

Formal Computational Skills Exercise 1: Functions

1. Evaluate the following functions at the specified values of x.

a) $y(x) = 3(x/90)^2 + \sin(x)$ for $x = 0, 90, 180$ (where x is in degrees)

b) $y(x) = 3(x/90)^2 + \cos(x - 90)$ for $x = 0, 90, 180$ (where x is in degrees)

c) What do you notice about the answers to a) and b)? Why?

d) $y(x) = \ln(x)$ for $x = e, e^2, e^{4.5}, 1$

e) $y(x) = \log(x)$ for $x = 10, 100, 10^{4.5}, 1$

f) What do you notice about your answers to d and e?

2. (i) Without plotting the graphs of these equations write down which describe curves and which straight lines:

(a) $y = e^{3x} + 5$ (b) $y = 3x - 5$ (c) $y = x^2 + 2x + 3$ (d) $y = 5.3x + 6.7$ (e) $y = \frac{2x}{3} + 4.5$

(ii) For each straight line, what are the gradient and intercept?

(iii) For each straight line, calculate $y(0)$ (ie y evaluated at $x=0$), $y(1)$ and $y(2)$ and the differences $y(2) - y(1)$ and $y(1) - y(0)$.

(iv) What do you notice about your answers to ii and iii?

3. Write out the following formulae in full:

a) $\sum_{i=1}^3 (i-1)x^i$ b) $\prod_{i=1}^3 2^i$ c) $\sum_{i=1}^3 \sum_{j=1}^2 w_{ji}x_i$ Which equation(s) are linear in x?

4. Write the following in summation notation:

a) $2x + 3x^2 + 4x^3 + 5x^4$ b) $w_1x_1 + w_2x_2 + w_3x_3 + \dots + w_nx_n$ Which equation(s) are linear in x?

5. What are the orders of the following polynomials:

a) $2x + 3x^7 + 6x^4$ b) $2 + 3x$ c) 7 d) $2x_1^2 + 16x_1 + x_3$

6. Simplify the following ie write them as x^a for some a:

a) $x^4 x^6$ b) $\frac{x^2}{x^3}$ c) $\frac{1}{x}$ d) $\frac{1}{x^a}$ e) $\sqrt[3]{x}$ f) $\left(\sqrt{x}\right)^3$ g) $\left(x^p x^q\right)^r$

7. Work out the value of x from the definition of a log ie

$$\text{if } a^c = b \text{ then } \log_a(b) = c$$

a) $\log_3(x) = 3$ b) $\log_2(8) = x$ c) $\log_4(1) = x$ d) $\log_a(1) = x$ e) $\log_2(2^3) = x$

f) $\log_a(a^b) = x$

Hint: Use the definition of a log to write down which numbers/letters correspond to a, b and c. Next put these values into the equation $a^c = b$ and deduce the answers.