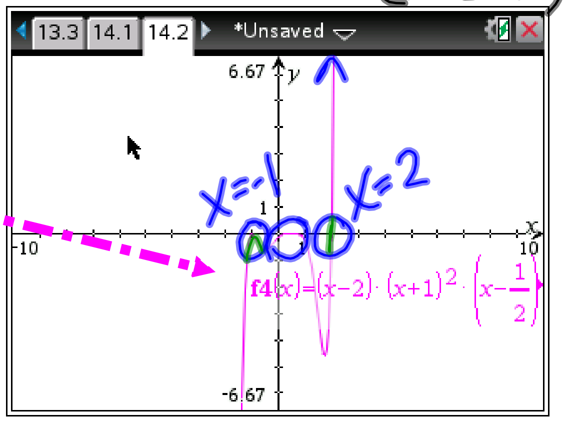
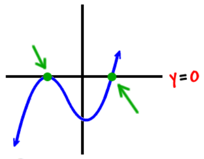
Multiplicity of Roots

Even multiplicity roots **touch** the x-axis. look like ∪ at Root $(\text{factor})^2$
Odd multiplicity roots **cross** the x-axis. looks linear @ Root $(\text{factor})^1$

The larger the multiplicity the flatter the graph is at that root.

Example: $f(x) = \underbrace{(x-2)}_{1}\underbrace{(x+1)^2}_{2}(x-\frac{1}{2})^4$





Examples:

1)

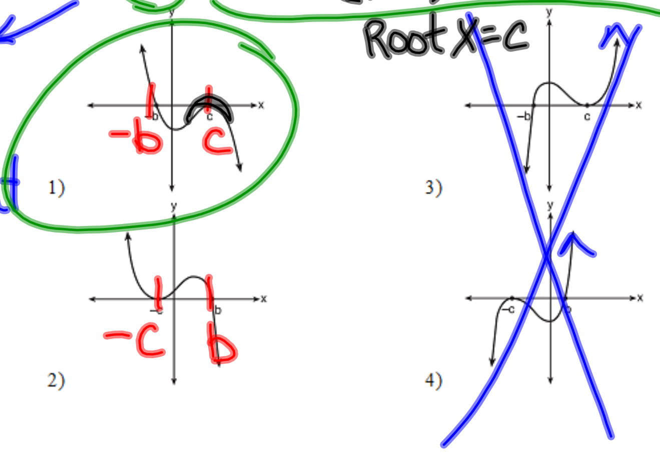
If a, b and c are all positive real numbers, which graph could represent the sketch of the graph of $p(x) = -a(x+b)\left(x^2 - 2cx + c^2\right)$?

$(x-c)^2$

Root $x=c$

$-a$ leading coefficient (Right ↓)

factor: $(x+b)$ single Root: $x=-b$



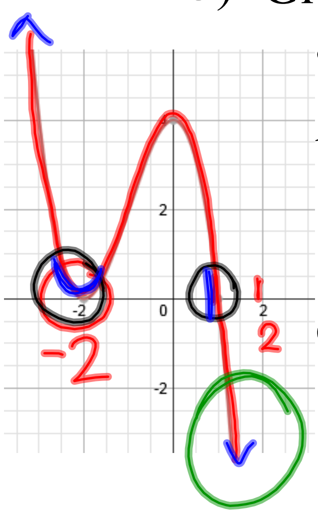
2) Find a Polynomial of degree 3 whose zeros are -3, 2, 5.

Roots

$x = -3, 2, 5$

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

3) Given the graph shown at the left



a) Find the roots

$x = -2, 1$

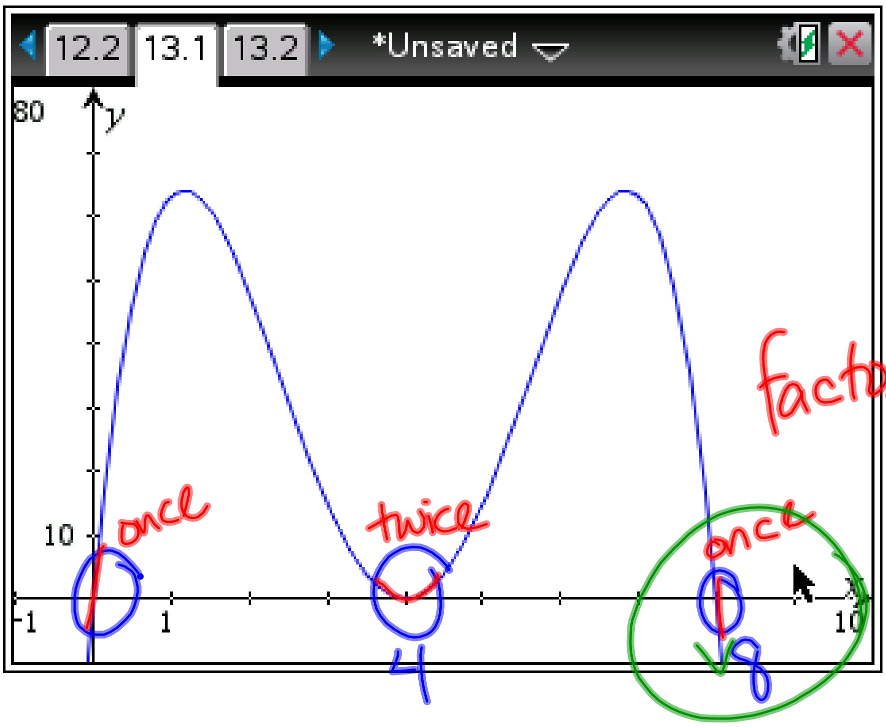
b) State the factors

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

c) Write a potential equation

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

Construct a polynomial function that might have this graph.



Roots:

$x = 0, 4, 8$

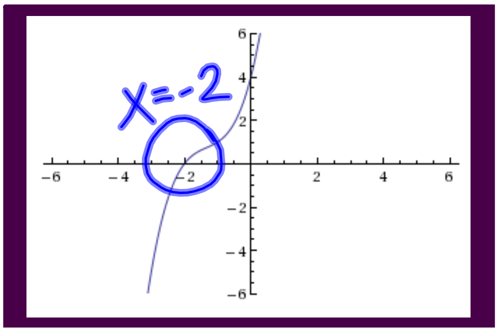
factors:

$x \quad (x-4) \quad (x-8)$

$$f(x) = -x(x-4)^2(x-8)$$

Example 1:

The graph of the polynomial function f(x) = $x^3 + 4x^2 + 6x + 4$ is shown below.



a) Based on the appearance of the graph, what seems to be the real solution to the equation: $y = x^3 + 4x^2 + 6x + 4$?

$x = -2$

b) Jiju does not trust the accuracy of the graph. Prove to her algebraically that your answer is in fact a zero of y = f(x).

If you plug in $x=-2$, and $y=0$ then it's a Root

$$(-2)^3 + 4(-2)^2 + 6(-2) + 4 = 0$$

$(-2)^3+4(-2)^2+6(-$▸

0

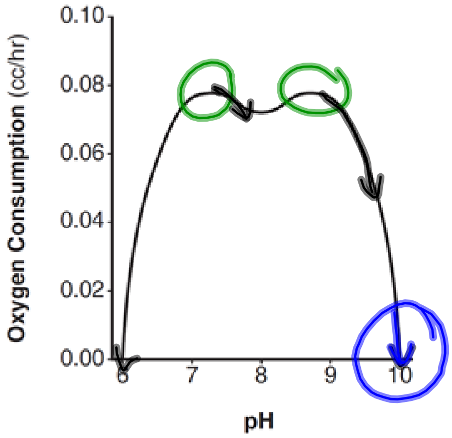
X	Y_1
-2	0
-1	1
0	4
1	15
2	40
3	85
4	156

Press + for ΔTbl

Regents Practice

There was a study done on oxygen consumption of snails as a function of pH, and the result was a degree 4 polynomial function whose graph is shown below.

even



Which statement about this function is *incorrect*?

1) The degree of the polynomial is even. TRUE
2) There is a positive leading coefficient. False
3) At two pH values, there is a relative maximum value. true — 2 turning points w/ max in that area
4) There are two intervals where the function is decreasing. TRUE

Regents Practice

A polynomial equation of degree three, $p(x)$, is used to model the volume of a rectangular box. The graph of $p(x)$ has x intercepts at -2, 10, and 14. Which statements regarding $p(x)$ could be true?

Roots

A. The equation of $p(x) = (x-2)(x+10)(x+14)$.

B. The equation of $\boxed{p(x) = -(x+2)(x-10)(x-14)}$.

C. The maximum volume occurs when $x = 10$.

Root can't be max

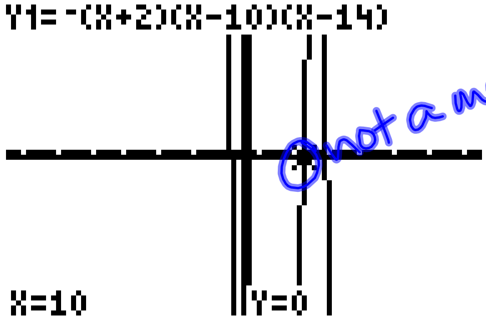
D. The maximum volume of the box is approximately 56.

1) *A* and *C*

2) *A* and *D*

3) ~~*B* and *C*~~

4) *B* and *D*

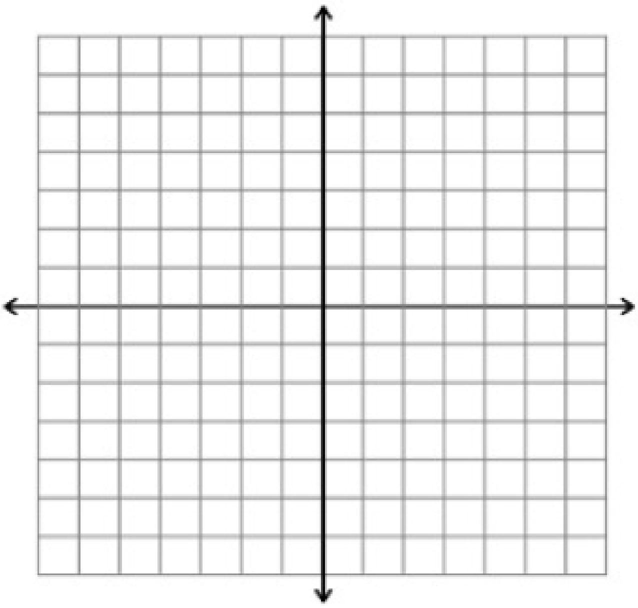


not a max

1. Solve algebraically for all real and imaginary values of x in simplest form.

$$x^4 + 4x^3 + 4x^2 + 16x = 0$$

2. Using your calculator, sketch the graph of $y = x^3 - 3x^2 + 2x + 1$ on the grid below. State the solution set of the equation $x^3 - 3x^2 + 2x + 1 = 0$.



What are the roots of the equation $4x^2 + 8x + 13 = 0$ in simplest $a + bi$ form?

$$(x^2+9)(x^2-4)=0$$

If a function has a negative leading coefficient and factors of (x-p)(x-q)(x+r) with a y-intercept at s, sketch and label all intercepts on the grid below.