

Practice and thinking problems:

1. Fill in the blanks to explain what a one-to-one function and an onto function are:

- a. For a one-to-one function, every element in the codomain has 1 or 0 points in its pre-image
 b. For an onto function, every element in the codomain has 1 or more points in its pre-image

Functions to use in problems 2 - 4

$F: \mathbb{R} \rightarrow \mathbb{R}$ s.t. $f(x) = x/2$
 $f: \mathbb{Z} \rightarrow \mathbb{R}$ such that $f(x) = \frac{x}{2}$

one-to-one

onto

yes

no

$g(x) = \mathbb{R} \rightarrow \mathbb{R}$ such that $g(x) = \sqrt[3]{x}$

yes

yes

$h: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ such that $h(x, y) = (y, 2x)$

yes

yes

$k: \mathbb{R}^2 \rightarrow \mathbb{R}$ such that $k(x, y) = \sqrt{x^2 + y^2}$

no

no

$F: \mathbb{R} \rightarrow \mathbb{R}^2$ such that $F(x) = (x, 2)$

yes

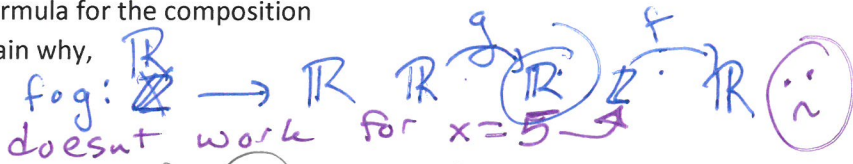
no

2. For each of the functions, tell whether it is one-to-one and whether it is onto.

3. For each of these possible function compositions:

- if it makes sense, write the formula for the composition
- if it doesn't make sense, explain why,

a. $f \circ g$ $(3\sqrt{x})/2$ \because



b. $g \circ f$ $\sqrt[3]{x/2}$

c. $f \circ h$ $h(x/2, y)$ $(y, 2x)$

d. $h \circ k$

e. $k \circ h$

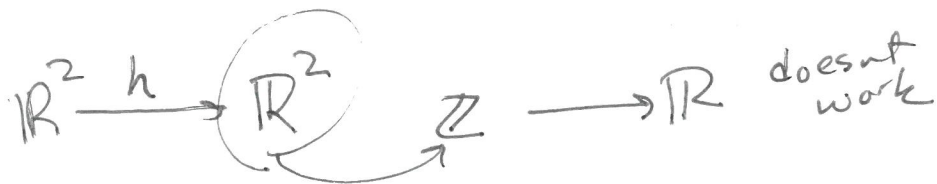
f. $g \circ k$

g. $k \circ g$

4. Find two examples of a function composition that uses F as one of the two functions.

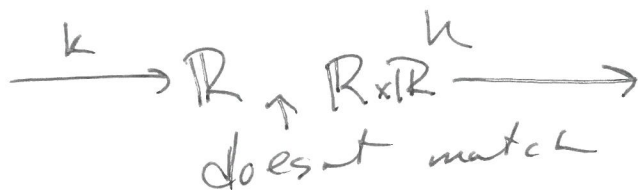
do for FIC

c. $f \circ h$



$$f(h(x,y)) = f(g, zx) \leftarrow \text{can't take half of this?}$$

d. $h \circ k$ doesn't make sense



e. $k \circ h$

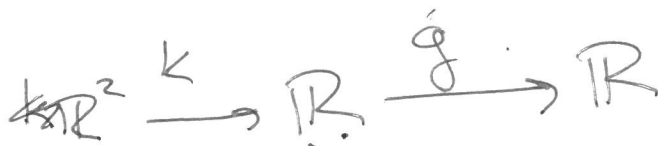
does work

$$= \sqrt{y^2 + 4x^2}$$

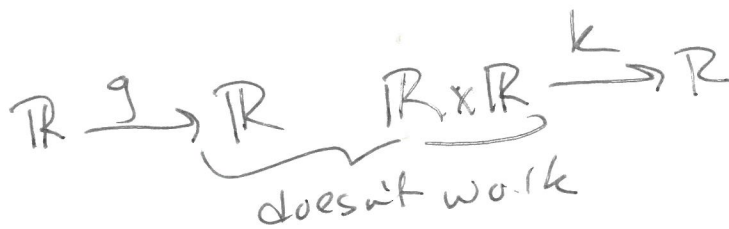


f. $g \circ k$

$$= \sqrt[3]{\sqrt{x^2 + y^2}}$$



g. $k \circ g$



h. $k \circ f$

\uparrow second
 \uparrow first

