Writing Equations of Lines

Find the eq of the line given: $f(1)=3$
$f(3)=7$

$(1,3)$ $(3,7)$

$m=\frac{7-3}{3-1}=\frac{4}{2}=2$

$y-y_1=m(x-x_1)$

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

$y-3=2x-2$

$y=2x+1$

Quadratic Equations:

Standard Form:

$$y = ax^2 + bx + c$$

Graphing or Vertex Form:

$$y = a(x-h)^2 + k$$

vertex: (h,k)
axis of symmetry x=h

how do you change from standard to vertex form???

$$y = x^2 + 4x - 7$$

$\frac{4}{2} = 2^2 = 4$

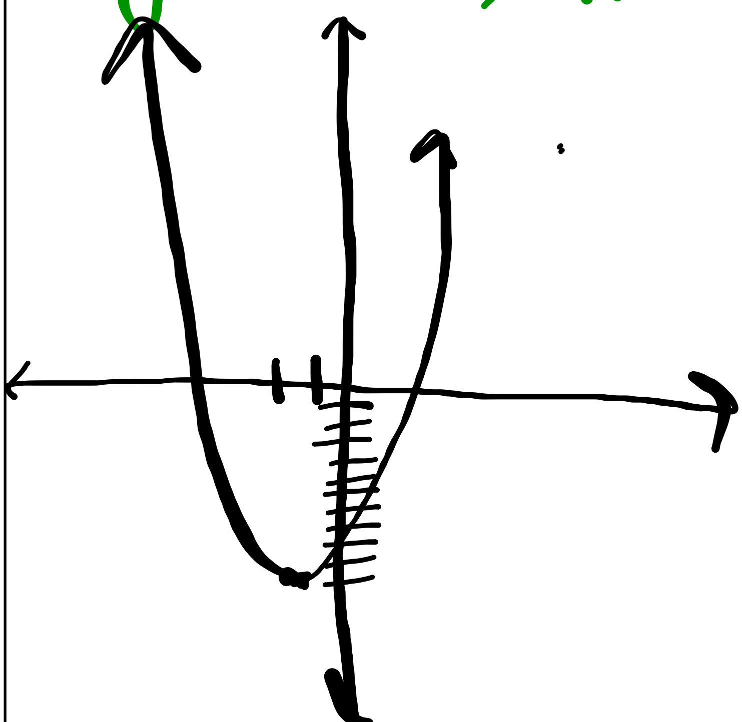
$y + 7 + \underline{4} = x^2 + 4x + \underline{4}$

$y + 11 = (x+2)^2$

$y = (x+2)^2 - 11$

V: $(-2, -11)$

a: $x = -2$



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

Write the eq. of the parabola w/ vertex (-2, -3) & point (-4, -5)

$$y = a(x-h)^2 + k$$

$$-5 = a(-4+2)^2 - 3$$

$$-5 = a(-2)^2 - 3$$

$$-5 = 4a - 3$$

$$\frac{-2}{4} = \frac{4a}{4}$$

$$a = -\frac{1}{2}$$

$$\boxed{y = -\frac{1}{2}(x+2)^2 - 3}$$

End Behavior (polynomial) 21

End Behavior is determined by the degree of the polynomial and the coefficient of the leading term. The mathematical notation is written using limits.

$$\lim_{x\to-\infty} f(x) =$$

left end

$$\lim_{x\to\infty} f(x) =$$

right end

Odd Degree: the left & right ends go in opp. directions

(+) coeff.

$$\lim_{x\to\infty} f(x) = \infty$$

$$\lim_{x\to-\infty} f(x) = -\infty$$

(-) coeff.

$$\lim_{x\to\infty} f(x) = -\infty$$

$$\lim_{x\to-\infty} f(x) = \infty$$

Even Degree: both ends go in the same direction

(+) coeff.
both up

$$\lim_{x\to\infty} f(x) = \infty$$

$$\lim_{x\to-\infty} f(x) = \infty$$

(-) coeff.
both down

$$\lim_{x\to\infty} f(x) = -\infty$$

$$\lim_{x\to-\infty} f(x) = -\infty$$

Find the zeros of: $y = 3x^3 - 5x^2 + 2x$

Given the zeros, write a polynomial equation of given degree:

degree 5, zeros: 0, 2, -5

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

degree 4, zeros: -2, 2

degree 4, zeros: -5, 0, 5

multiplicity

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The **power** of the factor determines the nature of the intersection at the point $x = a$.
(This is referred to as the multiplicity.)

Straight intersection:

$(x - a)^1$ The power of the zero is 1.

Tangent intersection :

$(x - a)^{even}$ The power of the zero is even.

Inflection intersection: **(like a slide through)**

$(x - a)^{odd}$ The power of the zero is odd.

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

Zero: 3 mult: 2

Zero: -2 mult: 1

Graph and decide end behavior

$$a) f(x) = x^3 + 2x^2 - 11x - 12$$

$$\lim_{x\to\infty} f(x) = \infty \qquad \lim_{x\to-\infty} f(x) = -\infty$$

$$b) g(x) = 2x^4 + 2x^3 - 22x^2 - 18x - 35$$

$$\lim_{x\to\infty} g(x) = \infty \qquad \lim_{x\to-\infty} g(x) = \infty$$

Practice:

Sketch the graph of: $y = x^2 (x+5)^3 (x+1)^2$

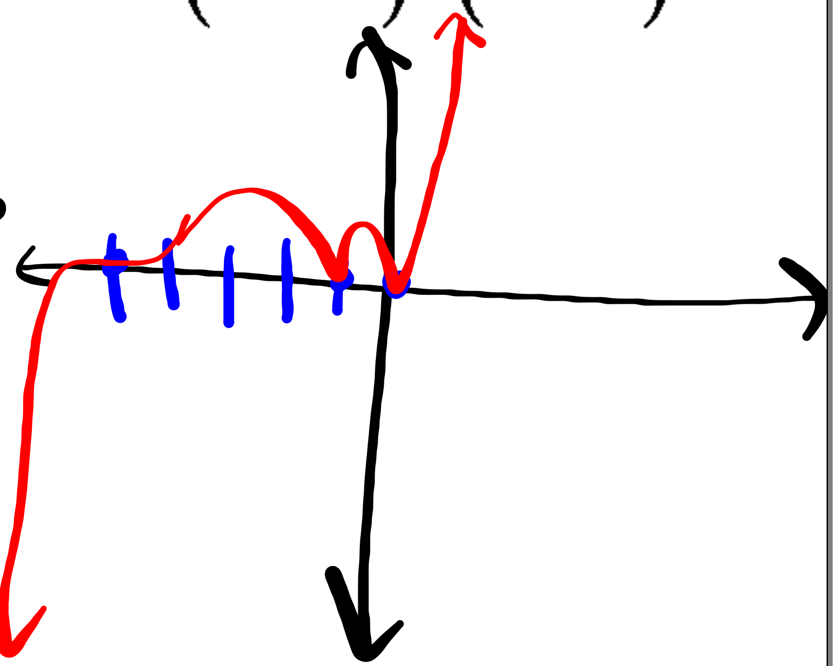
0 : 2 - BOUNCE

-5 : 3 - hug/slide

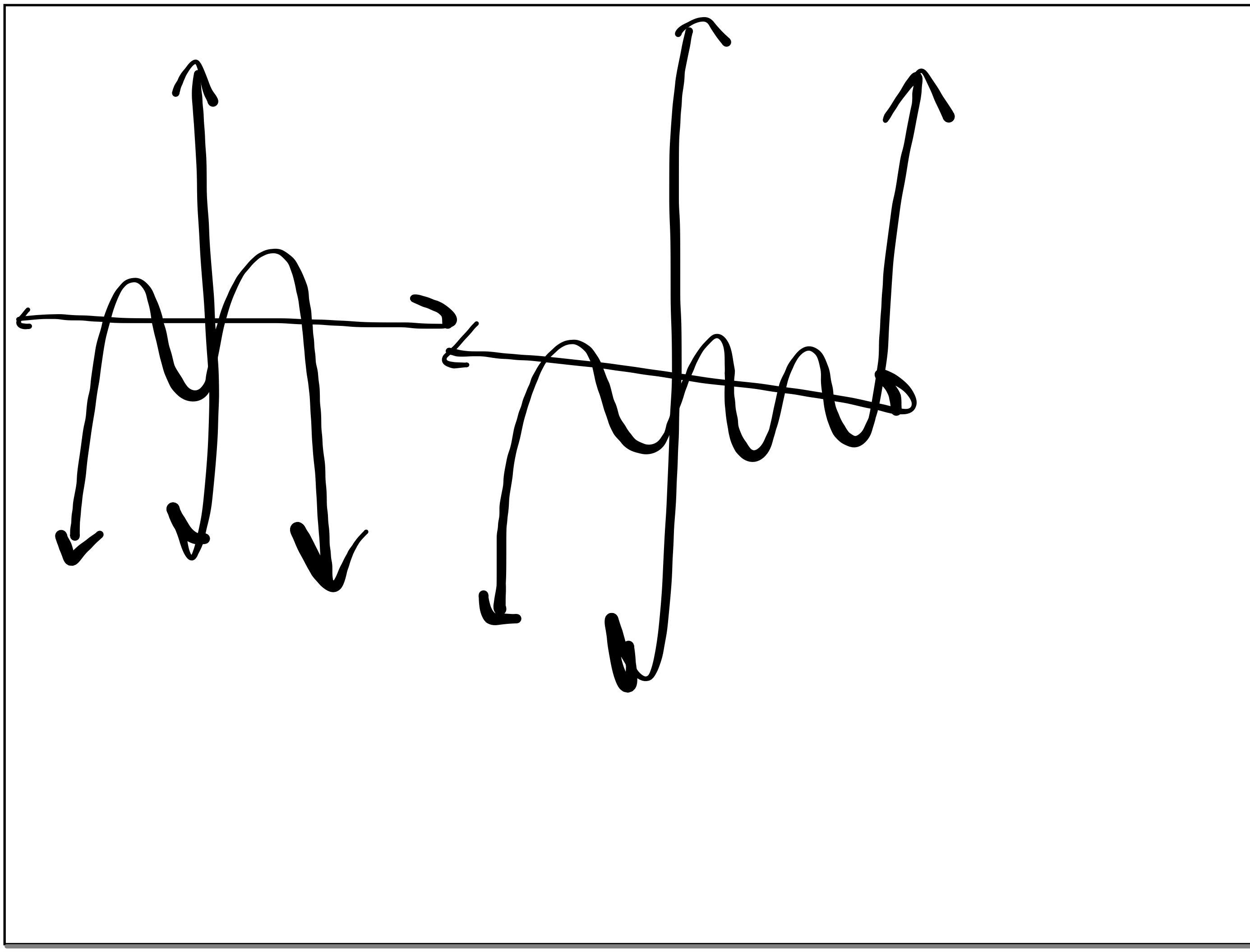
-1 : 2 - BOUNCE

D: 7

$\downarrow \uparrow$



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



Use the Remainder & Factor Thm. to find if the first polynomial is a factor of the second: (there are 2 ways)

$x-3$; x^3-x^2-x-15

Rational Root Theorem:

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if all coefficients are integers and the constant is not 0, then all possible rational roots are:

$$x = \pm \frac{\text{factors of constant}}{\text{factors of leading coefficient}}$$

or $x = \pm \dfrac{p}{q}$ when

p = factors of constant
q = factors of leading coefficient

Prove all the zeros of $2x^4 - 7x^3 - 8x^2 + 14x + 8$ must lie in the interval [-2,5]

Find all the zeros of: $2x^4 - 7x^3 - 8x^2 + 14x + 8$

1. Rational Roots Theorem
2. Graph to find Zeros
3. Syntheticlly Divide
4. Divide until Quadratic
5. Solve the Quadratic