

## Calculus Differentiation Exercise 2048

Axiom 1. switch  $\in \{0, 1\}$

Definition 1. If  $f$  is a function and  $w$  is an object, then the statement that  $w$  is a companion of  $f$  means that for each  $x$  in the domain of  $f$ ,  $w.x = f.x$ .

Axiom 2. If  $f$  is a function and  $A$  is a set, then  $(f, A)$  is a companion of  $f | A$ .

Definition 2. If  $(x, y)$  is an ordered pair, then  $\delta.(x, y) \equiv x$ .

Definition 3. If  $f$  is a function, then for each positive number  $r$ ,

$$f_r \equiv \begin{cases} (f, (-r, r)) & \text{if switch} = 0 \\ (f, [-r, r]) & \text{if switch} = 1 \end{cases}$$

Definition 4. For each positive number  $r$ ,  $Q_r \equiv \sqrt{r^2 - i^2}$

Axiom 3.  $r$  is a positive real number.

Task 1: Show that  $Q_1 \cdot \left(\frac{i}{r}\right) = \frac{Q_r}{r}$

Task 2: Show that, if switch = 0,  $Q_r' = \frac{-i}{Q_r}$

Task 3: Show that  $(iQ_r)' = \left(Q_r - \frac{i^2}{Q_r}\right)$

Task 4: Suppose that switch = 0. Let  $w \equiv h.(1/2)$ , where  $h \equiv \delta.(r^2 - g^2)$ , where  $g \equiv f'$ , where

$$f \equiv \frac{1}{2} \left( i Q_r + r^2 \left( \int \frac{1}{Q_r} \right) \cdot \left( \frac{i}{r} \right) \right)$$

Then: Which basket does  $100w$  belong to?

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