

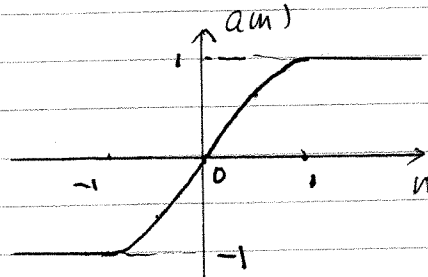
Problem #1:

$a(n)$	$da(n)/dn$	$d^2a(n)/dn^2$	$d^3a(n)/dn^3$
hard limit $\delta(n)$			
Symmetrical hard limit $2\delta(n)$			
linear $1$			
Saturating linear $\begin{cases} 1 & 0 \leq n \leq 1 \\ 0 & \text{otherwise} \end{cases}$			
Symmetrical saturating linear $\begin{cases} 1 &  n  \leq 1 \\ 0 &  n  > 1 \end{cases}$			
log-sigmoid $\frac{e^{-n}}{(1+e^{-n})^2}$ $1/e^{-n}$			
Hyperbolic Tangent Sigmoid $\frac{4}{(e^n - e^{-n})^2}$ $\tanh(n)$		 $-2 \tanh(n) / \cosh^2(n) = 8(e^n - e^{-n}) / (e^4 + e^{-4})$	 $(-2 \cosh^2(n) + 6 \sinh^2(n)) / \cosh^4(n) = 16(e^{2n} - 4 + e^{-2n}) / (e^{4n} + 1)$
positive linear $\begin{cases} 0 & n < 0 \\ 1 & n \geq 0 \end{cases}$			

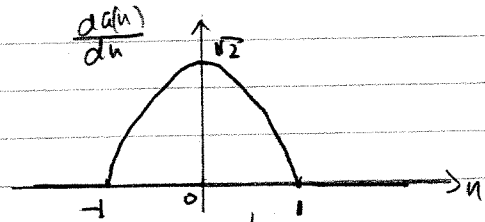
Problem # 2

$$a(n) = \begin{cases} -I_T & n < -I_T \\ \sqrt{(2I_T - n^2)} & -I_T < n < I_T \\ I_T & n > I_T \end{cases}$$

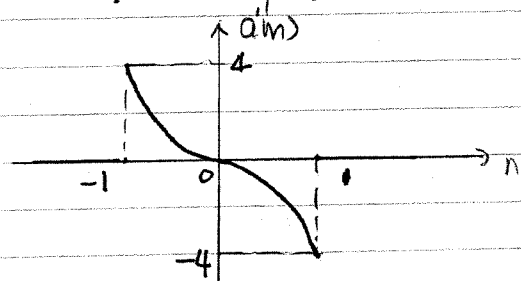
$$I_T = 1 \quad a(n) = \begin{cases} -1 & n < -1 \\ \sqrt{2 - n^2} & -1 < n < 1 \\ 1 & n > 1 \end{cases}$$



$$\frac{da(n)}{dn} = \begin{cases} 0 & n < -1 \\ \frac{2-n^2}{\sqrt{2-n^2}} & -1 < n < 1 \\ 0 & n > 1 \end{cases}$$



$$\frac{d^2a(n)}{dn^2} = \begin{cases} 0 & n < -1 \\ \frac{2n^3 - 6n}{(\sqrt{2-n^2})^3} & -1 < n < 1 \\ 0 & n > 1 \end{cases}$$



$$\frac{d^3a(n)}{dn^3} = \begin{cases} 48(n+1) & n < -1 \\ \frac{-12}{(2-n^2)^{5/2}} & -1 < n < 1 \\ 48(n-1) & n > 1 \end{cases}$$

