Math 215 - Worksheet 3

October 8, 2018

1. Let $A = \{a, b, c, d\}$, $B = \{c, d, e\}$, and $C = \{1, 2, 3, 4\}$. Which of the following are the graphs of functions between (some of) A, B and C? For those that are, what are the domain, codomains, and ranges of these? Which are one-to-one? Which are onto?

(a) $g_1 : \{(a, 2), (c, 2), (d, 2), (b, 2)\}$.

(b) $g_2 : \{(2, c), (1, e), (3, d), (4, d)\}$.

(c) $g_3 : \{(e, c), (c, e), (d, d), (c, e)\}$.

(d) $g_4 : \{(c, 1), (d, 3), (e, 4)\}$.

(e) $g_5 : \{(c, 4), (c, 2), (e, 1), (c, 3)\}$.

2. For each of the following, give an example of a function $f : \mathbb{R} \to \mathbb{R}$ with the desired range.

(a) $\mathrm{Im}(f_1) = \mathbb{R}$.

(b) $\mathrm{Im}(f_2) = \mathbb{R}^+$.

(c) $\mathrm{Im}(f_3) = \mathbb{R} - \mathbb{Z}$.

(d) $\mathrm{Im}(f_4) = \mathbb{Q}$.

3. Now give examples of functions $h : \mathbb{R} \to \mathbb{R}$ with the desired ranges, that are also *one-to-one*.

(a) $\text{Im}(h_1) = \mathbb{R}^+$.

(b) $\text{Im}(h_2) = (-\pi, \pi)$.

(c) $\text{Im}(h_4) = [0, \infty)$.

(d) $\text{Im}(h_3) = \mathbb{R} - \{0\}$.