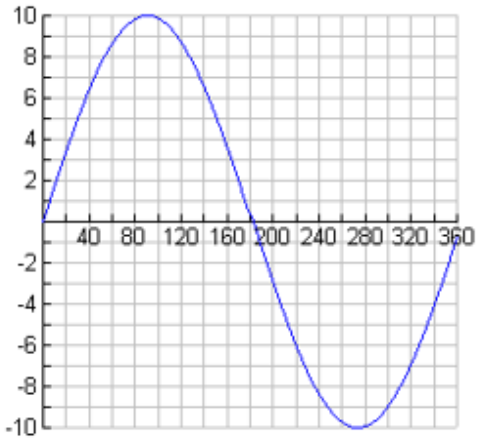
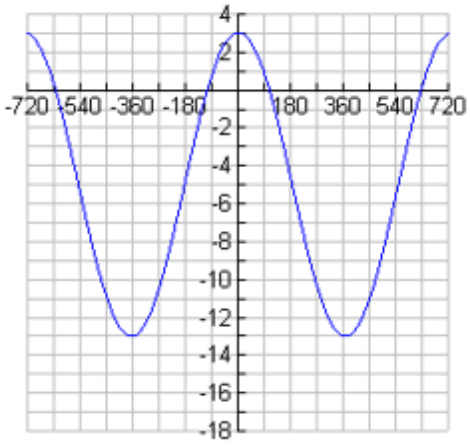
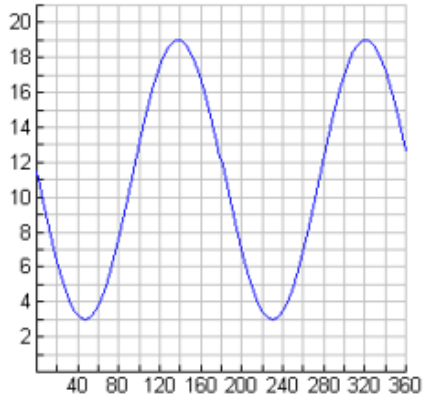
Warm - up



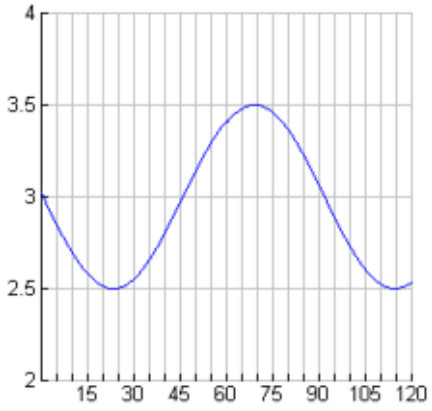
Min -10
Max 10
Axis $y = 0$
Amplitude 10
Domain $x \in \mathbb{R}$
Range $-10 \leq y \leq 10$



Min -13
Max 3
Axis $y = -5$
Amplitude 8
Domain $x \in \mathbb{R}$
Range $-13 \leq y \leq 3$



Min 3
Max 19
Axis $y = 11$
Amplitude 8
Domain $x \in \mathbb{R}$
Range $3 \leq y \leq 19$



Min 2.5
Max 3.5
Axis $y = 3$
Amplitude 0.5
Domain $x \in \mathbb{R}$
Range $2.5 \leq y \leq 3.5$

What did you do for homework?

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PRACTISING

5. Using a graphing calculator and the WINDOW settings shown, graph each function. Use DEGREE mode. State whether the resulting functions are periodic. If so, state whether they are sinusoidal.
   a) $y = 3\sin x + 1$ c) $y = \cos(2x) - \sin x$ e) $y = 0.5\cos x - 1$
   b) $y = (0.004x)\sin x$ d) $y = 0.005x + \sin x$ f) $y = \sin 90°$

6. Based on your observations in question 5, what can you conclude about any function that possesses sine or cosine in its equation?

7. If $g(x) = \sin x$ and $h(x) = \cos x$, where $0° \leq x \leq 360°$, calculate each and explain what it means.
   a) $g(90°)$ b) $h(90°)$

8. Using a graphing calculator in DEGREE mode, graph each sinusoidal function. K Use the WINDOW settings shown. From the graph, state the amplitude, period, increasing intervals, decreasing intervals, and equation of the axis for each.
   a) $y = 2\sin x + 3$ c) $y = \sin(0.5x) + 2$ e) $y = 2\sin(0.25x)$
   b) $y = 3\sin x + 1$ d) $y = \sin(2x) - 1$ f) $y = 3\sin(0.5x) + 2$

FURTHER Your Understanding

pg. 243

1. Use differences to identify the type of function represented by the table of values.

a)

x	y
−4	5
−3	8
−2	13
−1	20
0	29
1	40

c)

x	y
−2	−2.75
0	−2
2	1
4	13
6	61
8	253

b)

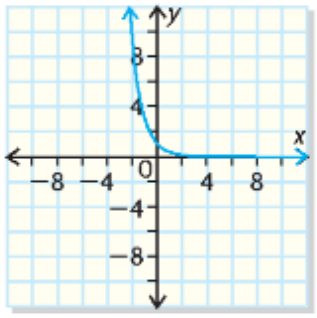
x	y
−5	32
−4	16
−3	8
−2	4
−1	2
0	1

d)

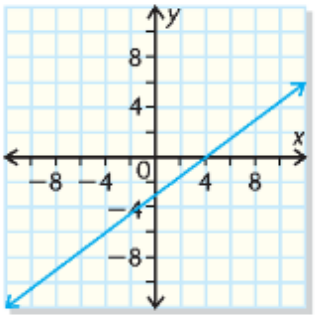
x	y
0.5	0.9
0.75	1.1
1	1.3
1.25	1.5
1.5	1.7
1.75	1.9

2. What type of function is represented in each graph? Explain how you know.

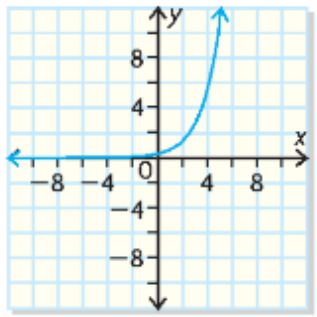
a)



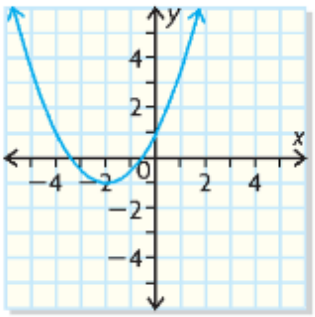
c)



b)



d)



Function Notation

Learning Goals

- learn functions notation
- be able to use function notation

Write down an equation of a straight line.

$y = \frac{1}{2}x + 5$

Write down an equation of a parabola.

$y = \frac{1}{2}x^2 + 6$

Graph your lines on your TI-Nspire

$f1(x) = \frac{1}{2}x + 5$

Function Notation

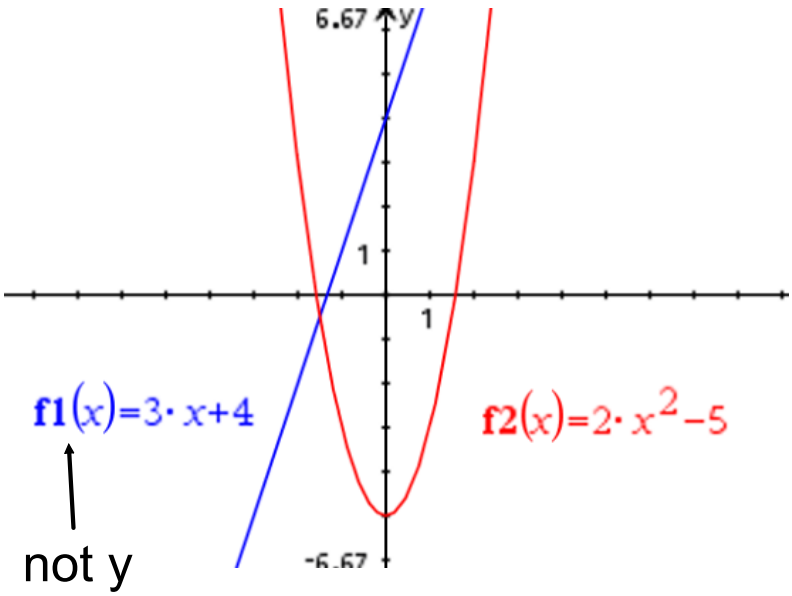
- **another way of writing an equation**
- **instead of y we use f(x)**

function

f at x

y=4x-5* is the same as *f(x)=4x-5

Function Notation



not y

y=3x+5

What is the value of y when x=2?

$x = 2$

$y = 3x + 5$

$= 3(2) + 5$

$= 11$

f(x)=3x+5

f(2)=? $3(2)+5$

$= 11$

Is it always "f"?

No, any letter can be used.

Most common --- f, g, h

d(t) --- distance as a function of time

h(t) --- height as a function of time

v(t) --- velocity as a function of time

Using different letters makes it easier to talk about 2 or more different functions.

On the Boards...

f(x)=2x+3

Find f(3)

$f(3) = 2(3)+3$
$= 6+3$
$= 9$

f(4)

$f(4) = 2(4)+3$
$= 8+3$
$= 11$

$g(x)=3x^2-2x+5$

Find g(5)

$= 3(5)^2-2(5)+5$
$= 70$

2g(5)

$= 2\left(3(5)^2-2(5)+5\right)$
$= 2(70)$
$= 140$

g(5)-g(4)

$= 3(5)^2-2(5)+5-\left(3(4)^2-2(4)+5\right)$
$= 70-45$
$= 25$

g(5-4)

$= g(1)$
$= 3(1)^2-2(1)+5$
$= 6$

$f(x)=x^2+5x$
$g(x)=3x+15$

Find

g(1)

$= 3(1)+15$

$= 3+15$

$= 18$

g(3x)

$= 3(3x)+15$

$= 9x+15$

Solve for x
f(x)=g(x)

$x^2+5x = 3x+15$

$x^2+5x-3x-15=0$

$x^2+2x-15=0$

$(x-3)(x+5)=0$

$x=3 \quad x=-5$

3f(1)+g(-2)

$= 3\left(1^2+5(1)\right)+3(-2)+15$

$= 3(6)-6+15$

$= 18-6+15$

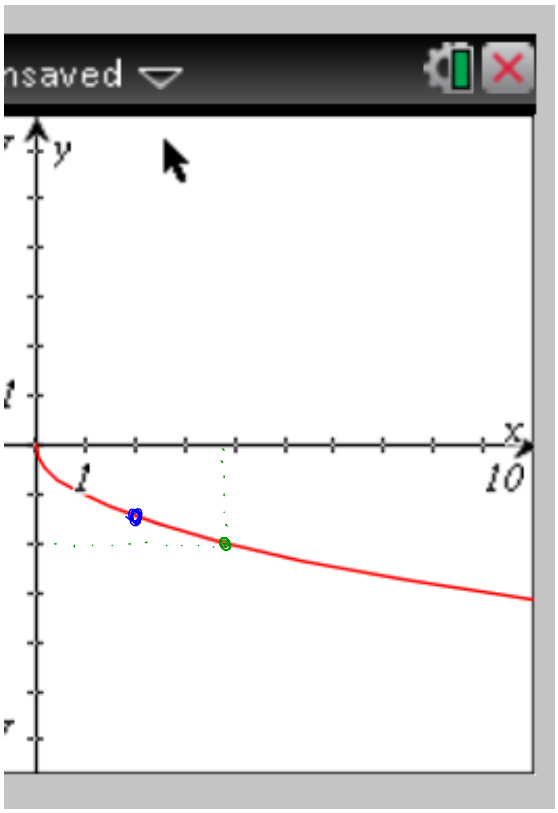
$= 27$

f(3x)+g(2x)

$=(3x)^2+5(3x)+3(2x)+15$

$= 9x^2+15x+6x+15$

$= 9x^2+21x+15$



Example: For the function shown in the graph, determine each of the following values.

a) f(2) $= -1.5$

b) f(-1) undefined

c) x if f(x) = -2

$x = 3.7$

Do you understand?

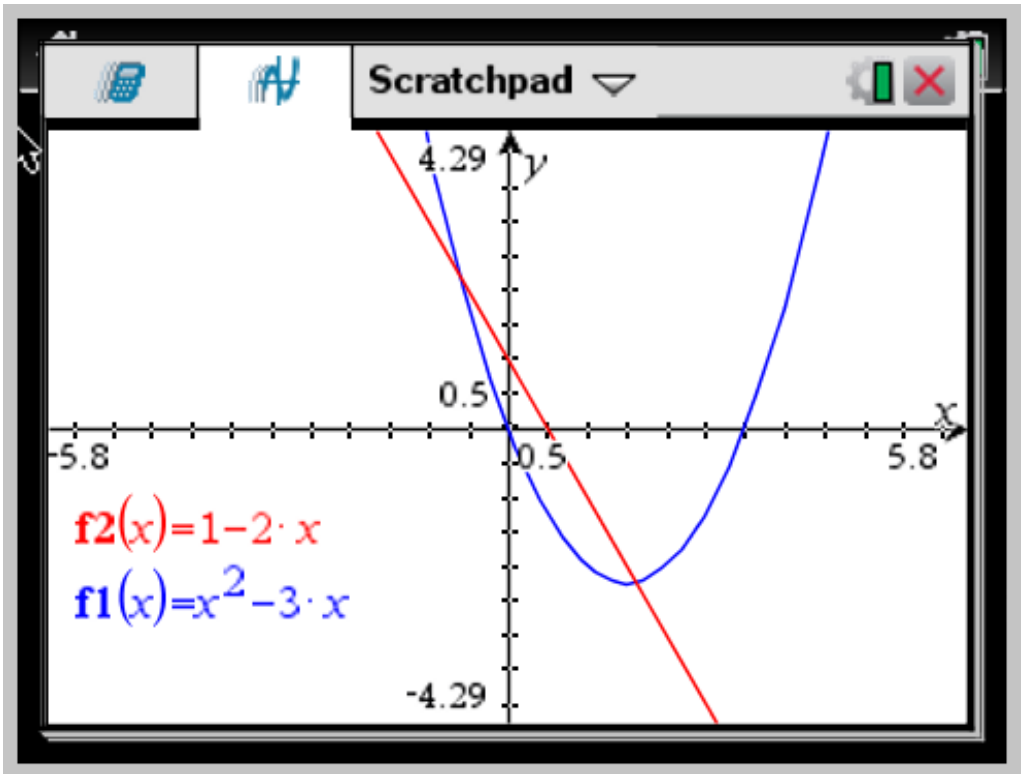
Consider the functions $f(x) = x^2 - 3x$ and $g(x) = 1 - 2x$.

a) Show that $f(2) > g(2)$, and explain what that means about their graphs.
Use your TI-Nspire to graph.

$f(2) = 2^2 - 3(2)$
$= 4 - 6$
$= -2$

$>$

$g(2) = 1 - 2(2)$
$= 1 - 4$
$= -3$



Seatwork

pg 22 # 1, 2, 10, 11ab

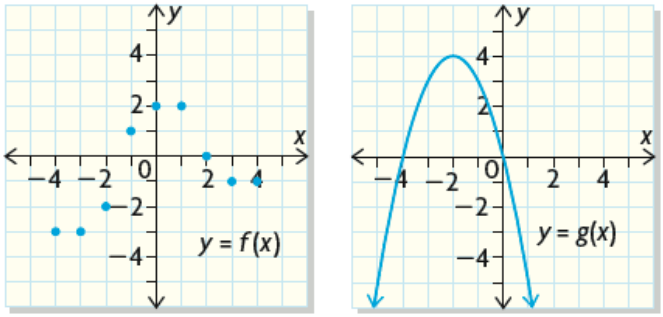
pg 88 # 9, 17a

Handout

pg 22

1. Evaluate, where $f(x) = 2 - 3x$.
   a) $f(2)$ c) $f(-4)$ e) $f(a)$
   b) $f(0)$ d) $f\left(\frac{1}{2}\right)$ f) $f(3b)$

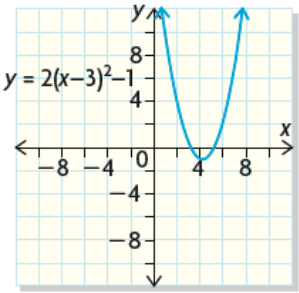
2. The graphs of $y = f(x)$ and $y = g(x)$ are shown.



Using the graphs, evaluate
   a) $f(1)$ c) $f(4) - g(-2)$
   b) $g(-2)$ d) x when $f(x) = -3$

9. Consider the function $f(s) = s^2 - 6s + 9$.
   a) Create a table of values for the function.
   b) Determine each value.
      i) $f(0)$ iv) $f(3)$
      ii) $f(1)$ v) $[f(2) - f(1)] - [f(1) - f(0)]$
      iii) $f(2)$ vi) $[f(3) - f(2)] - [f(2) - f(1)]$
   c) In part (b), what do you notice about the answers to parts (v) and (vi)? Explain why this happens.

10. The graph at the right shows $f(x) = 2(x - 3)^2 - 1$.
K a) Evaluate $f(-2)$.
   b) What does $f(-2)$ represent on the graph of f?
   c) State the domain and range of the relation.
   d) How do you know that f is a function from its graph?



11. For $g(x) = 4 - 5x$, determine the input for x when the output of $g(x)$ is
   a) -6 b) 2 c) 0 d) $\frac{3}{5}$

13. As a mental arithmetic exercise, a teacher asked her students to think of a number, triple it, and subtract the resulting number from 24. Finally, they were asked to multiply the resulting difference by the number they first thought of.

A

a) Use function notation to express the final answer in terms of the original number.

b) Determine the result of choosing numbers 3, -5, and 10.

c) Determine the maximum result possible.

16. Let $f(x) = x^2 + 2x - 15$. Determine the values of x for which

a) $f(x) = 0$ b) $f(x) = -12$ c) $f(x) = -16$

20. A function $f(x)$ has these properties:

- The domain of f is the set of natural numbers.
- $f(1) = 1$
- $f(x + 1) = f(x) + 3x(x + 1) + 1$

a) Determine $f(2), f(3), f(4), f(5)$, and $f(6)$.

b) Describe the function.

pg 88

9. Determine two non-equivalent polynomials, $f(x)$ and $g(x)$, such that $f(0) = g(0)$ and $f(2) = g(2)$.

17. a) Consider the linear functions $f(x) = ax + b$ and $g(x) = cx + d$.
Suppose that $f(2) = g(2)$ and $f(5) = g(5)$.
Show that the functions must be equivalent.

b) Consider the two quadratic functions $f(x) = ax^2 + bx + c$ and $g(x) = px^2 + qx + r$.
Suppose that $f(2) = g(2), f(3) = g(3)$, and $f(4) = g(4)$.
Show that the functions must be equivalent.

Answers

pg 22

1. a) -4 c) 14 e) $2 - 3a$

b) 2 d) $\frac{1}{2}$ f) $2 - 9b$

2. a) 2 b) 4 c) -5 d) -3 or -4

10. a) 49

b) The y-coordinate of the point on the graph with x-coordinate -2

c) domain $= \{x \in \mathbb{R}\}$, range $= \{y \in \mathbb{R} \mid y \geq -1\}$

d) It passes the vertical-line test.

11. a) 2 b) 0.4 c) 0.8 d) $\frac{17}{25}$

13. a) $f(x) = (24 - 3x)x$ b) $45, -195, -60$ c) 48

16. a) $3, -5$ b) $1, -3$ c) -1

20. a) $8, 27, 64, 125, 216$ b) cube of x or x^3

pg 88

9. Answers will vary. For example, $f(x) = 2x$ and $g(x) = x^2$

17. a) both functions are linear; a pair of linear functions intersect at only one point, unless they are equivalent; since the functions are equal at two values, they must be equivalent

b) both functions are quadratic; a pair of quadratic functions intersect at most in two points, unless they are equivalent; since the functions are equal at three values, they must be equivalent

MCR3U - 1.2 Function Notation

Ex. #1 Create a Table of Values for $f(x) = 3x + 2$.

x	f(x)

Determine the following values

a) f(1) b) f(3)

c) f(1) + f(3) d) 3f(1) + 4f(3)

Ex. #2 Given $g(x) = x + 5$

a) Name the function. _____

b) Determine each value

(i) g(-1) = (ii) g(2) =

(iii) g(-1) + g(2) = (iv) 2g(-1) + 3g(2) =

c) Determine the input for x when the output of g(x) is,
(i) 11 (ii) 5 (iii) -7

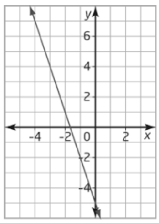
Ex #3 This graph represents the function f(x)

a) Evaluate f(-2)

b) What does f(-2) represent on the graph of f?

c) Determine the value of x when f(x) = 7

d) Determine the value of x when f(x) = -5



MCR3U - 1.2 Function Notation

Ex #4 Given $k(x) = (x-2)(x+3)$ determine the value of x when $k(x) = 0$.

Ex #5 Given $h(x) = x^2 + 3x + 4$ determine the value of x when $h(x) = 2$.

Ex #6 Given $f(x) = x^2 + 3x + 2$ and $g(x) = 2x + 5$

a) Prove that $f(1) < g(1)$ and explain what that means about their graphs *(hint:NSpire)*.

b) Determine $f(2b)$ and $g(2b)$.

c) Determine $f(c+2) - g(c-2)$.

Worksheet #5

MCR3U - 1.2 Function Notation

Ex. #1 Create a Table of Values for $f(x) = 3x + 2$.

x y

x	f(x) = 3x+2
-1	-1
0	3(0)+2 = 2
1	5
2	8
3	11
4	14

Determine the following values

a) f(1) — what's y when x=1 — 5

b) f(3) — 11

c) f(1) + f(3) = 5 + 11 = 16

d) 3f(1) + 4f(3) = 3(5) + 4(11) = 59

Ex. #2 Given $g(x) = x + 5$

a) Name the function. g

b) Determine each value

(i) g(-1) = = (-1)+5 = 4

(ii) g(2) = 2+5 = 7

(iii) g(-1) + g(2) = = 4 + 7 = 11

(iv) 2g(-1) + 3g(2) = = 2(4) + 3(7) = 29

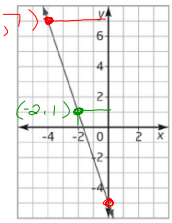
c) Determine the input for x when the output of g(x) is,

(i) 11: 11 = x+5, 11-5 = x+5-5, 6 = x

(ii) 5: 5 = x+5, 5-5 = x+5-5, 0 = x

(iii) -7: -7 = x+5, -7-5 = x+5-5, -12 = x

Ex #3 This graph represents the function f(x)



a) Evaluate f(-2) = -1

b) What does f(-2) represent on the graph of f?
The value of y when x = -2

c) Determine the value of x when f(x) = 7
y = 7
∴ x = -4

d) Determine the value of x when f(x) = -5
y = -5
∴ x = 0

MCR3U - 1.2 Function Notation

Ex #4 Given $k(x) = (x-2)(x+3)$ determine the value of x when $k(x) = 0$.

y = (x-2)(x+3), y = 0

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

x-2 = 0 → x = 2

x+3 = 0 → x = -3

Ex #5 Given $h(x) = x^2 + 3x + 4$ determine the value of x when $h(x) = 2$.

2 = x²+3x+4

0 = x²+3x+2

0 = (x+2)(x+1)

x+2 = 0 → x = -2

x+1 = 0 → x = -1

Ex #6 Given $f(x) = x^2 + 3x + 2$ and $g(x) = 2x + 5$

a) Prove that $f(1) < g(1)$ and explain what that means about their graphs *(hint:NSpire)*.

f(1) = 1²+3(1)+2 = 6

g(1) = 2(1)+5 = 7

∴ f(1) < g(1)

b) Determine $f(2b)$ and $g(2b)$.

f(2b) = (2b)²+3(2b)+2 = 4b²+6b+2

g(2b) = 2(2b)+5 = 4b+5

c) Determine $f(c+2) - g(c-2)$.

f(c+2) = (c+2)² + 3(c+2) + 2

= c²+4c+4+3c+6+2

= c²+7c+12

g(c-2) = 2(c-2) + 5

= 2c-4+5

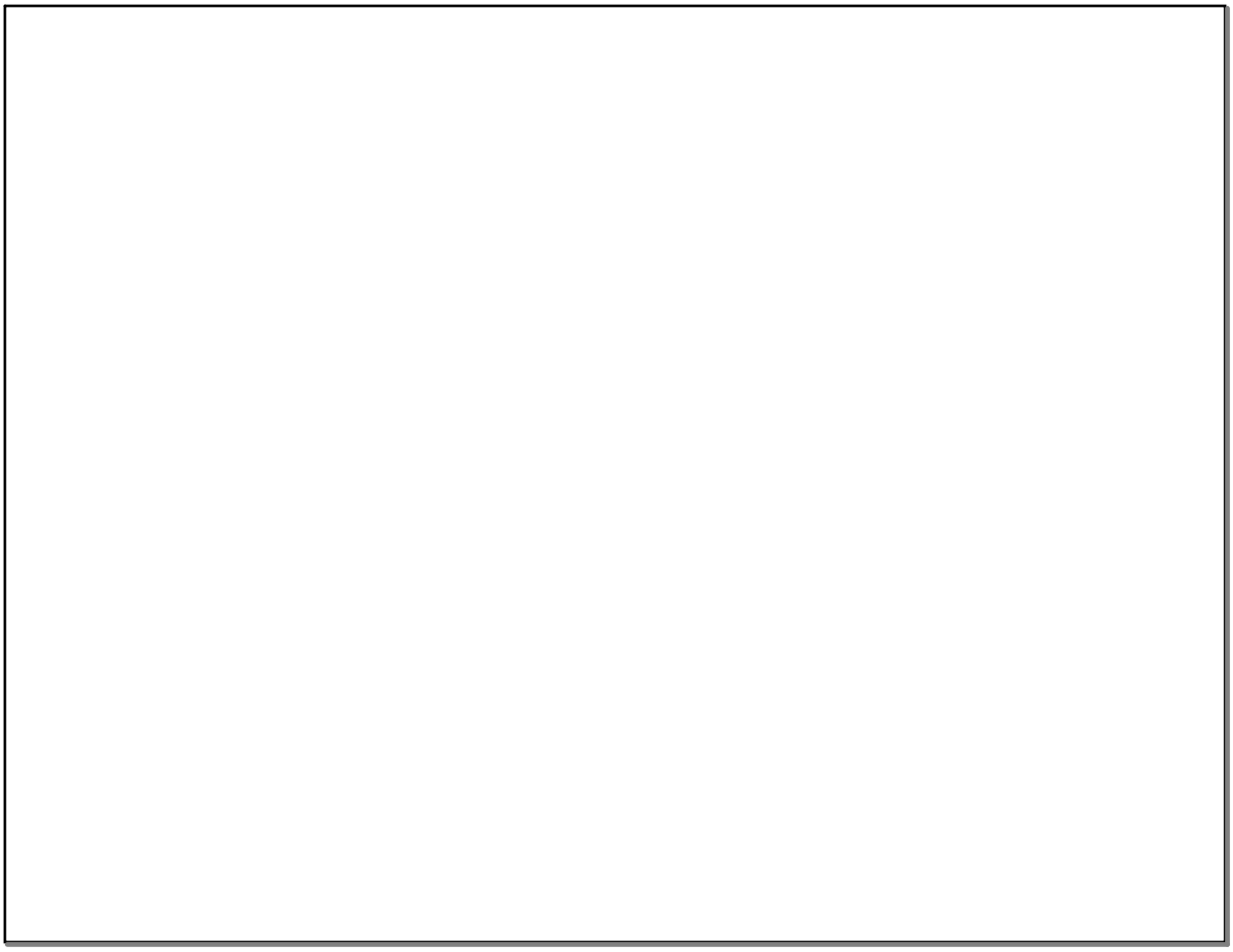
= 2c+1

So... f(c+2) - g(c-2)

= c²+7c+12-(2c+1)

= c²+7c+12-2c-1

= c²+5c+11



Attachments

1.7.2 Worksheet.pdf

Function_or_Not_a_Function.tns