**GCSE/IGCSE-FM Functions**

**Exercise 1 - Functions**

1. If , find:
	1.
	2.
	3.
2. If , find:
	1.
	2. The possible values of such that
	3. The possible values of such that
3. [AQA Worksheet] . Work out when
4. [AQA Worksheet] .
If , determine the value of .
5. If , determine the following, simplifying where possible.
	1.
6. [AQA IGCSEFM June 2012 Paper 2]
 for all values of . Solve
7. [AQA Worksheet]
Show that
8. If determine:
(a)
(b)
(c)
(d)
(e) Solve
9. [Edexcel Specimen Papers Set 1, Paper 2H Q18]

Express in the form

* [Senior Kangaroo 2011 Q20] The polynomial is such that
 and
. What is the value of ?

**Exercise 2 – Inverse Functions**

1. Find for the following functions.
2.
3.
4.
5.
6.
7.
8. *[Edexcel IGCSE Jan2016(R)-3H Q16c]*

 Find

1. Find for the following functions.
2.
* Find the value of for which is a self inverse function.

**Exercise 3 – Composite Functions**

1. If and , determine:
	1.
	2.
	3.
2. If and determine:
	1.
	2.
3. If and , find , simplifying your expression.
4. If and and , find the possible values of .
5. If and and , find .
6. Let and .

If , determine the possible values of .

1. Let and .

If , determine the possible values of .

* [Based on MAT question]

 and

Let means that you apply the function times.
a) Find in terms of and .

b) Note that . Find all other ways of combining and that result in the function .

**Exercise 4 – Piecewise Functions**

1. [Jan 2013 Paper 2] A function is defined as:
2. Draw the graph of for



1. Use your graph to write down **how many** solutions there are to
2. Solve
3. [June 2013 Paper 2] A function is defined as:

Draw the graph of for



1. [Set 1 Paper 1] A function is defined as:

Draw the graph of for .



1. [Specimen 1 Q4] A function is defined as:

Calculate the area enclosed by the graph of and the axis.



1. [AQA Worksheet Q9]

Draw the graph of from .

1. [AQA Worksheet Q10]



Show that

**Exercise 5 – Range/Domain**

1. [AQA Worksheet] Work out the range for each of these functions.
(a) for all
(b)
(c)
2. [AQA Worksheet] (a)
Give a reason why is not a suitable domain for .
(b) Give a possible domain for
3. The range of is
Work out and .
4. [Set 1 Paper 2] (a) The function is defined as:
The range of is
Work out the value of .
(b) The function is defined as
 for all .
(i) Express in the form
(ii) Hence write down the range of .
5. [June 2012 Paper 1] for all values of .
(a) What is the value of ?
(b) What is the range of ?
6. [Jan 2013 Paper 2]
(a) What is the range of ?
(b) You are given that .
Work out the value of .
7. By completing the square or otherwise, determine the range of the following functions:
(a) for all
(b) for all
8. [AQA Worksheet] Here is a sketch of for all , where is a constant.


The range of is . Work out the value of .
9. [Set 3] The straight line shows a sketch of for the full domain of the function.

(a) State the domain of the function.
(b) Work out the equation of the line.
10. [Set 3] is a quadratic function with domain all real values of . Part of the graph of is shown.

(a) Write down the range of .
(b) Use the graph to find solutions of the equation .
(c) Use the graph to solve .
11. [Set 2] The function is defined as:
Work out the range of .
12. The function has the domain
 and is defined as:
Work out the range of .
13. [June 2012 Paper 2] A sketch of for domain is shown.

The graph is symmetrical about . The range of is .
Work out the function .

**Exercise 6 – Forming Equations**

Finding a suitable function (for which you may always use a straight line) that matches the following criteria.

1. Domain is . Range . is an increasing function.
2. Domain is . Range .
 is a decreasing function.
3. Domain is . Range . is an increasing function.
4. Domain is . Range . is a decreasing function.
5. Domain is . Range . is a decreasing function.