University of Roehampton London

Mathematics for Data Science **2022/23**

Week-1 Calculus in Data Science

Answer the following questions

1. 0 is included in the set of positive integers. (T/F)

False

2. 0 is included in the set of integers. (T/F)

True

3. Irrational numbers can be expressed as a fraction. (T/F)

False

4. Negative numbers are included in the set of Natural numbers. (T/F)

False

5. The value of *pie* is Irrational. (T/F)

True

Solve the following

1. Simplify the following numerical expression

$$-2\left(1\times 4-2\div 2\right)+\left(6+2-3\right)$$

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Solution:

$$-2(1\times 4-2\div 2)+(6+2-3)$$
$$=-2(4-1)+(6+2-3)$$
$$=-2(3)+(6+2-3)$$
$$=-2(3)+(8-3)$$
$$=-2(3)+(5)$$
$$=-6+5$$
$$=-1 \checkmark$$

2. What is x if $(x + 5)^{-3} = -1$?
Solution : -6

3. Solve $(m/n)^{-2}(n/m)^{4}$
Solution : n^6/m^6

4. Simplify if, log(a/b)+log(b/a)=log(a+b).

Solution : a + b = 1

5. Find the value of x if log(6x)−log(4−x)=log(3)

Solution : 4/3

6.

$$\lim_{n\to\infty}\left(\frac{1}{1.5}+\frac{1}{5.9}+\ldots+\frac{1}{(4n-3)(4n+1)}\right)=$$

Solution: 0

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7.

$$\lim_{x \to 0} \frac{x(e^x - 1)}{1 - \cos x} \text{ is equal to}$$

Solution: 2

8. Find the Derivative of $f(t) = \left(4t^2 - t\right)\left(t^3 - 8t^2 + 12\right)$

Solution:

$$f'(t) = (8t - 1)\left(t^3 - 8t^2 + 12\right) + \left(4t^2 - t\right)\left(3t^2 - 16t\right) = 20t^4 - 132t^3 + 24t^2 + 96t - 12$$

9. Find the first order partial derivatives of the following function

$$f(x, y, z) = 4x^3y^2 - \mathbf{e}^z y^4 + \frac{z^3}{x^2} + 4y - x^{16}$$

Solution:

$$\frac{\partial f}{\partial x} = f_x = 12x^2y^2 - \frac{2z^3}{x^3} - 16x^{15}$$
$$\frac{\partial f}{\partial y} = f_y = 8x^3y - 4\mathbf{e}^z y^3 + 4$$
$$\frac{\partial f}{\partial z} = f_z = -\mathbf{e}^z y^4 + \frac{3z^2}{x^2}$$

10. Determine the area of the region bounded by

$$x = 3 + y^2,\ x = 2 - y^2,\ y = 1 \text{ and } y = -2.$$

Solution:

$$A = \int_{-2}^{1} 3 + y^2 - \left(2 - y^2\right)\, dy = \int_{-2}^{1} 1 + 2y^2\, dy = \left(y + \frac{2}{3}y^3\right)\Big|_{-2}^{1} = \boxed{9}$$