Math 1311
Section 2.2
Graphs

Graphing with the calculator
Step 1: Enter the function or functions in the Y= menu.
Step 2: Selecting the Viewing Window:
Step 3: Viewing the Graph:
Step 4: Tracing the Graph and finding the function value for a particular X value.

Example 1: Graph the function $f(x) = x^2 - 2$

Step 1: Enter the function in the Y = menu.

```
Plot1 Plot2 Plot3
\Y1◘X^2-2█
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

Step 2: Set the Graphing Window in the Window menu.

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-2
 Ymax=25
 Yscl=2
 Xres=1
```

The Xmin is the left side of the x-axis.
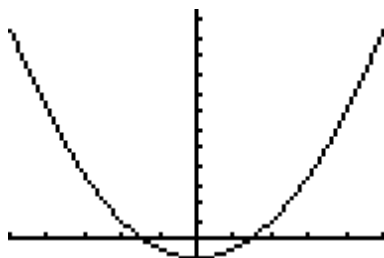The Xmax is the right side of the x-axis.
The Xscl is how far apart the tick marks are on the x-axis.
The Ymin and Ymax are the smallest and largest y values on the y-axis.
The Yscl is how far apart the tick marks are on the y-axis.
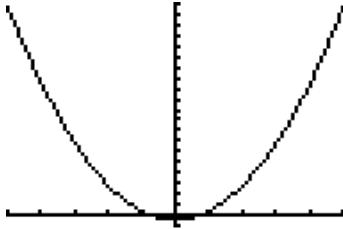The Xres leave at 1.

Step 3: Graph – here is what it looks like when I hit graph with the settings above.

Let me change the window settings.
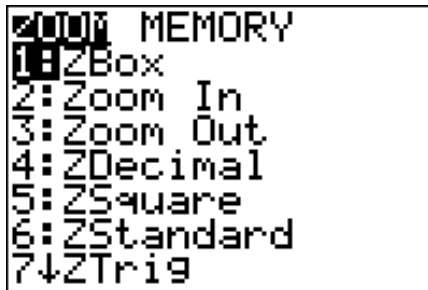
```
WINDOW
  Xmin=-10
  Xmax=10
  Xscl=2
  Ymin=-5
  Ymax=100
  Yscl=5
  Xres=1
```

Here is what it looks like now:

Sometimes using Zoom option works better.

Alternative Step 2: Press [TBLSET F2 / WINDOW] and enter the minimum and maximum input values (Xmin and Xmax).

```
ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7↓ZTrig
```

Alternative Step 3: Now press [FORMAT F3 / ZOOM] [CATALOG / 0] to see the graph.   Not always the best choice.
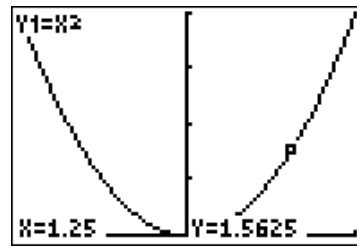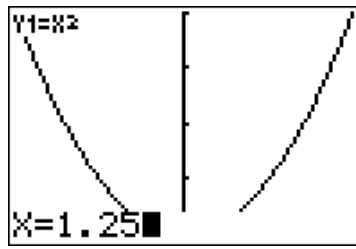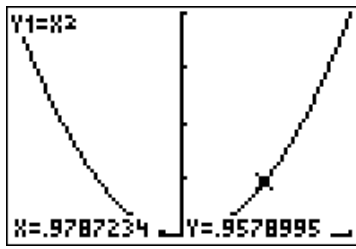
Step 4: Reading Values from the Graph

While looking at the graph, we can press [CALC F4 / TRACE], then using the left and right arrows, we can read values on the graph.

While tracing, if we enter any number (between X_{min} and X_{max}) and then press [ENTRYSOLVE / ENTER] we will see the function's value for that value of x.

Example 2: Find $f(1.25)$ for $f(x) = x^2$. $f(1.25) = 1.5625$

Screen 1: `Y1=X2` ... `X=.9787234` `Y=.9578995`
Screen 2: `Y1=X2` ... `X=1.25`
Screen 3: `Y1=X2` ... `X=1.25` `Y=1.5625`, point P

Example 3: Graph the function $f(x) = 2^x - x^2$.

  a. Find a good window to view the piece from $x = 0$ to $x = 5$.

  b. Find $f(2)$.

  c. Find $f(3.4)$.

$$[-2,7] \times [-7,7]$$
$$\uparrow \quad \uparrow \qquad \uparrow \quad \uparrow$$
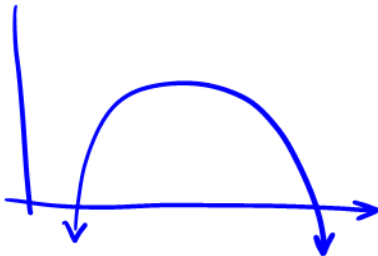$$X_{min} \quad X_{max} \quad Y_{min} \quad Y_{max}$$

(b) $f(2) = 0$

(c) $f(3.4) = -1.004$

Example 4: The yearly profit from the sale of n thousand widgets is
$P(n) = -180 + 100n - 4n^2$ million dollars.

  a. Sketch a graph of this function showing values of n between 0 and 20.

Window : $[-2,22] \times [-10,500]$

  b. Calculate $P(0)$ and explain in practical terms what your answer means.

$P(0) = -180$ Profit if 0 widgets are sold.
They loose \$180 million

  c. What profit will the producer make if 15 thousand widgets are sold?

$P(15) = 420$

\$ 420 million

d. The break-even point is the point at which the profit is zero. Use the graph to <mark>estimate</mark> the break-even point.

$$P(x) = 0 \quad \text{trace the graph}$$

$$2.085 \times 1000 = 2085 \text{ widgets}$$

e. What is the largest profit possible?

trace... y $445 million

Example 5: The monthly payment on \$120000 borrowed at 6% compounded continuously if the loan is for x years is $M(x) = \dfrac{120000(e^{0.005}-1)}{1-e^{-0.06x}}$. Loans of this amount are typically <mark>10 to 30 years</mark> in length. <mark>Sketch the graph</mark> of this function, and while looking at the graph, determine the monthly payment if the money is borrowed for 15 years.
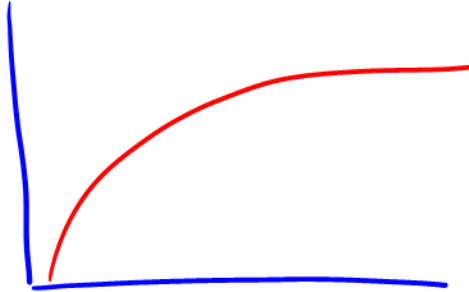
(a) graph

(b) $M(15)$

$= \$1,013.60$
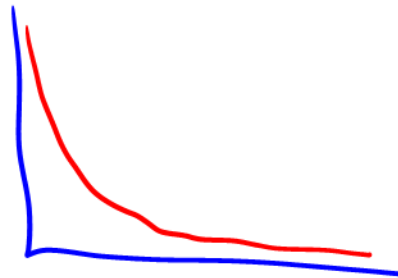
Example 6: A potato is placed in a preheated oven to bake. Its temperature F as a function of time t is given by $F(t) = 400 - 325e^{-t/50}$. Where F is measured in degrees Fahrenheit and t is time in minutes since the potato was placed in the oven.

a. Graph $F(t)$.

b. What is the initial temperature of the potato?

$t=0 \qquad F(0) = 75°$

c. Did the potato's temperature rise more during the first 30 minutes or during the second 30 minutes of baking time?

d. Is the graph concave up or concave down? What does this tell us about the average rate of change?

e. The potato will be done when it reaches a temperature of 270 degrees. Estimate when it will be done.

at about 46 minutes

f. What is the temperature of the oven?