

### Cubic Functions

I. 1) What is the parent equation for the Cubic Function?  $y = x^3$

Root:  $(0,0)$

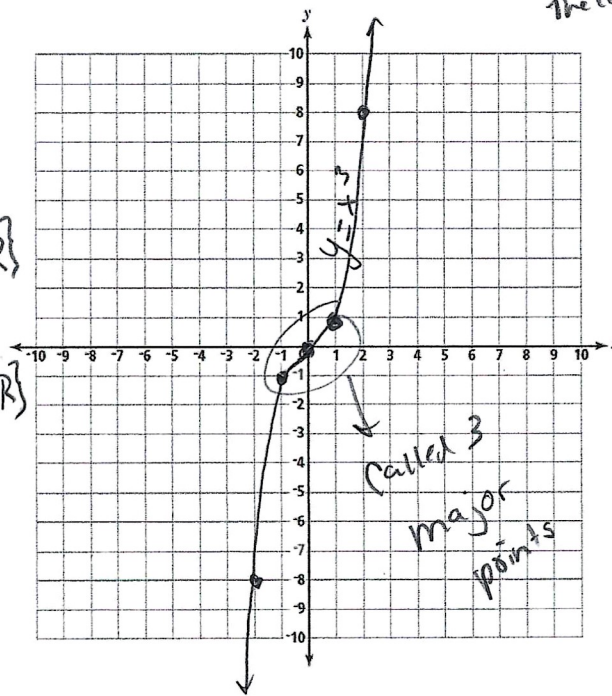
2) Graph the parent function for the Cubic Function.

3) What is the Domain:  $(-\infty, \infty)$  or  $\{x | x \in \mathbb{R}\}$   
 or All reals

4) What is the Range:  $(-\infty, \infty)$  or  $\{y | y \in \mathbb{R}\}$   
 or All reals

5) What is the Degree: 3  
 (highest exponent)

6) What is the root:  $(0,0)$   
 where the graph intersects the x-axis



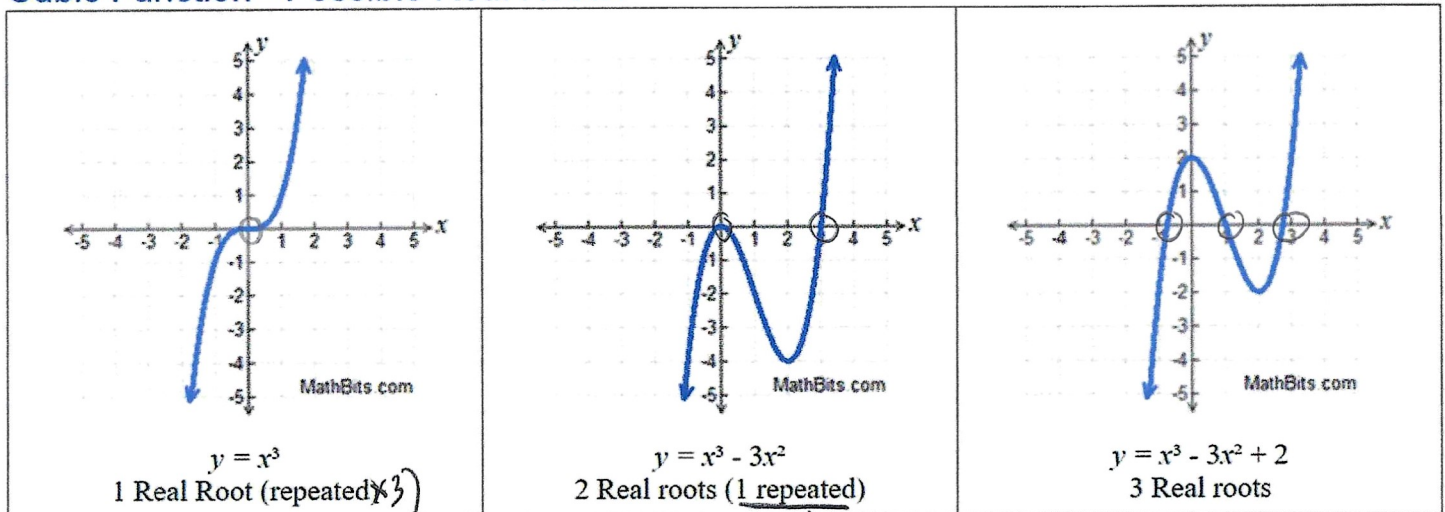
\* plot/write down all the coordinates you can graph

x	y
-2	-8
-1	-1
0	0
1	1
2	8

II. A cubic function is a polynomial function of degree 3 of the form  $f(x) = ax^3 + bx^2 + cx + d$ , where a, b, c, and d are real numbers and  $a \neq 0$ .

\*A cubic function may have one, two or three x-intercepts, corresponding to the real roots of the related cubic equation (see below)  
 ↓  
 aka Roots

### Cubic Function - Possible Real Roots:



$y = x^3$   
 1 Real Root (repeated)

$x = 0$   
 $x = 0$   
 $x = 0$

$y = x^3 - 3x^2$   
 2 Real roots (1 repeated)

$x = 0$   
 $x = 0$   
 $x = 3$   
 Turning point that is an x-intercept is what is repeated

$y = x^3 - 3x^2 + 2$   
 3 Real roots

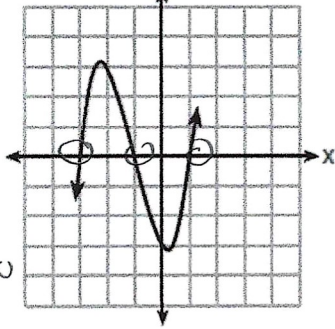
$x = -1$   
 $x = 1$   
 $x = 2$

### III. Regents Examples with roots:

7)

A cubic function is graphed on the set of axes below.

Went backwards from 3 roots Cubic



$$\frac{(x+3)(x+1)(x-1)=0}{x=-3 \quad x=-1 \quad x=1}$$

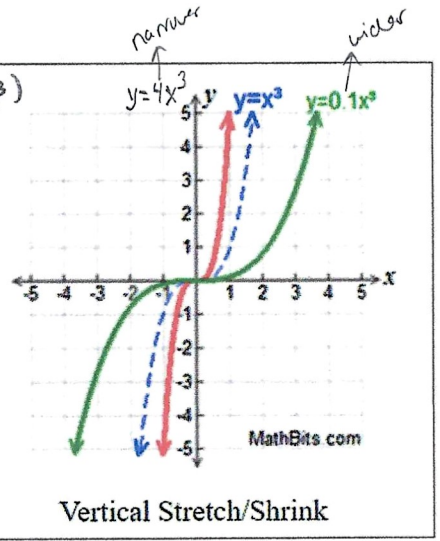
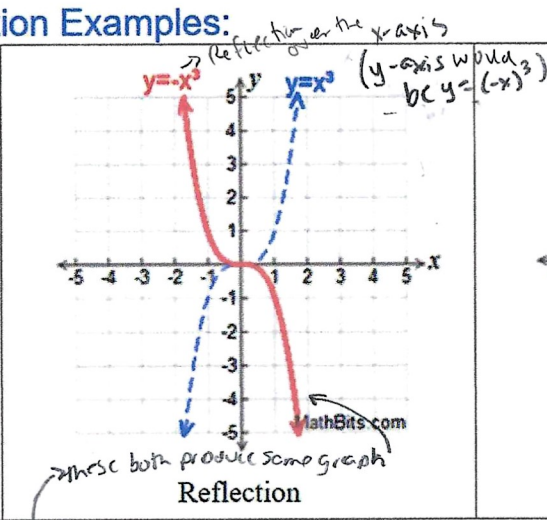
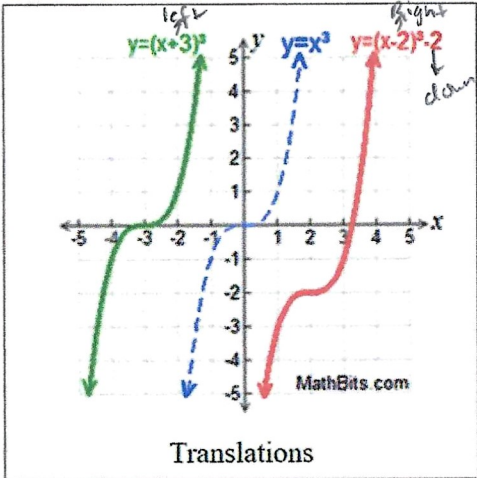
Which function could represent this graph?

- 1)  $f(x) = (x-3)(x-1)(x+1)$       3)  $h(x) = (x-3)(x-1)(x+3)$   
 2)  $g(x) = (x+3)(x+1)(x-1)$       4)  $k(x) = (x+3)(x+1)(x-3)$

check in calc to make sure it is correct

### IV. Transformations of Cubic Functions:

#### Cubic Function - Transformation Examples:



$y = -f(x) \rightarrow$  Reflection in  $x$ -axis; also  $y = -x^3$   
 $y = f(-x) \rightarrow$  Reflection in  $y$ -axis; also  $y = (-x)^3$

#'s 9-11: How would each of the following graphs change in relation to the parent graph  $y = x^3$ ?

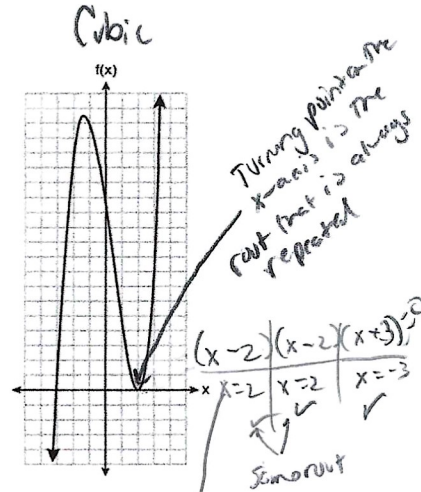
9)  $y = (x-3)^3$  - Translated 3 units right from  $(0,0)$

10)  $y = x^3 + 5$  - Translated 5 units up from  $(0,0)$

11)  $y = 3(x+2)^3 - 7$  - narrower by a scale factor of 3 and  
 - Translated 2 units left + 7 units down from  $(0,0)$

8)

A function is graphed below.



Can also plug in calc to check put into  $y=$

A possible equation for this function is

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

These are quadratic b/c you would get  $x^2$  not  $x^3$  when you double distribute

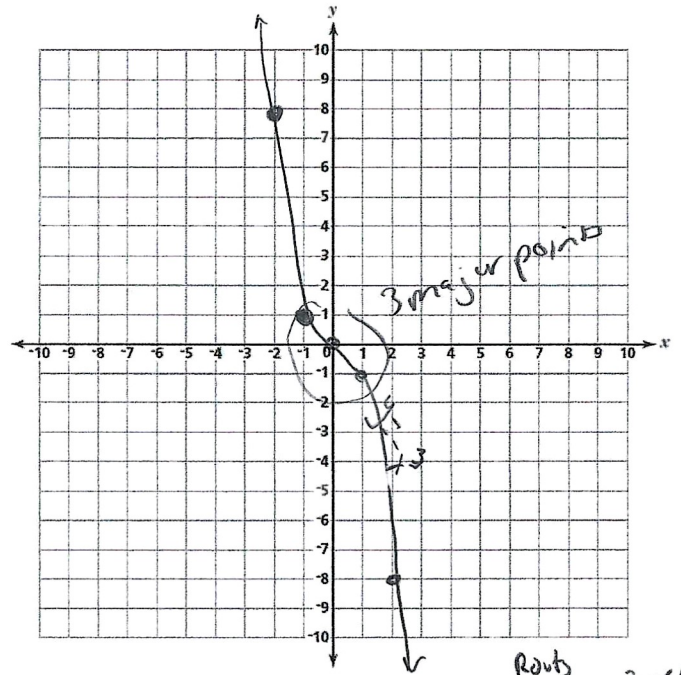
$$\frac{(x-2)(x-2)(x+3)=0}{x=2 \quad x=2 \quad x=-3}$$

#'s 12-14: Graph the following cubic functions.

12)  $y = -x^3$

Reflection in the x-axis

x	y
-2	8
-1	1
0	0
1	-1
2	-8



Domain:  $(-\infty, \infty)$  or  $\{x | x \in \mathbb{R}\}$  or All Reals

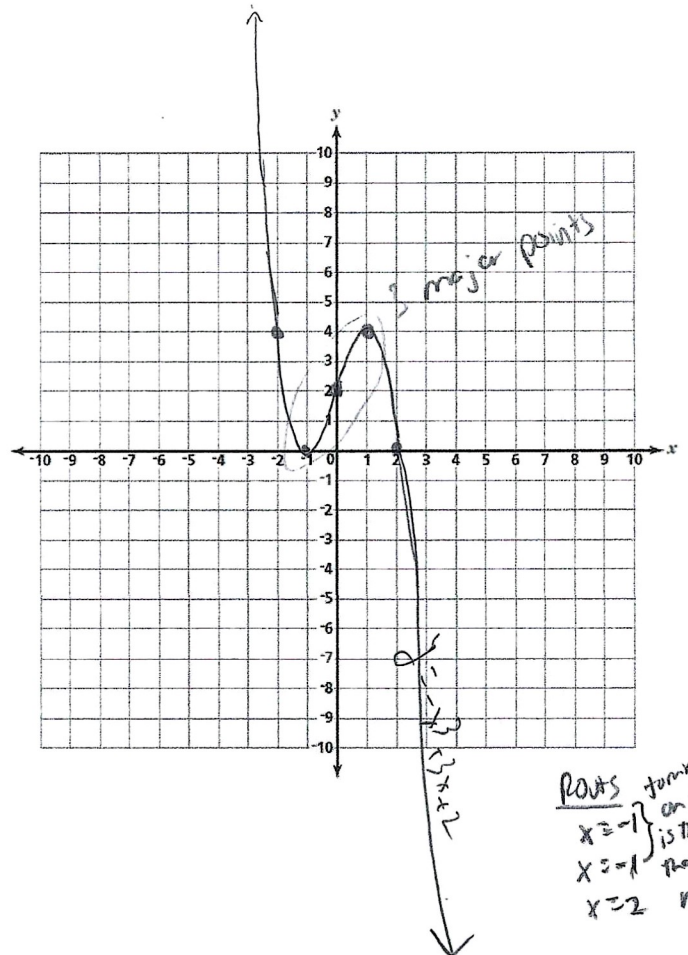
Range:  $(-\infty, \infty)$  or  $\{y | y \in \mathbb{R}\}$  or All Reals

Roots:  $(0, 0)$  1 real root  
 where  $y=0$

Roots  
 $x=0$   
 $x=0$   
 $x=0$   
 3 repeated

13)  $y = -x^3 + 3x + 2$

x	y
-2	4
-1	0
0	2
1	4
2	0



Domain:  $(-\infty, \infty)$  or  $\{x | x \in \mathbb{R}\}$  or All reals

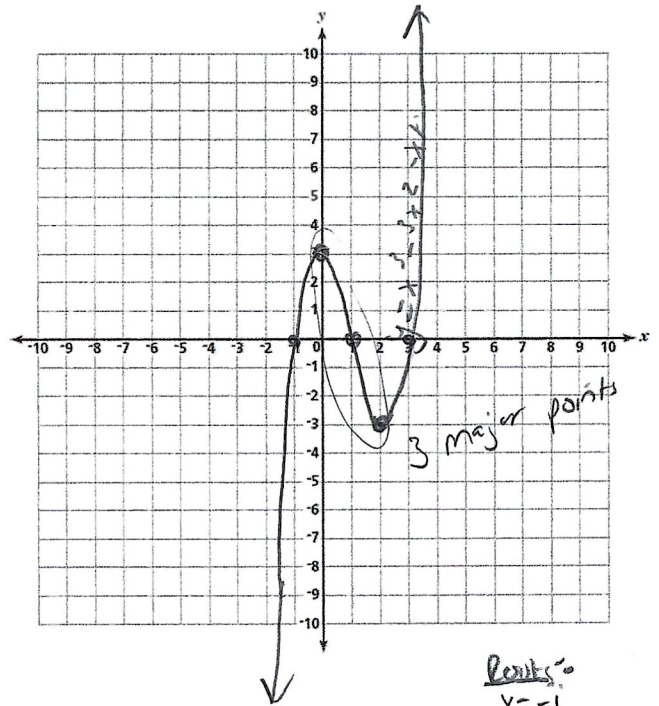
Range:  $(-\infty, \infty)$  or  $\{y | y \in \mathbb{R}\}$  or All reals

Roots:  $(-1, 0) + (2, 0)$  2 real roots  
 where  $y=0$

Roots  
 $x=1$  turning point  
 $x=-1$  is the root  
 $x=2$  repeated

14)  $y = x^3 - 3x^2 - x + 3$

X	Y
-1	0
0	3
1	0
2	-3
3	0



Roots:  $x = -1$   
 $x = 1$   
 $x = 3$

Domain:  $(-\infty, \infty)$  or  $\{x | x \in \mathbb{R}\}$  or All reals

Range:  $(-\infty, \infty)$  or  $\{y | y \in \mathbb{R}\}$  or All reals

Roots:  $(-1, 0), (1, 0), (3, 0)$  3 real roots

↓  
 when  $y=0$