4.5 - Composition of functions

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EXERCISE | 4.5.2: Composition of functions on integers.

Consider three functions f, g, and h, whose domain and target are **Z**. Let

$$f(x) = x^2 \qquad g(x) = 2^x \qquad h(x) = \left\lceil \frac{x}{5} \right\rceil$$

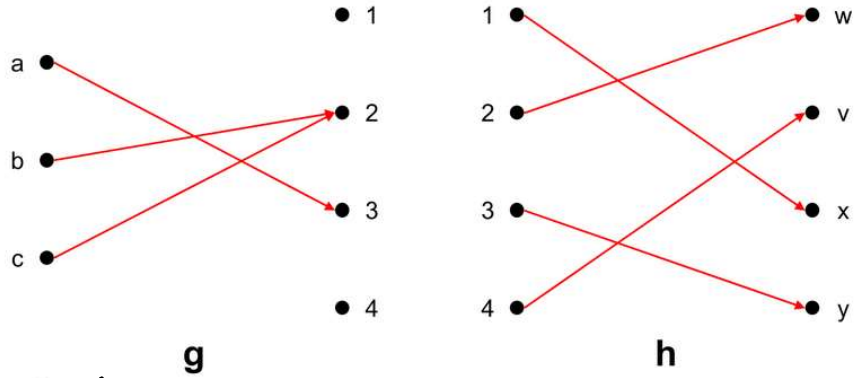
(a) Evaluate (f o g)(0) $f(g(0)) = f(2^0) = f(1) = (1)^2 = 1$

(b) Evaluate (f o h)(52) $f(h(52)) = f\left(\left\lceil \frac{52}{5} \right\rceil\right) = f(\lceil 10.4 \rceil) = f(11) = (11)^2 = 121$

(c) Evaluate (g o h o f)(4) $g(h(f(4))) = g(h(4^2)) = g(h(16)) = g\left(\left\lceil \frac{16}{5} \right\rceil\right) = g(\lceil 3.2 \rceil) = g(4) = 2^4 = 16$

EXERCISE | 4.5.5: Composition of functions defined by arrow diagrams.

Define two functions: g: {a, b, c} → {1, 2, 3, 4} and h: {1, 2, 3, 4} → {w, v, x, y}. The functions are shown in the arrow diagrams below.



(a) What is the range of g? $\{2, 3\}$

(b) What is the domain of h o g? $\{a, b, c\}$

(c) What is $h^{-1}(y)$? 3

4.6 - Logarithms and exponents

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EXERCISE | 4.6.1: Find an equivalent expression - exponents.

For each expression, give an equivalent expression that is a power of 6. That is your answer should have the form 6^{*}, where * is an expression with numbers and possibly the variable k.

(a) $(6^k)^k = 6^{k \cdot k} = 6^{k^2}$

(b) $(6^{2k})^3 = 6^{(2k)\cdot 3} = 6^{6k}$

(c) $(6^{2^k})^2 = 6^{2^k \cdot 2^1} = 6^{2^{k+1}}$

EXERCISE | 4.6.2: Find an equivalent expression - logarithms.

For each expression, give an equivalent expression that is of the form $\log_5(*)$, where * is an expression with numbers and possibly the variable k.

(a) $\log_5 k + \log_5 2 = \log_5(k \cdot 2) = \log_5(2k)$

(b) $2 \cdot \log_5 k = \log_5(k^2)$

(c) $\log_5 k - \log_5 7 = \log_5\left(\frac{k}{7}\right)$

EXERCISE | 4.6.4: Approximating the log function.

The table below shows integer powers of 3 up to 6:

$3^0 = 1$
$3^1 = 3$
$3^2 = 9$
$3^3 = 27$
$3^4 = 81$
$3^5 = 243$
$3^6 = 729$

$b^e = a \Rightarrow \log_b(a) = e$

find closest exponent value

Use the values in the table to calculate the values for the expressions below. You should not need a calculator!

(a) $\lceil \log_3 189 \rceil = 5$

(b) $\lfloor \log_3 536 \rfloor = 5$

(c) $\lfloor \log_3 2 \rfloor = 0$