CASIO fx-82ZA PLUS
FUNCTIONS
Rencia Lourens – RADMASTE Centre

MODE 3: Table

[MODE] [3:TABLE]

A. Intersection of Graphs

1. Find the points of intersection of the straight line f(x) = x – 3 and the parabola g(x) = x^2 – x – 6 when $x \in [-3;4]$

<table>
<tr><td>Key Sequence:</td><td>On screen:</td></tr>
<tr><td>

- Input f(x) formula [=]
to input the variable x:
[ALPHA] [X]
- Input g(x) formula [=]
- Set boundaries for the table:
Start? [-3] [=]
End? [4] [=]
Steps? [1] [=]

Point of Intersection (-1 ; -4)

Point of Intersection (3 ; 0)
</td><td>

- f(X) = X – 3
- g(X) = X² – X – 6

<table>
<tr><td></td><td>x</td><td>f(x)</td><td>g(x)</td></tr>
<tr><td>1</td><td>-3</td><td>-6</td><td>6</td></tr>
<tr><td>2</td><td>-2</td><td>-5</td><td>0</td></tr>
<tr><td>3</td><td>-1</td><td>-4</td><td>-4</td></tr>
<tr><td>4</td><td>0</td><td>-3</td><td>-6</td></tr>
<tr><td>5</td><td>1</td><td>-2</td><td>-6</td></tr>
<tr><td>6</td><td>2</td><td>-1</td><td>-4</td></tr>
<tr><td>7</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td>8</td><td>4</td><td>1</td><td>6</td></tr>
</table>
</td></tr>
</table>

2. Find the point(s) of intersections of the graphs $y = x^2 - 3x - 4$ and $y = -x + 1\frac{1}{4}$
   - This question differs from the previous one because it is not giving us an interval to work with; we hence have to choose our own one. An easy domain to start with is [–5; 5].
   - The question also differs from the previous one because we do not find an intersection immediately.

Key Sequence:	**On screen:**
• Input f(x) formula [=] • Input g(x) formula [=] • Set boundaries for the table: *Start?* [-5] [=] *End?* [5] [=] *Steps?* [1] [=] **Note:** • $-5 \le x \le -2$: $f(x) < g(x)$ • $-1 \le x \le 3$: $f(x) > g(x)$ • $4 \le x \le 5$: $f(x) < g(x)$ **Hence:** • One Point of Intersection should be $-2 < x < -1$ • Second point of intersection should be $3 < x < 4$	• $f(X) = -X + 1\frac{1}{4}$ • $g(X) = X^2 - 3X - 4$

	X	*f(x)*	*g(x)*
1	-5	6.25	36
2	-4	5.25	24
3	-3	4.25	14
4	-2	3.25	6
5	-1	2.25	0
6	0	1.25	-4
7	1	0.25	-6
8	2	-0.75	-6
9	3	-1.75	-4
10	4	-2.75	0
11	5	-3.75	6

- We are going to repeat the process but first focus on the domain $-2 \le x \le -1$.
- Afterwards we will repeat the process for the domain $3 \le x \le 4$.

  Key Sequence for the next example is actually

  [AC] (brings you to f(x))

  [=] (brings you to g(x))

  [=] (brings you to [start?])

  So you don't have to enter the equations again.

  You just have to press [AC]; [=]; [=] and you are at start

Key Sequence:	**On screen:**
• Set boundaries for the table: *Start?* [-2] [=] *End?* [-1] [=] *Steps?* [0.25] [=] **Point of Intersection (– 1,5 ; 2,75)**	• $f(X) = -X + 1\frac{1}{4}$ • $g(X) = X^2 - 3X - 4$

	X	*f(x)*	*g(x)*
1	–2	3.25	6
2	–1.75	3	4.3125
3	–1.5	2.75	2.75
4	–1.25	2.5	1.3125
5	–1	2.25	0

Next domain:

<table>
<tr><td>

Key Sequence:

- [AC] [=] [=]
- Set boundaries for the table:
  Start? [3] [=]
  End? [4] [=]
  Steps? [0.25] [=]

Point of Intersection (3,5; -2,25)

</td><td>

On screen:

- $f(X) = -X + 1\frac{1}{4}$
- $g(X) = X^2 - 3X - 4$

	X	*f(x)*	*g(x)*
1	3	– 1.75	–4
2	3.25	–2	–3.1875
3	3.5	– 2.25	– 2.25
4	3.75	– 2.5	–1.1875
5	4	– 2.75	0

</td></tr>
</table>

If we still did not find the point of intersection we can

- change the domain again – by making sure that we have the intervals where there is a change from $f(x) < g(x)$ to $f(x) > g(x)$ or vice versa.
- change the steps again

B. Finding the turning point of a parabola

1. Find the turning point of $f(x) = x^2 - 4x - 1$

- We are not sure about the range so will work with $x \in [-5;5]$

<table>
<tr><td>

Key Sequence:

- Input f(x) formula [=]
- Input g(x) formula [=]
- Set boundaries for the table:
  Start? [–5] [=]
  End? [5] [=]
  Steps? [1] [=]

Turning point of f(x)
(2 ; – 5)

</td><td>

On Screen:
$f(X) = X^2 - 4X - 1$

	x	*f(x)*	*g(x)*
1	–5	44	
2	–4	31	
3	–3	20	
4	–2	11	
5	–1	4	
6	0	-1	
7	1	-4	
8	2	-5	
9	3	-4	
10	4	-1	
11	5	4	

</td></tr>
</table>

2. Find the turning point of $f(x) = 4x^2 - 4x - 2$

- Start with domain $x \in [-5;5]$.

Key Sequence:

- Input f(x) formula [=]
- Input g(x) formula [=]
- Set boundaries for the table:

  Start? [–5] [=]

  End? [5] [=]

  Steps? [1] [=]

Turning point should be in this interval

On Screen:

f(X) = 4X^2 – 4X – 2

	x	$f(x)$	$g(x)$
1	–5	118	
2	–4	78	
3	–3	46	
4	–2	22	
5	–1	6	
6	0	-2	
7	1	-2	
8	2	6	
9	3	22	
10	4	46	
11	5	78	

- We are going to repeat the process but first focus on the domain $0 \le x \le 1$

Key Sequence:

- [AC] [=] [=]
- Set boundaries for the table:

  Start? [0] [=]

  End? [1] [=]

  Steps? [0.25] [=]

Turning point (0,5; –3)

On Screen:

f(X) = 4X^2 – 4X – 2

	x	$f(x)$	$g(x)$
1	0	-2	
2	0.25	-2.75	
3	0.5	-3	
4	0.75	-2.75	
5	1	-2	

3. Find the turning point of $f(x) = 2x^2 - 8{,}5x + 4$
Start with domain $x \in [-5;5]$.

Key Sequence:

- Input f(x) formula [=]
  Input g(x) formula [=]
- Set boundaries for the table:
  Start? [–5] [=]
  End? [5] [=]
  Steps? [1] [=]

Turning point should be in this interval

On Screen:
$f(X) = 2X^2 - 8.5X + 4$

	x	$f(x)$	$g(x)$
1	–5	96.5	
2	–4	70	
3	–3	47.5	
4	–2	29	
5	–1	14.5	
6	0	4	
7	1	-2.5	
8	2	-5	
9	3	-3.5	
10	4	2	
11	5	11.5	

- We are going to repeat the process but focus on the domain $1 \le x \le 3$

Key Sequence:

- [AC] [=] [=]
-
- Set boundaries for the table:
  Start? [1] [=]
  End? [3] [=]
  Steps? [0.25] [=]

Turning point should be in this interval

On Screen:
$f(X) = 2X^2 - 8.5X + 4$

	x	$f(x)$	$g(x)$
1	1	-2.5	
2	1.25	-3.5	
3	1.5	-4.25	
4	1.75	-4.75	
5	2	-5	
6	2.25	-5	
7	2.5	-4.75	
8	2.75	-4.25	
9	3	-3.5	

- So working with "steps" of 0,25 was not small enough.
- We are going to repeat the process but now focus on the domain $2 \le x \le 2{,}25$ and change the "steps"

Key Sequence:

- [AC] [=] [=]
- Set boundaries for the table:
  Start? [2] [=]
  End? [2.25] [=]
  Steps? [0.0625] [=]

Turning point (2,125; -5,03125)

- Using S ⇔ D key: $\left(\frac{35}{16};-\frac{643}{128}\right)$
- Using $a\frac{b}{c} \Leftrightarrow \frac{d}{c}$ key: $\left(2\frac{3}{16};-5\frac{3}{128}\right)$

On Screen:

$f(X) = 2X^2 - 8.5X + 4$

	x	$f(x)$	$g(x)$
1	2	-5	
2	2.0625	-5.0234375	
3	2.125	-5.03125	
4	2.1875	-5.0234375	
5	2.25	-5	

- We are looking for symmetry in the $f(x)$ value and then a minimum or maximum point.

C. Finding Intercepts with the axes

1. Find the intercepts with both the axes of the graph of $f(x) = x^2 - 5x + 6$

Key Sequence:

- Input f(x) formula [=]
- Input g(x) formula [=]
- Set boundaries for the table:
  Start? [–5] [=]
  End? [5] [=]
  Steps? [1] [=]

***y* - intercept**
***x* - intercepts**

(0; 6) is the y – intercept
(2; 0) and (3; 0) are the x - intercepts

On Screen:

$f(X) = X^2 - 5X + 6$

	x	$f(x)$	$g(x)$
1	–5	56	
2	–4	42	
3	–3	30	
4	–2	20	
5	–1	12	
6	0	6	
7	1	2	
8	2	0	
9	3	0	
10	4	2	
11	5	6	

2. Find the intercepts with both axes of $f(x) = -x^2 + 3x - 3$

Key Sequence:

- Input f(x) formula [=]
- Input g(x) formula [=]
- Set boundaries for the table:
  Start? [–5] [=]
  End? [5] [=]
  Steps? [1] [=]

***y* - intercept**
***x* - intercepts**

(0; –3) is the y – intercept
There are no x – intercepts and the turning point will be between $1 < x < 2$. Just to make sure you can work in the domain $1 < x < 2$ in steps of 0.25.
We will find that the turning point is at (1,5; –0,75) and 0,75 < 0 – hence no x – intercepts.

On Screen:
$f(X) = -X^2 + 3X - 3$

	x	*f(x)*	*g(x)*
1	–5	-43	
2	–4	-31	
3	–3	-21	
4	–2	-13	
5	–1	-7	
6	0	-3	
7	1	-1	
8	2	-1	
9	3	-3	
10	4	-7	
11	5	-13	

3. Find the intercepts with both axes of $f(x) = -4x^2 + 8x + 21$.

Key Sequence:

- Input f(x) formula [=]
- Input g(x) formula [=]
- Set boundaries for the table:
  Start? [–5] [=]
  End? [5] [=]
  Steps? [1] [=]

***y* - intercept**
***x* - intercepts**

(0; 21) is the y – intercept
x – intercepts would be in the intervals
$-2 < x < -1$ and $3 < x < 4$

On Screen:
$f(X) = -4X^2 + 8X + 21$

	x	*f(x)*	*g(x)*
1	–5	-119	
2	–4	-75	
3	–3	-39	
4	–2	-11	
5	–1	9	
6	0	21	
7	1	25	
8	2	21	
9	3	9	
10	4	-11	
11	5	-39	

Key Sequence:

- [AC] [=] [=]
- Set boundaries for the table:
  Start? [–2] [=]
  End? [–1] [=
  Steps? [0.25] [=]

***x* - intercepts**
(–1,5; 0) is a x – intercept

AC

- Keep equation
- Set boundaries for the table:
  Start? [3] [=]
  End? [4] [=]
  Steps? [0.25] [=]

***x* - intercepts**
(3,5; 0) is a x – intercept

On Screen:
$f(X) = 4X^2 + 8X + 21$

	x	*f(x)*
1	–2	–11
2	–1.75	–5.25
3	–1.5	0
4	–1.25	4.75
5	–1	9

	x	*f(x)*
1	3	9
2	3.25	4.75
3	3.5	0
4	3.75	–5.25
5	4	–11

D. Finding Vertical Asymptotes of the Reciprocal Function.

1. Find the vertical asymptote for $f(x) = \frac{4}{x-1} + 2$

$$\boldsymbol{y = \frac{4}{x} \text{ for } x \in [-4\,;\,4]}$$

Key Sequence:

- Input f(x) formula [=]
- g(x) = [=]
- Set boundaries for the table:
  Start? [-5] [=]
  End? [5] [=]
  Steps? [1] [=]

Asymptote

On screen:

- $f(X) = \frac{4}{X-1} + 2$

	x	*f(x)*
1	-5	1.33333
2	-4	1.2
3	-3	1
4	-2	0.66666
5	-1	0
6	0	-2
7	1	ERROR
8	2	6
9	3	4
10	4	3.33333
11	5	3

MODE 2: Statistics

[MODE] [2:STAT]

Stats Menu:

Key	Menu Item	Explanation
1.	1-VAR	Single variable / Data handling
2.	A + BX	Linear regression
3.	_ + CX^2	Quadratic regression
4.	ln X	Logarithmic regression
5.	e ^ X	Exponential regression
6.	A . B ^ X	AB exponential regression
7.	A . X ^ B	Power regression
8.	1/X	Inverse regression

E. Finding the equations of functions

1. Find the equation of the straight line through (-1; -1) and (2; 5)
   - Remember in STATS the Linear function is given as (y=A+Bx)

Solution:	**Key Sequence:**
Set your calculator to Stats mode – Linear Regression	[MODE] [2:STAT] [2] (A+BX)
Enter the data into the double variable table Input x-values first and then y-values. Use the [REPLAY] arrows to move the cursor to the y-column.	| ***x*** | ***y*** 1 | -1 [=] | -1 [=] 2 | 2 [=] | 5 [=]
Clear the screen - ready for the stats sub menu	[AC] [SHIFT] [1] (STAT)

Key	Menu Item	Explanation
5: Reg	1. A 2. B 3. r 4. $\hat{x}$ 5. $\hat{y}$	Regression co-efficient of A Regression co-efficient of B Correlation co-efficient r Estimated value of x Estimated value of y

- Calculate the value of A.
- Press: [SHIFT] [1] [5: Reg] [1: A] [=]
- A = 1
- Now calculate the value of B
- Press: [SHIFT] [1] [5: Reg] [2: B] [=]
- B = 2
- So the equation is y = 1 + 2x or in the familiar notation: y = 2x + 1

2. Find the Quadratic function with x intercepts (-1; 0) and (4, 0) and y intercept (0; 8)
   - Remember in STATS the Quadratic function is given as ($y=A+Bx+Cx^2$)

Solution:	**Key Sequence:**
Set your calculator to Stats mode – Quadratic Regression	[MODE] [2:STAT] [3] (_ + CX^2)
Enter the data into the double variable table Input x-values first and then y-values. Use the [REPLAY] arrows to move the cursor to the y-column.	<table><tr><th></th><th>x</th><th>y</th></tr><tr><td>1</td><td>-1 [=]</td><td>0 [=]</td></tr><tr><td>2</td><td>4 [=]</td><td>0 [=]</td></tr><tr><td>3</td><td>0 [=]</td><td>8 [=]</td></tr></table>
Clear the screen - ready for the stats sub menu	[AC] [SHIFT] [1] (STAT)

Key	**Menu Item**	**Explanation**
5: Reg	1. A 2. B 3. C 4. $\hat{x}1$ 5. $\hat{x}2$ 6. $\hat{y}$	Regression co-efficient of A Regression co-efficient of B Regression co-efficient of C Estimated value of x_1 Estimated value of x_2 Estimated value of y

- Calculate the value of A
- Press: [SHIFT] [1] [5: Reg] [1: A] [=]
- Then A = 8
- Now calculate the value of B
- Press: [SHIFT] [1] [5: Reg] [2: B] [=]
- Then B = 6
- Now calculate the value of C
- Press: [SHIFT] [1] [5: Reg] [3: C] [=]
- Then C = –2
- Hence the equation is $y = 8 + 6x – 2x^2$ or in the familiar format: $y = –2x^2 + 6x + 8$.

3. Find the Quadratic function passing through points (1; 2), (–1; –2) and (2; 7).

Solution:	**Key Sequence:**
Set your calculator to Stats mode – Quadratic Regression	[MODE] [2:STAT] [3] (_ + CX^2)
Enter the data into the double variable table Input x-values first and then y-values. Use the [REPLAY] arrows to move the cursor to the y-column.	<table><tr><th></th><th>x</th><th>y</th></tr><tr><td>1</td><td>-1 [=]</td><td>-2[=]</td></tr><tr><td>2</td><td>1[=]</td><td>2 [=]</td></tr><tr><td>3</td><td>2 [=]</td><td>7 [=]</td></tr></table>
Clear the screen - ready for the stats sub menu	[AC] [SHIFT] [1] (STAT)

Key	Menu Item	Explanation
5: Reg	1. A 2. B 3. C 4. $\hat{x}1$ 5. $\hat{x}2$ 6. $\hat{y}$	Regression co-efficient of A Regression co-efficient of B Regression co-efficient of C Estimated value of x_1 Estimated value of x_2 Estimated value of y

- Calculate the value of A
- Press: [SHIFT] [1] [5: Reg] [1: A] [=]
- Then A = –1
- Now calculate the value of B
- Press: [SHIFT] [1] [5: Reg] [2: B] [=]
- Then B = 2
- Now calculate the value of C
- Press: [SHIFT] [1] [5: Reg] [3: C] [=]
- Then C = 1
- Hence the equation is $y = -1 + 2x + x^2$ or in the familiar format: $y = x^2 + 2x - 1$.

4. Find the equation of the exponential graph* passing though the points (0; 1) and (2; 4).

* The CASIO fx-82ZA+ will only find equations of graphs of the form $y = A.B^X$

Solution:	Key Sequence:
Set your calculator to Stats mode – Exponential Regression	[MODE] [2:STAT] [6] ($A.B^X$)
Enter the data into the double variable table Input *x*-values first and then *y*-values. Use the [REPLAY] arrows to move the cursor to the *y*-column.	<table><tr><th></th><th>*x*</th><th>*y*</th></tr><tr><td>1</td><td>0 [=]</td><td>1[=]</td></tr><tr><td>2</td><td>2 [=]</td><td>4 [=]</td></tr></table>
Clear the screen - ready for the stats sub menu	[AC] [SHIFT] [1] (STAT)

Key	Menu Item	Explanation
5: Reg	1. A 2. B 3. r 4. $\hat{x}$ 5. $\hat{y}$	Regression co-efficient of A Regression co-efficient of B Correlation coefficient Estimated value of x Estimated value of y

- Calculate the value of A
- Press: [SHIFT] [1] [5: Reg] [1: A] [=]
- Then A = 1
- Now calculate the value of B
- Press: [SHIFT] [1] [5: Reg] [2: B] [=]

- Then B = 2
- Hence the equation is $y = 1.2^x$ *or* $y = 2^x$

5. Find the Quadratic function with turning point (–1; 4) and through point (0; 5).

- We need to identify a third point on the graph. From the turning point we know that the axis of symmetry is $x = –1$. The point symmetrical to (0; 5) would then be (–2; 5).

Solution:	**Key Sequence:**
Set your calculator to Stats mode – Quadratic Regression	[MODE] [2:STAT] [3] (_ + CX^2)
Enter the data into the double variable table Input x-values first and then y-values. Use the [REPLAY] arrows to move the cursor to the y-column.	| | ***x*** | ***y*** | | 1 | -1 [=] | 4[=] | | 2 | -2[=] | 5 [=] | | 3 | 0 [=] | 5 [=] |
Clear the screen - ready for the stats sub menu	[AC] [SHIFT] [1] (STAT)

Key	**Menu Item**	**Explanation**
5: Reg	1. A 2. B 3. C 4. $\hat{x}1$ 5. $\hat{x}2$ 6. $\hat{y}$	Regression co-efficient of A Regression co-efficient of B Regression co-efficient of C Estimated value of x_1 Estimated value of x_2 Estimated value of y

- Calculate the value of A
- Press: [SHIFT] [1] [5: Reg] [1: A] [=]
- Then A = 5
- Now calculate the value of B
- Press: [SHIFT] [1] [5: Reg] [2: B] [=]
- Then B = 2
- Now calculate the value of C
- Press: [SHIFT] [1] [5: Reg] [3: C] [=]
- Then C = 1
- Hence the equation is $y = 5 + 2x + x^2$ or in the familiar format: $y = x^2 + 2x +5$.