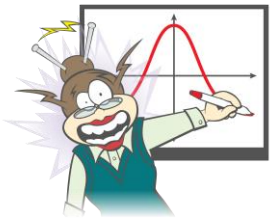


Mathematical Methods with TI-Nspire™ CX CAS
Mathematical Methods Exam-Style Questions
Part 1: Functions and their graphs
Webinar questions and student revision questions

Author: Frank Moya

Each of the questions included here can be solved using the TI-Nspire CX CAS.

Multiple representations: graphical, algebraic, numerical and tables/lists

Question 1

Consider the functions $f : R \to R,\ f(x) = x^3 - 3x + 3$ and $g : R \to R,\ g(x) = -\frac{1}{4}(9x - 13)$.

a. On the same set of axes, obtain graphs of f and g with suitable window settings. Add a lined grid to the graphs.
b. Use a graphical method to find the coordinates of the points of intersection of the graphs of f and g.
c. Obtain tables of values for the graphs of these functions.
   i. Explore changing the table settings.
   ii. Use the table to confirm the points of intersection
d. In a Calculator page, use two different methods to find the coordinates of the points of intersection of the graphs.

Response:

Piecewise (hybrid) functions

Question 2

Insert a new problem in your document.

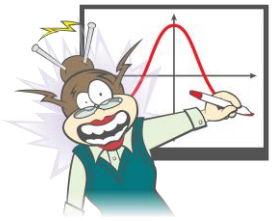
Use an efficient method to define the piecewise function $f(x) = \begin{cases} 4 - x^2, & x \in [-3, 3] \\ x^2 - 14, & x \in R \setminus [-3, 3] \end{cases}$ on your TI-Nspire.

Obtain a graph of f and of the line $y = 2x + 4$.

Find the exact coordinates of all points of intersection of the graph of f and of the line $y = 2x + 4$.

Response:

Multiple-choice Questions



Question 3 **Implied or maximal domain**

Consider the function $f : D \to R,\ f(x) = 3x + \log_e(3 - 2x)$, where D is the **maximal domain**.

Therefore, D is

R	$[3, \infty)$	$(-\infty, 3)$
$\left[\frac{3}{2}, \infty\right)$	$\left(-\infty, \frac{3}{2}\right)$	

Response:

Question 4 **Other properties of the function**

The function f is defined as in Question 3 above. Use the graph of f and other tools to explore the **range** of f.

Set up an editable Notes page template for key properties of the function. These might include:

- Domain
- Roots
- Coordinates of function maximum/minimum to help determine the range.

Response:

Question 5

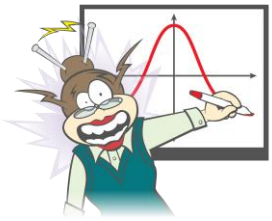
Explore different methods to solve this problem.

Let $f : R \to R,\ f(x) = 8 + 4x - x^4$.

If $f(x) = (2 - x)(ax^3 + bx^2 + cx + d)$, then

A. $a = 1, b = 2, c = 4, d = 4$	**B.** $a = 1, b = -2, c = -4, d = 4$	**C.** $a = -1, b = 2, c = 4, d = -1$
D. $a = 0, b = 2, c = 4, d = 4$	**E.** $a = 0, b = 2, c = -2, d = 1$	

Response:



Question 6 Fraction tools

Let $g:D\to R,\ g(x)=\dfrac{4x+2}{2-x}$.

If $g(x)=p+\dfrac{q}{2-x}$, where p,q are positive integers, then

A. $p=4,\ q=2$	**B.** $p=-4,\ q=2$	**C.** $p=-4,\ q=10$
D. $p=-4,\ q=-10$	**E.** $p=-4,\ q=-2$	

Response:

Question 7 Rational functions

Let $g:D\to R,\ g(x)=\dfrac{4x+2}{2-x}$. The maximal domain, D, and equations of the vertical and horizontal asymptotes of the graph of g are, respectively

A. $R\setminus\{2\}, x=2, y=4$	**B.** $R\setminus\{2\}, x=2, y=-4$	**C.** $R\setminus\{-2\}, x=-2, y=-4$
D. $R\setminus\{4\}, x=4, y=-2$	**E.** $R\setminus\{-4\}, x=-4, y=2$	

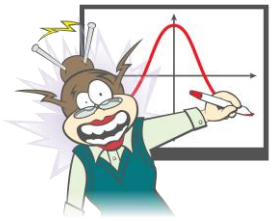
Response:

Question 8 Inverses

The inverse of $h:(-\infty,2)\to R,\ h(x)=\dfrac{1}{\sqrt{3-x}}$ is

A. $h^{-1}:R\setminus\{0\}\to R,\ h^{-1}(x)=\dfrac{1}{3-x^2}$	B. $h^{-1}:R^+\to R,\ h^{-1}(x)=x^2-3$
C. $h^{-1}:R^+\to R,\ h^{-1}(x)=3-\dfrac{1}{x^2}$	D. $h^{-1}:(3,\infty)\to R,\ h^{-1}(x)=3-x^2$
E. $h^{-1}:(0,1]\to R,\ h^{-1}(x)=3-\dfrac{1}{x^2}$	

Response:



Question 9 Functional equations

The function f satisfies the relation $\left(f\left(x\right)\right)^2 = f\left(2x\right)+2$ for all real numbers x.

The rule for f could be

A. $f\left(x\right)=x-2$	**B.** $f\left(x\right)=\sin\left(x\right)$	**C.** $f\left(x\right)=x^2+4$
D. $f\left(x\right)=e^x+e^{-x}$	**E.** $f\left(x\right)=2\log_e\left(x+4\right)$	

Response:

Question 10 Trigonometric equations

The sum of the solutions to the equation $-3\sin(2x)=\sqrt{3}\cos\left(2x\right)$ for $x=\left[-\pi,k\right]$ is $\frac{5\pi}{3}$.

The value of k could be (same A – E as Q. 6 above).

A. $\frac{\pi}{6}$	**B.** $\frac{2\pi}{3}$	**C.** $\frac{5\pi}{6}$
D. $\frac{4\pi}{3}$	**E.** $\frac{13\pi}{3}$	

Response:

Question 11 Simultaneous linear equations

The equations $ax-3y=5$ and $3x-ay-8+a=0$ will have

a. a unique solution when (choose from options A-E below)
b. no solution when (choose from options A-E below)
c. infinitely many solutions when (choose from options A-E below)

A. $a\in\left\{-3,3\right\}$	**B.** $a\in\left[-3,3\right]$	**C.** $a\in R\setminus\left\{-3,3\right\}$
D. $a=-3$	**E.** $a=3$	

Response: