Date ____________ 1.3 Notes Solving Equations Graphically

Solve algebraically.

a) $\left(\frac{2x+1}{3}+16\right)^3=(3x)^3$

$2x+1+48=9x$

$2x+49=9x$

$49=7x$

$\boxed{x=7}$

intersection

b) $x^3+2x^2=9x+18$

$x^3+2x^2-9x-18=0$

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

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

$(x+2)(x-3)(x+3)=0$

$\boxed{x=-2,3,-3}$

c) $-x^4+1=2x^2-3$ … What can you do if you can't solve algebraically?

Solving equations graphically: 2 different methods

Example (c): $-x^4+1=2x^2-3$. ⟶ $x^4+1-2x^2+3=0$

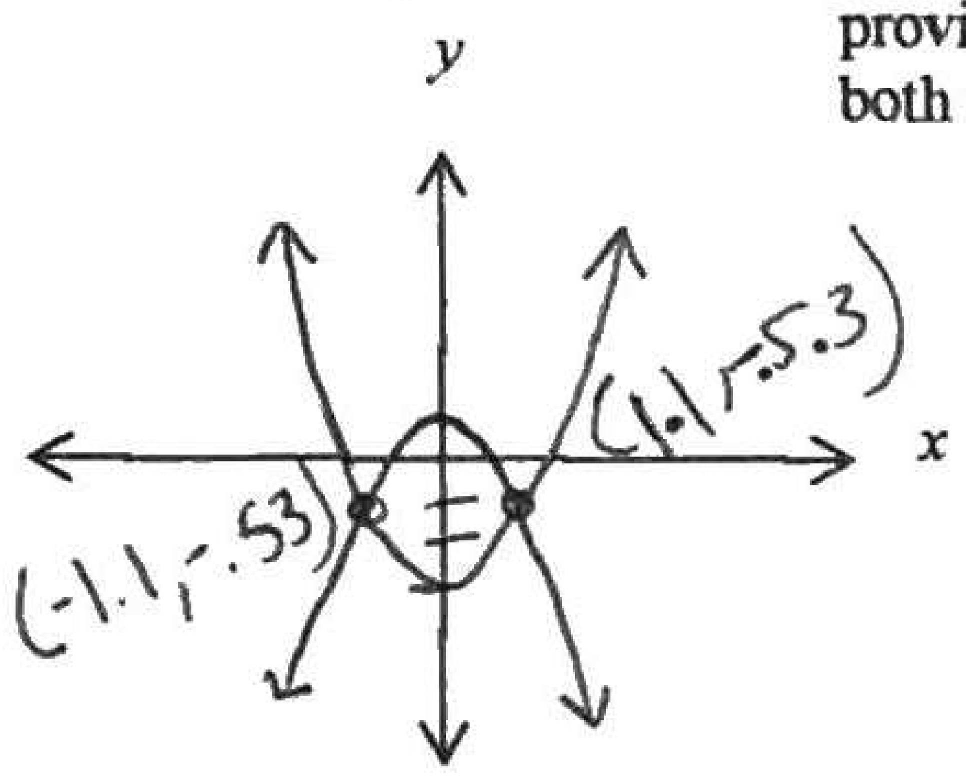
Method 1: intersection Method

Let $y_1 = -x^4+1$

$y_2 = 2x^2-3$

Use color and label each one.

Give a viewing window that provides a complete graph for both equations. Label key points.



$\boxed{x \approx -1.1,\ 1.1}$

$[-10, 10]$ by $[-10, 10]$

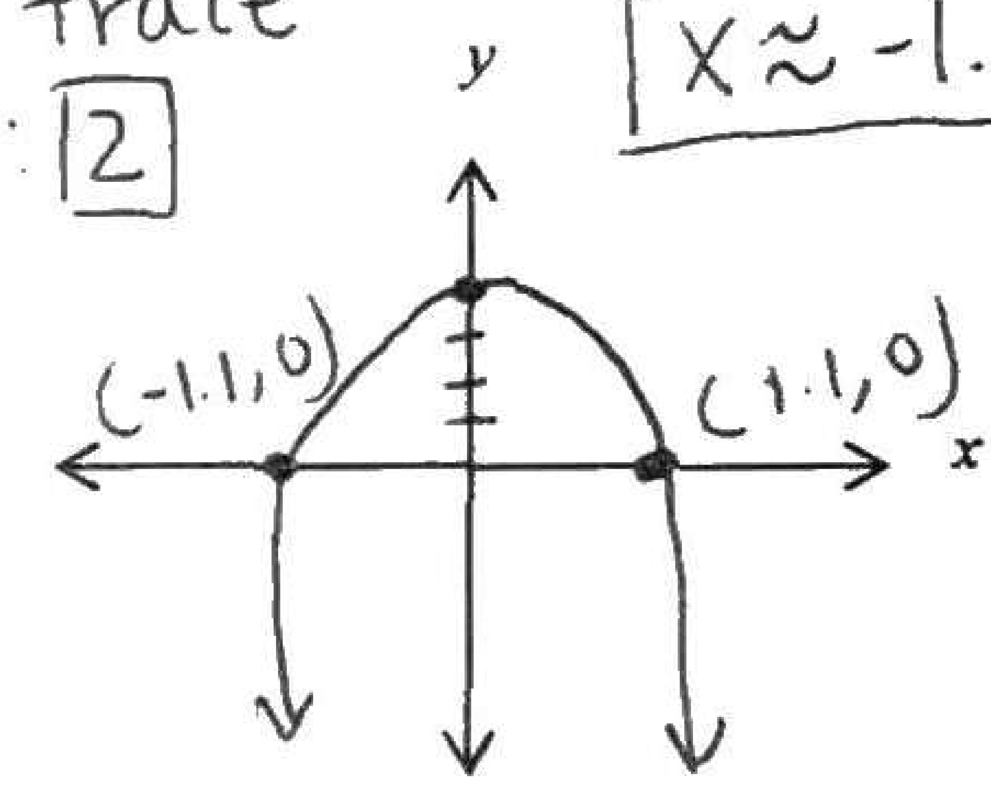
Method 2: zero or x-int Method

Let $y_1 = -x^4-2x^2+4$

$\boxed{\text{2nd}}$ trace

calc : $\boxed{2}$

$\boxed{x \approx -1.1, 0}$



$[-5, 5]$ by $[-5, 5]$

$\boxed{x \approx -1.1, 0}$

The solutions are your x - values **only. Why?** When solving the original problem, there are only x-values in the equation.

In general, solve $h(x)=g(x)$ by graphing:

Method 1: intersection Method

1. Graph $y_1 = h(x)$ and $y_2 = g(x)$.
2. Find each point of intersection.
3. The solutions are the x-values of each point of intersection.

Method 2: zero or x-int Method

1. Rewrite the equation as $h(x)-g(x)=0$.
2. Graph $y_1 = h(x)-g(x)$
3. Find the x-ints. or zeros
4. The solutions are the x-values.

Summary: Solve the following equation three different ways. $2x+3=4(x-1)+1$

i) Use algebra

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

$2x+3=4x-3$

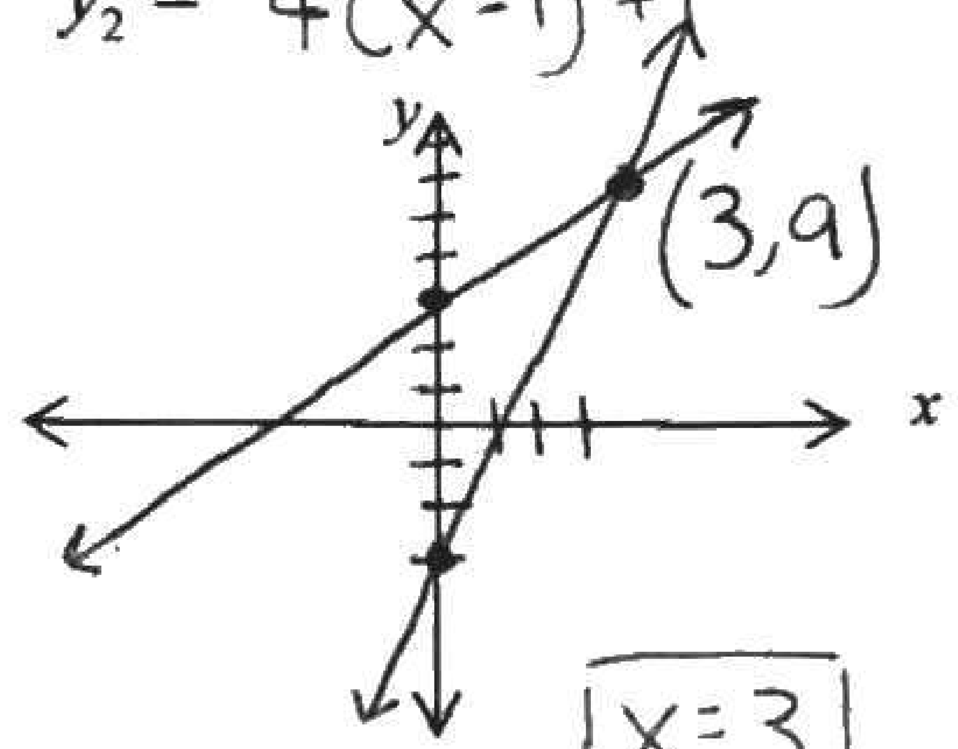
$6=2x$

$\boxed{x=3}$

ii) Use your TI to graph a system

$y_1 = 2x+3$

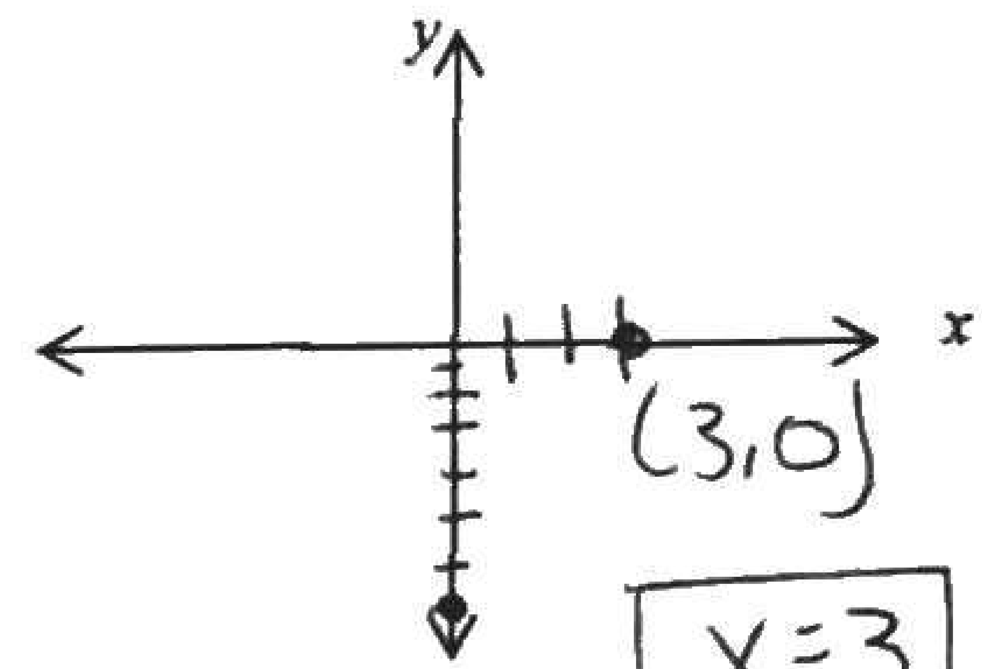
$y_2 = 4(x-1)+1$



$\boxed{x=3}$

iii) Use your TI to graph a single equation

$y_1 = 2x-6$



$\boxed{x=3}$

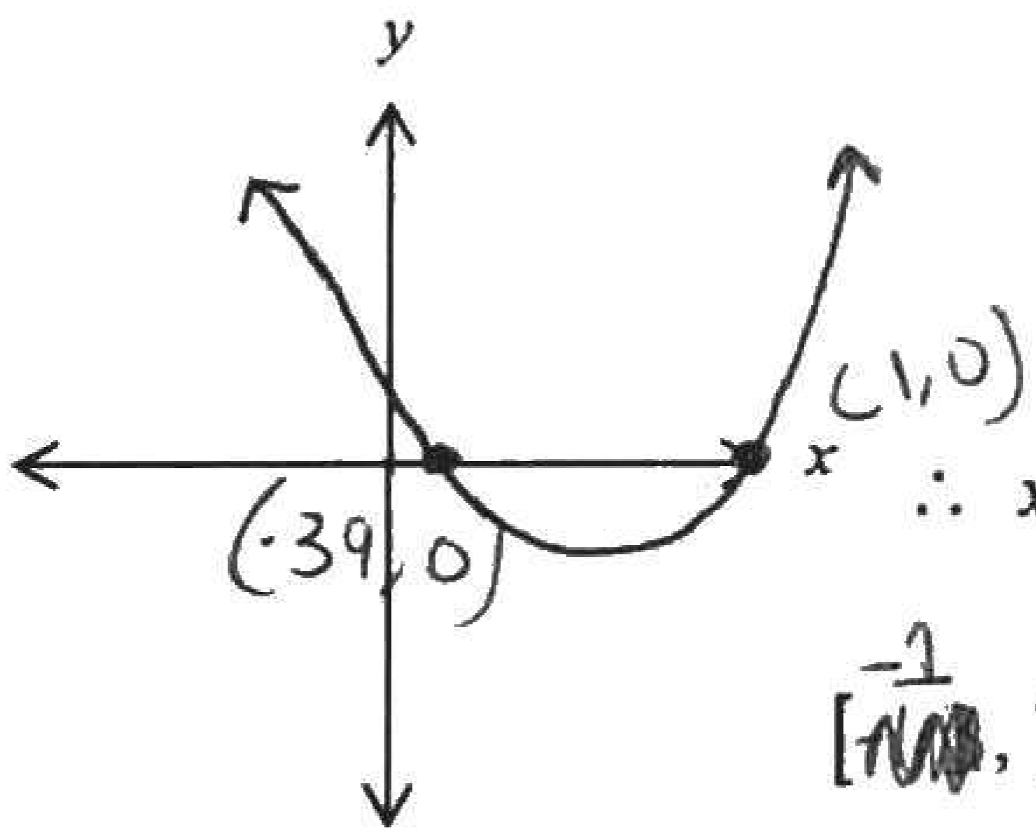
Observation: The algebra approach was the easiest method and did not require a TI. If an equation can not be solved algebraically we will find solutions using our TI.

Special cases:

1. Solve: $\sqrt{x^4+x^2-3x+1}=0$. Use **Zbox**.

Let $y_1 = \sqrt{x^4+x^2-3x+1}$ What happens? Calc can't find zeros b/c no neg. values

Instead, try $y_1 = x^4+x^2-3x+1$



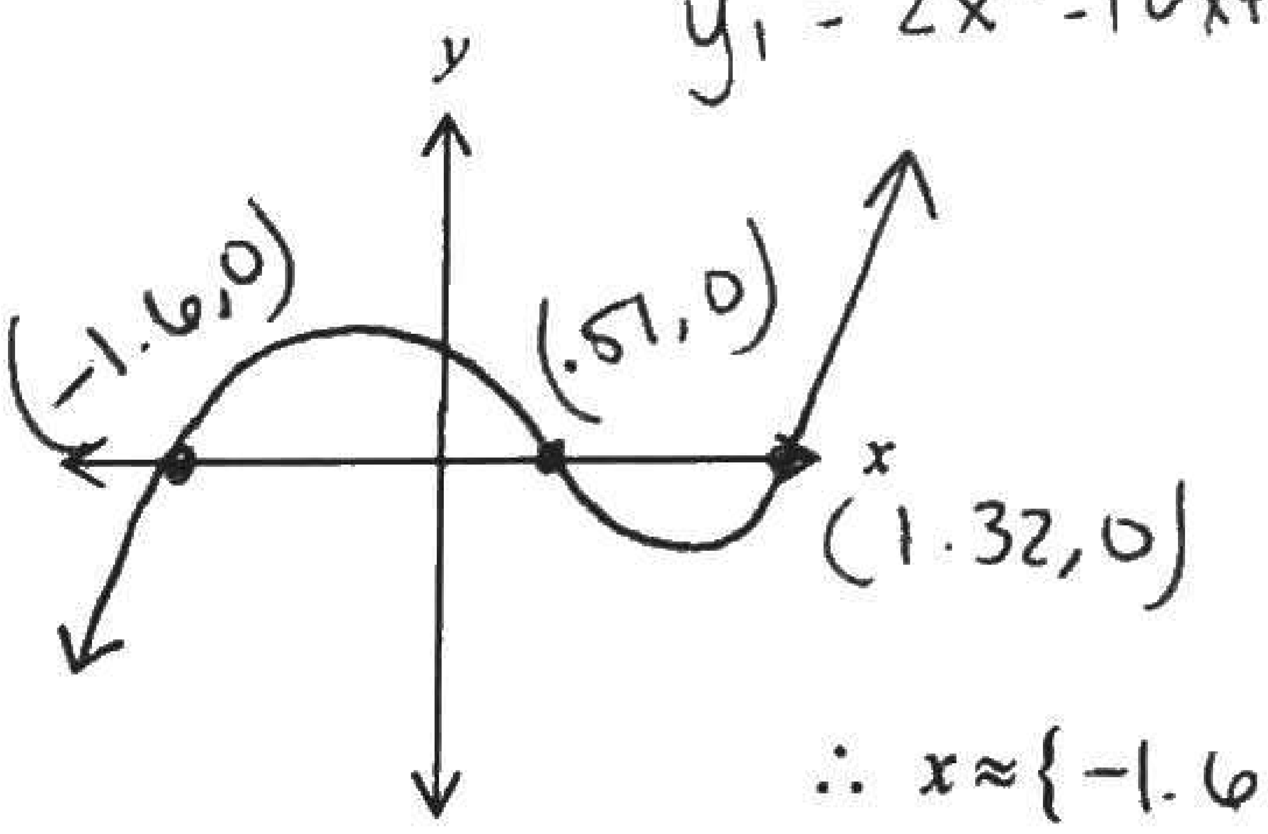
$\therefore x \approx \{.39, 1\}$

$[-1, 3]$ by $[-1, 2]$

Helpful Hint:

To solve $\sqrt{f(x)}=0$, you can simplify your work and solve $f(x)$ = 0 because (in your own words)... the only time $\sqrt{\#}=0$ is when $\#=0$

2. Solve $\dfrac{2x^5-10x+5}{x^3+x^2-12x}=0$. $\rightarrow$ $y_1 = 2x^5-10x+5$



Helpful Hint:

$\therefore$ To solve $\dfrac{f(x)}{g(x)}=0$, you can simplify your work by setting the $f(x)$ = 0 because (in your own words)... the only time $\frac{f(x)}{g(x)}=0$ is when $f(x)=0$ ($g(x)=0$ is undefined.)

Always check for x-values that make the denominator = 0.

$\therefore x \approx \{-1.6, .51, 1.3\}$ "extraneous" solutions

$[-2, 3]$ by $[-4, 15]$