


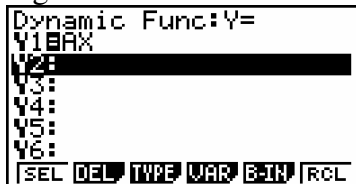
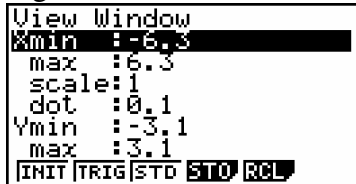
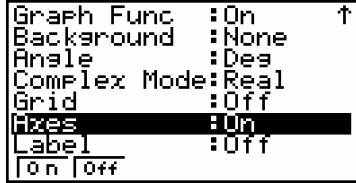
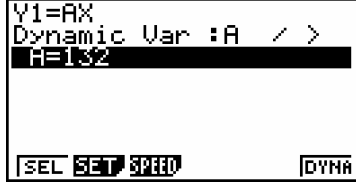



Casio 9860 – DYNA Investigation and Instructions

Instructions	Screenshots
<p>This activity is both a self-guided instruction worksheet and a student investigation of Straight Lines, Parabolas, Cubics, Hyperbolas, and Exponentials.</p> <p>1) Straight line graphs: Investigating the effect of 'A' in $Y = AX$</p> <p>Select MENU, then DYNA and into the 'Y1:' line enter AX ( then A then ) line. Press EXE. (Fig1) NOTE You must use  for X in DYNA, GRAPH and TABLE modes.</p> <p><u>To set up the axes:</u> Go to View window (SHIFT F3) and select INIT (F1) (Fig2) Press EXIT (Fig1)</p> <p><u>Turning on the axes:</u> Go to SET UP (SHIFT MENU) and arrow up to Axes and turn on with F1 if necessary. Set Grid and Label to Off. Press EXIT. (Fig3)</p> <p><u>To set the values for A:</u> Select VAR (F4). (You will be at screen Fig4 but will have most likely have a different value for A. Select SET (F2) and enter the values according to Fig5, pressing EXE after each entry. Press EXIT. You should be back at a screen like Fig4</p>	<p>Fig1</p>  <p>Fig2</p>  <p>Fig3</p>  <p>Fig4</p>  <p>Fig5</p> 

To select the speed:

Press SPEED (F3), and set speed to Stop&Go (F1) (Fig6) (you can experiment with this):

Press EXIT

Activating DYNA:

Select DYNA (F6) (Fig7) **Use EXE** to go to the next graph (with the next value of A)

(To stop press AC. To restart, EXIT, and press DYNA again)

QUESTIONS:

a) What is the effect when A is positive compared to A being negative?

b) What happens to the graph as A moves from 0.5 to 3 (and -0.5 to -3)

c) What do we call the co-efficient of X in a straight line graph?

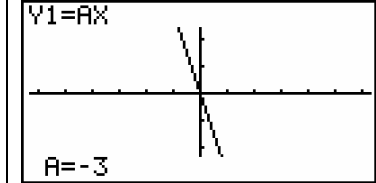
2) Straight line graphs: Investigating the effect of 'B' in $Y = 2X + B$

a) Before entering this into your calculator, what do you think will be the effect of B on the graph?

Fig6



Fig7



With DYNA still activated, press AC, EXIT, EXIT and in the Dynamic Function screen enter $2X+B$ (2 \times, θ, T + ALPHA)

B) **EXE** as shown in Fig8

Arrow up to **Y1** and use **SEL (F1)** to deselect the first graph (Fig9)

Go to **View Window (SHIFT F3)** and enter the min and max values for X and Y as per Fig10.

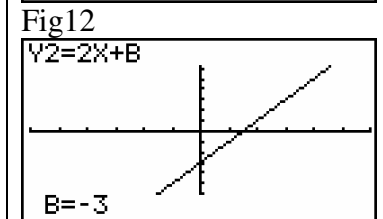
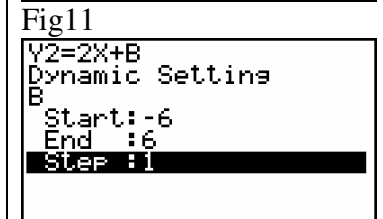
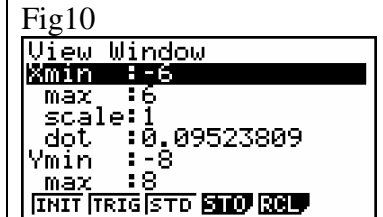
NOTE: Ignore scale, dot and all other settings

Press **EXIT** then **press VAR**, then **SET** and enter the values in Fig11

EXIT, and press **DYNA (Fig12)**

Press EXE repeatedly to see the graphs with different values for B

b) What effect does B have on the straight line? What is B called?



3) Investigating Quadratics (A quadratic equation, when graphed, is called a parabola)

Consider: $Y = AX^2$

Return to the Dynamic function screen. **(AC EXIT EXIT)** With the cursor over Y2 deselect by pressing F1 (Fig13)

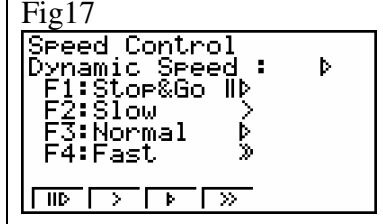
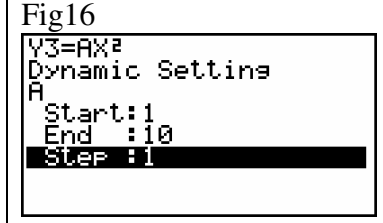
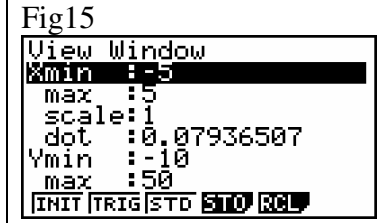
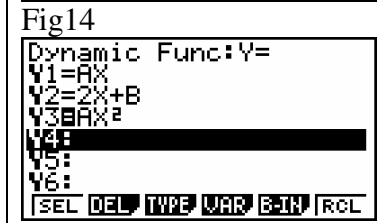
Into Y3 **enter AX²** ( A  ) and **EXE** (Fig14)

Go to View Window (SHIFT F3) and enter the **min and max values for X and Y as per Fig15.**
NOTE: Ignore scale, dot and all other settings

EXIT, select VAR (F4), then **select SET** (F2)
Enter the values as per Fig16

EXIT, press SPEED (F3) and select **NORMAL** (F3) (Fig17)
EXIT from there and select **DYNA** (F6).

a) How does the number before the X² term (the X² coefficient) affect the graph? Why does it affect the graph in this way?



4) Investigating Quadratics of the type $Y = 2X^2 + C$

a) Before we do this, what do you think will be the effect of the 'C' value on the graph?

Stop the DYNA animation (**press AC**), then **EXIT** twice.

Deselect the previous equation (F1), then **type in $2X^2 + C$ in Y4** (Fig18)

Change the **View Window settings according to Fig19**, ignoring scale and dot.

Press **EXIT, VAR and SET** and enter the **dynamic settings as per Fig20**

Press **EXIT and DYNA**.

b) What is the effect of 'C'?

d) What is the value 'C' called in relation to the graph?

Fig18

```
Dynamic Func:Y=  
Y1=AX  
Y2=2X+B  
Y3=AX^2  
Y4=2X^2+C  
Y5:  
Y6:  
[SEL DEL TYPE VAR B-IN RCL
```

Fig19

```
View Window  
Xmin :-5  
max :5  
scale:1  
dot :0.07936507  
Ymin :-10  
max :10  
[INIT TRIG STD STO RCL
```

Fig20

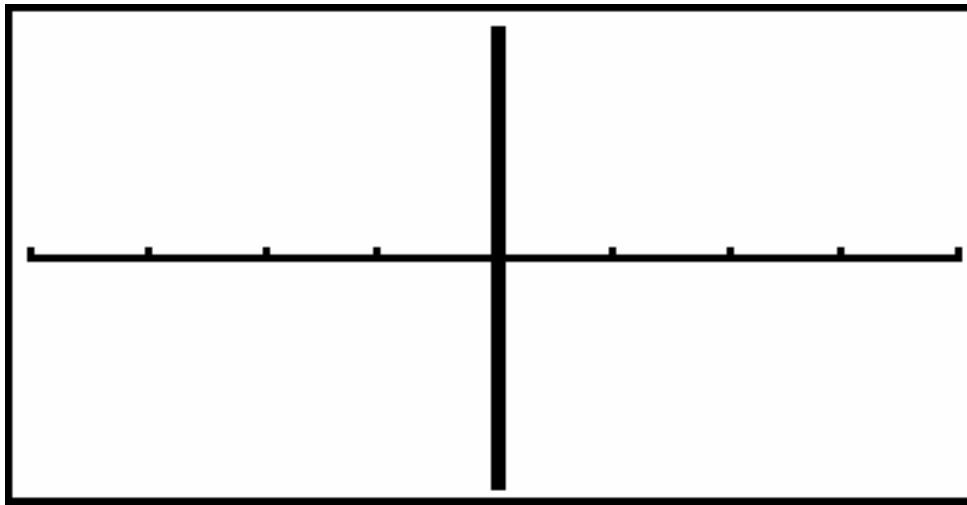
```
Y4=2X^2+C  
Dynamic Settings  
C  
Start:-5  
End :5  
Step :1
```

5) Investigating Cubics

Return to the Dynamic Function screen: **Press AC** to turn DYNA off, then **EXIT EXIT**.

Deselect the previous equation and enter AX^3 into Y5 (Fig21)

a) Before seeing this one, make a small free-hand sketch of your prediction of what any cubic graph will look like? (ie what will be the effect of the 'cube' on the X?)



Change the **View Window according to Fig22**

Change the **Dynamic Setting as per Fig23**

Press EXIT and DYNA.

b) Describe the effect the value of A has on the graph.

c) When A is a negative value what happens to the graph?

Fig21

```
Dynamic Func:Y=
Y1=AX
Y2=2X+B
Y3=AX^2
Y4=2X^2+C
Y5=AX^3
Y6=
[SEL] [DEL] [TYPE] [VAR] [B-IN] [RCL]
```

Fig22

```
View Window
Xmin : -4
max : 4
scale: 1
dot : 0.06349206
Ymin : -50
max : 50
[INIT] [TRIG] [STD] [STO] [RCL]
```

Fig23

```
Y5=AX^3
Dynamic Settings
A
Start: -20
End : 20
Step : 2
```

Answer the next question before activating DYNA.

Consider the cubic $Y = 2X^3 + C$

d) What will be the effect of the 'C' on the graph $Y = 2X^3 + C$?

Return to the Dynamic Function Window, deselect the previous function and enter $Y = 2X^3 + C$ into the (Fig24)

Leave the View Window settings unchanged but adjust the dynamic setting as per Fig25

Activate DYNA with $Y = 2X^3 + C$. Were you correct in part c)? _____

5) Investigating Exponential Graphs eg $Y = N^X$, $Y = N^X + 4$, $Y = N^X - 10$, etc

Go to the Dynamic Function screen, deselect the previous expression and enter $Y = N^X + 4$ into Y7 (Fig26)

Change the View Window according to Fig27

Change the Dynamic Setting as per Fig28

Press EXIT and DYNA.

Choose an appropriate speed setting and press DYNA.

a) Why is the graph a straight line when $N = 1$?

Fig24

```
Dynamic Func:Y=
Y2=2X+B
Y3=AX^2
Y4=2X^2+C
Y5=AX^3
Y6=2X^3+C
Y7:
[SEL][DEL][TYPE][VAR][B-IN][RCL]
```

Fig25

```
Y6=2X^3+C
Dynamic Settings
C
Start:-20
End:20
Step:5
```

Fig26

```
Dynamic Func:Y=
Y3=AX^2
Y4=2X^2+C
Y5=AX^3
Y6=2X^3+C
Y7=N^X+4
Y8:
[SEL][DEL][TYPE][VAR][B-IN][RCL]
```

Fig27

```
View Window
Xmin:-5
max:5
scale:1
dot:0.07936507
Ymin:-5
max:20
[INIT][TRIG][STD][STO][RCL]
```

Fig28

```
Y7=N^X+4
Dynamic Settings
N
Start:1
End:5
Step:1
```

b) What is the equation of the graph when it is a straight line?

c) Why does the graph curve when N is greater than 1?

Tracing A DYNA Graph:

We can't trace graphs in DYNA. But we can in GRAPH mode.

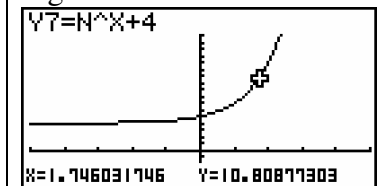
With DYNA running in the previous example ($Y = N^X + 4$) **stop it with AC** when there is a curved graph on the screen. Then go into GRAPH mode (press MENU then 5). You will see your equations are copied there.

Select $Y = N^X + 4$ and DRAW. Now **trace with SHIFT F1** (Fig29)

e) Use the right-left arrows to scroll to the y intercept. Why does the graph cross the Y axis at 5 (rather than 4)? HINT: Consider the equation.

f) Trace in the negative X direction. What Y value does the graph get closer and closer to but never touch?

Fig29



6) Investigating Hyperbolas $Y = \frac{A}{X}$

Return to DYNA. **(MENU then 6) Deselect any selected graphs, then enter A÷X at Y8** (Fig30)

Set the **View Window to INIT** (F1) (Fig31)

Set the **Dynamic Setting as per Fig32**
EXIT and press DYNA (Fig33)

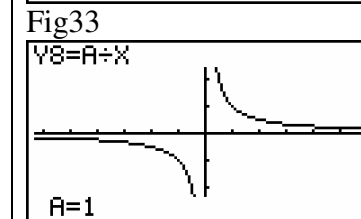
a) Why is each graph in 2 parts?

b) Why does the graph move further from the origin as A increases?

```
Fig30
Dynamic Func:Y=
Y4=2X^2+C
Y5=AX^3
Y6=2X^3+C
Y7=N^X+4
Y8A÷X
Y9
[SEL][DEL][TYPE][VAR][B-IN][RCL]
```

```
Fig31
View Window
Xmin :-6.3
max :6.3
scale:1
dot :0.1
Ymin :-3.1
max :3.1
[INIT][TRIG][STD][STO][RCL]
```

```
Fig32
Y8=A÷X
Dynamic Settings
A
Start:1
End :5
Step :1
```



Let's see what happens for negative values of N.

Change the Dynamic Settings as per Fig34 then EXIT and activate DYNA.

c) Why do these graphs lie in the other quadrants?

7) **EXTENSION ACTIVITY ONE**

Let's return to Question 5 (exponential graphs). What happens when the N in $Y = N^X + 4$ becomes less than 1?

Go to the Dynamic Function screen, **deselect $Y=A \div X$ reselect $Y = N^X + 4$** (Fig35) Make sure no other functions are selected.

Change the View Window according to Fig36

Change the **Dynamic Setting as per Fig37**

Press DYNA (F6)

a) Why does the graph curve upward in the negative X region (on the left) when the N values that are less than 1?

```
Fig34
Y8=A+X
Dynamic Settings
A
Start:-5
End:-1
Step:1
```

```
Fig35
Dynamic Func:Y=
Y3=AX^2
Y4=2X^2+C
Y5=N^X
Y6=2X^3+C
Y7=N^X+4
Y8=A+X
[SEL DEL TYPE VAR B-IN RCL
```

```
Fig36
View Window
Xmin:-5
max:5
scale:1
dot:0.07936507
Ymin:-5
max:20
[INIT TRIG STD STO RCL
```

```
Fig37
Y7=N^X+4
Dynamic Settings
N
Start:0.1
End:2
Step:0.1
```

b) Why does the curve get steeper on the left as N changes from 0.9 to 0.1?

c) Why is the left curve much steeper when $N = 0.1$ than the right curve when $N = 1.9$?

d) Experiment with different Dynamic Settings and see what you find!

8) **EXTENSION ACTIVITY TWO**

We have seen the difference between quadratics and cubics. Let's see what happens for other values of N when $Y = X^N$

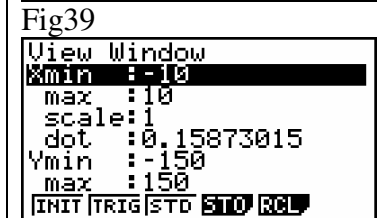
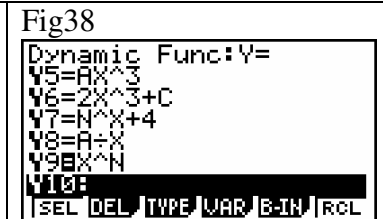
Enter $Y = X^N$ into the Dynamic Function screen and **de-select other equations** (Fig38)

Change the **View Window according to Fig39**

Change the **Dynamic Setting as per Fig40**

Change the **Speed Setting to Slow as per Fig41**
Press EXIT then DYNA

a) Look closely at what is happening. What happens when N is an odd number?



b) What happens when N is an even number?

c) What is the difference in the shapes of $Y = X^2$ and $Y = X^{10}$?

d) What is the difference in the shapes of $Y = X^3$ and $Y = X^9$?

NOTES: