	0	-16	-32	
0	-24	-24	-8	24
1	-32	-8	16	24
2	0	32	40	24
3	96	96	64	24

2. when only the y-intercept (or not all x-intercepts) is in the table:

1. identify "a" $\frac{-12}{3!} = \frac{-12}{6} = -2$

2. identify "d" $(0, 3)$

3. choose 1 point for (x, y) and plug in a, d, x, y $(-1, 10)$

4. choose another point for (x, y) and plug in a, d, x, y $(1, -2)$

5. solve the system of equations

6. write your equation with a, b, c, d

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

$y = -2x^3 + bx^2 + cx + 3$

$(-1, 10)$ $10 = -2(-1)^3 + b(-1)^2 + c(-1) + 3$

$10 = 2 + b - c + 3$

$10 = 5 + b - c \rightarrow 5 = b - c$

$(1, -2)$ $-2 = -2(1)^3 + b(1)^2 + c(1) + 3$

$-2 = -2 + b + c + 3$

$-2 = 1 + b + c \rightarrow -3 = b + c$

$5 = b - c$

$+\ -3 = b + c$

$2 = 2b$

$1 = b$

$-3 = 1 + c$

$-1 \quad -1$

$-4 = c$

x	y	not linear	not quad.	cubic
-3	78			
-2	31	-47		
-1	10	-21	26	
0	3	-7	14	-12
1	-2	-5	2	-12
2	-17	-15	-10	-12
3	-54	-37	-22	-12

$$ax^4 + bx^3 + cx^2 + dx + e$$

3. quartic: $a = \frac{4th\ difference}{4!}$

Situations:

A. all 4 zeros are in the table -

Use the factored form

B. only y-intercept in table -

Choose 3 points to write

3 equations, solve the system

x	y
-3	406
-2	81
-1	6
0	1
1	6
2	81
3	406

-325	250	-180	120
-75	70	-60	120
-5	10	60	120
5	70	180	
75	250		
325			
↑ not linear	↑ not quad	↑ not cubic	↑ QUARTIC

$$a = \frac{120}{4!} = \frac{120}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{120}{24} = 5$$

$e = (0, 1)$

$$y = 5x^4 + 1$$