ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ & ΤΗΛΕΠΙΚΟΙΝΩΝΙΩΝ
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Βασικές Μαθηματικές Έννοιες στη Γλωσσική Τεχνολογία

Project 2

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TABLE OF CONTENTS

Question **1**

The composite function $S(f(x))$ where $S(x) = \frac{1}{1+e^{-x}}$ and $f(x) = ax + b$, is calculated as follows:

$$S(f(x)) = \frac{1}{1+e^{-f(x)}} = \frac{1}{1+e^{-(ax+b)}} = \frac{1}{1+\frac{1}{e^{(ax+b)}}} = \frac{1}{\frac{e^{(ax+b)}+1}{e^{(ax+b)}}} = \frac{e^{(ax+b)}}{e^{(ax+b)}+1} = \frac{e^{ax}e^{b}}{e^{ax}e^{b}+1}$$

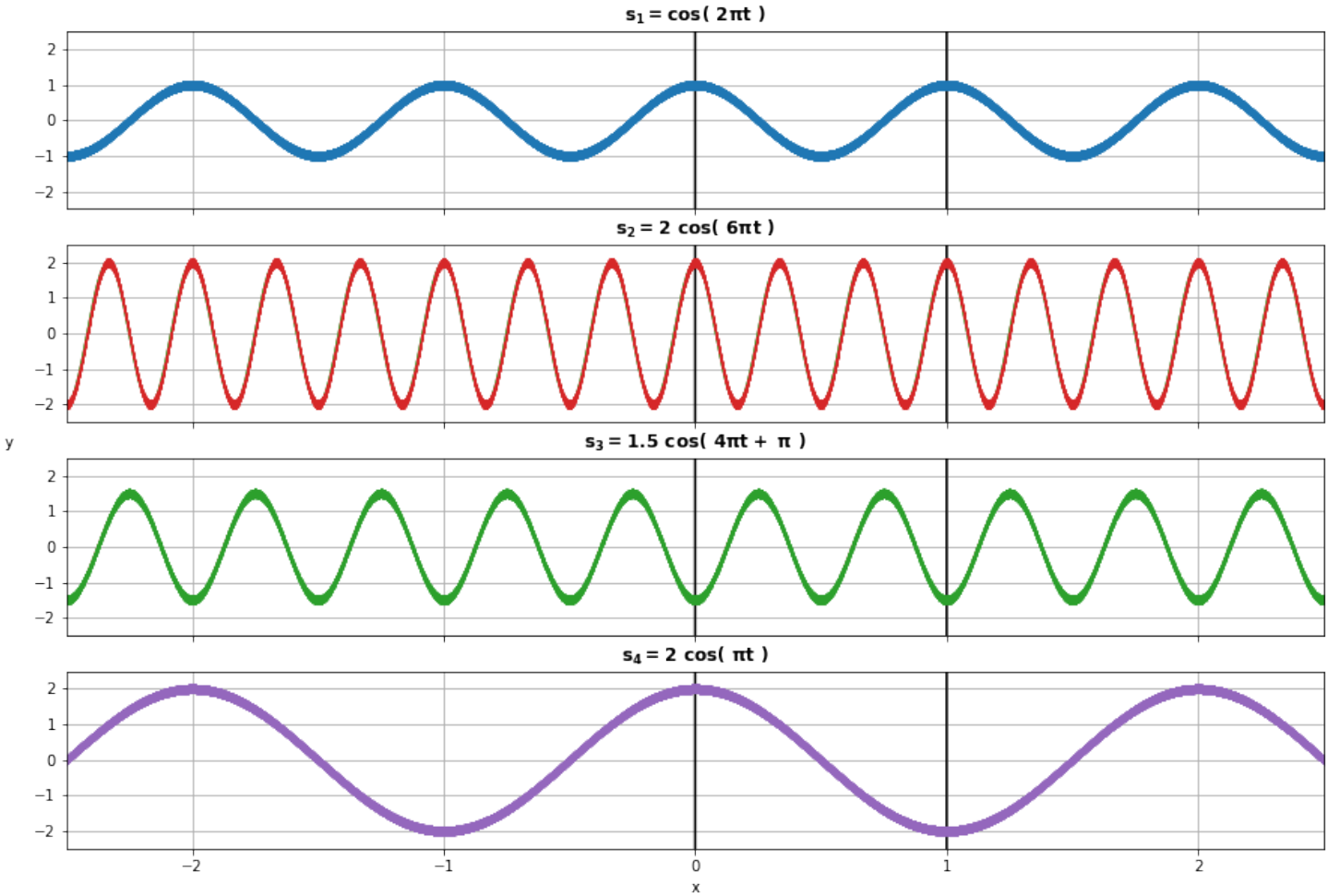
Question **2**

Lalala

Question **3**

$s = A\ cos(\ 2\pi f t\ )$

(a) $A_1 = 1, \quad f = 1, \quad \theta = 0, \quad s_1 = cos(\ 2\pi t\ )$
(b) $A_2 = 2, \quad f = 3, \quad \theta = 0, \quad s_2 = 2\ cos(\ 6\pi t\ )$
(c) $A_1 = 1.5, \quad f = 2, \quad \theta = \pi, \quad s_3 = 1.5\ cos(\ 4\pi t\ +\ \pi)$
(d) $A_1 = 2, \quad f = 0.5, \quad \theta = 0, \quad s_4 = 2\ cos(\ \pi t\ )$



Question **4**

Question **5**

(a) The derivative of function $f(x) = ax^2$ is $f'(x) = 2ax$ ($\mathbf{a} \rightarrow \mathbf{4}$)

(b) The derivative of function $f(x) = cos(2\pi ft)$ is $f'(x) = -sin(2\pi ft)$ ($\mathbf{b} \rightarrow \mathbf{1}$)

(c) The derivative of function $f(x) = bx^3$ is $f'(x) = 3bx^2$ ($\mathbf{c} \rightarrow \mathbf{2}$)

(d) The derivative of function $f(x) = e^{cx}$ is $f'(x) = ce^{cx}$ ($\mathbf{d} \rightarrow \mathbf{3}$)

Question **6**

$$S'(x) = (\frac{1}{1+e^{-x}})' = [(1+e^{-x})^{-1}]' = (-1)(1+e^{-x})^{-2}(1+e^{-x})' = -\frac{(e^{-x})'}{(1+e^{-x})^2}$$

$$= \frac{e^{-x}}{(1+e^{-x})^2} \quad (\mathbf{1})$$

$$S(x)(1-S(x)) = (\frac{1}{1+e^{-x}})(1-\frac{1}{1+e^{-x}}) = (\frac{1}{1+e^{-x}})(\frac{1+e^{-x}-1}{1+e^{-x}}) = (\frac{1}{1+e^{-x}})(\frac{e^{-x}}{1+e^{-x}})$$

$$= \frac{e^{-x}}{(1+e^{-x})^2} \quad (\ \mathbf{2}\ )$$

$(1)\ ,\ (2) \implies S'(x) = S(x)\ (\ 1 - S(x)\ )$

Question **7**

$$S(x) = \frac{1}{1+e^{-x}}, \qquad f(x) = ax + b, \qquad S(f(x)) = \frac{1}{1+e^{-f(x)}}$$

$$S'(f(x)) = \left(\frac{1}{1+e^{-f(x)}}\right)' \overset{Q_1}{=} \left(\frac{e^{ax}e^{b}}{e^{ax}e^{b}+1}\right)' = \frac{(e^{ax}e^{b})'(e^{ax}e^{b}+1) \ - \ (e^{ax}e^{b})(e^{ax}e^{b}+1)'}{(e^{ax}e^{b}+1)^2}$$

$$= \frac{(ae^{ax}e^{b})(e^{ax}e^{b}+1) \ - \ (e^{ax}e^{b})(ae^{ax}e^{b})}{(e^{ax}e^{b}+1)^2} = \frac{(ae^{ax}e^{b})(e^{ax}e^{b}+1 \ - \ e^{ax}e^{b})}{(e^{ax}e^{b}+1)^2}$$

$$= \frac{ae^{ax+b}}{(e^{ax}e^{b}+1)^2}$$

Question **8**

Lala

Question **9**

Lala

Question **10**

Lala