R programming exercise I

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Set

With R, do the following tasks.

1. Create a *universal* set $Q = \{-100, -99, \ldots, 99, 100\}$
2. If the last number of your NIM is even, create a set
   $P = \{x \in Q \mid x \text{ is even number}\}$, or
   $P = \{x \in Q \mid x \text{ is odd number}\}$ otherwise.
3. Create $R = \{x \in Q \setminus S \mid S \text{ is } \{\text{D,D,M,M,Y,Y,Y,Y}\} \text{ of today}\}$
4. $P \cup R$
5. $Q \setminus (P \cup R)$
6. $(Q \setminus P) \cap (Q \setminus R)$

Function

Write the following functions in R.

1. $f(x, y) = \sqrt{x} + y^2$
2. $g(a, b) = ab(a^2 + \frac{b}{3})$
3. $h(x, y) = \sqrt{f(x, y) + 3 + g(x, y)}$
4. $f_1(x) = x^3 + x + 1$, $f_2(x) = \sqrt{x} - 1$, $(f_1 \circ f_2)(x)$
5. Graph functions $f_1(x) = \frac{1}{x}$, $f_2(x) = \frac{2}{x}$, $f_3(x) = \frac{3}{x}$, $f_4(x) = \frac{4}{x}$, $f_5(x) = \frac{5}{x}$ in one plot

Find the expressions of the following limits.

1. $\lim_{\theta \to 0} \frac{1 - \cos\theta}{\theta}$
2. $\lim_{h \to 0} \frac{2(-3+h)^2 - 18}{h}$
3. $\lim_{t \to 4} \frac{t - \sqrt{3t+4}}{4-t}$

Differentiation

Find the derivative expression from

1. $y = \sqrt{x}(x+1)$
2. $y = \frac{2x^2-3}{\sqrt{x}}$
3. $y = \frac{x-1}{x+1}$
4. Create functions based on derivative expressions above

Integration

Find the expression (regardless the limits) and then evaluate the integrals with the given limits.

1. $\int_0^3 2x^3 \, \mathrm{d}x$
2. $\int_{-1}^2 (1 - 5x^4) \, \mathrm{d}x$
3. $\int_{-2}^2 (x^4 - 3x^2 + 5) \, \mathrm{d}x$
4. $\int_1^4 (x^2 + \frac{1}{2\sqrt{x}}) \, \mathrm{d}x$
5. $\int_0^2 x(2 - 3x)^2 \, \mathrm{d}x$