

1) $f(x) = [-r, r]$ $f\left(\frac{r\alpha + r}{\omega}\right) \rightarrow D_{f\left(\frac{r\alpha + r}{\omega}\right)} = [-r, r]$

$-r \leq \frac{r\alpha + r}{\omega} \leq r$ $-1 \leq r\alpha + r \leq r$ $-1 \leq r\alpha \leq 1$ $-r \leq \alpha \leq r$

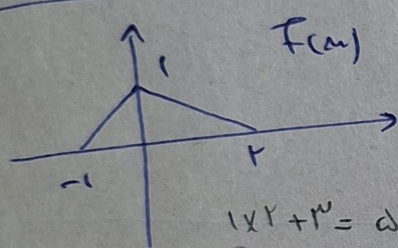
$f(r\alpha - r) \rightarrow D = [-r, r]$ $\rightarrow \begin{matrix} r\left(\frac{r}{r}\right) - r = r \\ r\left(\frac{-r}{r}\right) - r = -r \end{matrix}$

$f(\alpha) \rightarrow D = ? \rightarrow D = [-1, r]$

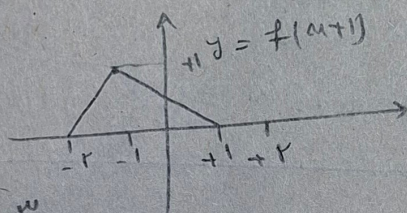
$f\left(\frac{r\alpha + 1}{r}\right) \rightarrow D = [-1, r]$ $\frac{r\left(\frac{r}{r}\right) + 1}{r} = \frac{-r}{r} = -1$

$f(r - \alpha\omega) \rightarrow D = \left(-\frac{r}{\omega}, \frac{r}{\omega}\right]$ $\frac{r\left(\frac{r}{\omega}\right) + 1}{r} = \omega$

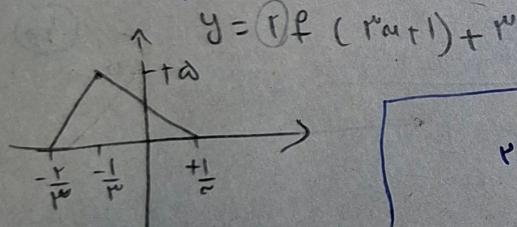
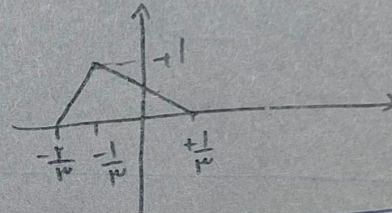
$-1 \leq r - \alpha\omega \leq \omega \xrightarrow{-r} -r \leq -\alpha\omega < r \xrightarrow{\times (-1)} r > \alpha\omega > -r \xrightarrow{\frac{r}{\omega}} \alpha > -\frac{r}{\omega}$



$y = r f(r\alpha + 1) + r$ $r f(r)$

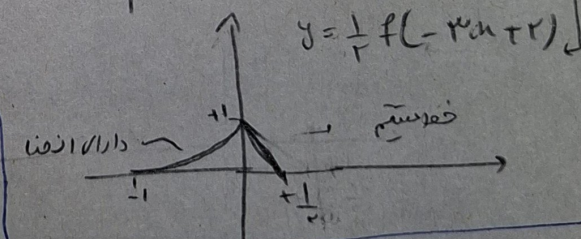
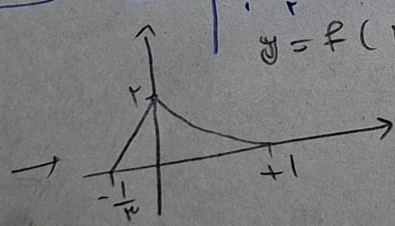
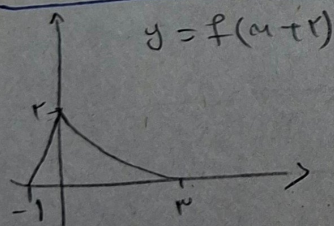
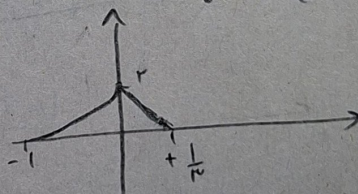
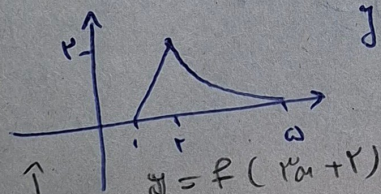


$y = f(r\alpha + 1)$



$y = \frac{1}{r} f(r - r\alpha)$ $r f(r)$

$y = f(-r\alpha + r)$



$y = -\frac{1}{r\omega} \alpha^2 + \frac{r}{\omega} \alpha + 1$ (α, y)

خوارزمی اصل محاسبه

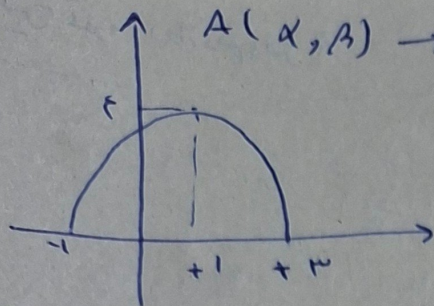
$y = -\frac{1}{r\omega} \left(\alpha^2 - \frac{4}{\omega} \alpha\right) + 1 = -\frac{1}{r\omega} \left[\left(\alpha - \frac{2}{\omega}\right)^2 - \frac{4}{\omega^2}\right] + 1 = -\frac{1}{r\omega} \left(\alpha - \frac{2}{\omega}\right)^2 + \frac{4}{r\omega^2} + 1$

$\frac{d}{d\alpha} \left(-\frac{1}{r\omega} \alpha^2 + \frac{r}{\omega} \alpha + 1\right) = \frac{r}{\omega} - \frac{2}{r\omega} \alpha = 0$

$y = -\frac{1}{r\omega} (\alpha - \frac{2}{\omega})^2 + \frac{4}{r\omega^2} + 1$ $y = 0$

$\frac{1}{r\omega} (\alpha - \frac{2}{\omega})^2 = \frac{4}{r\omega^2} + 1$ $\rightarrow (\alpha - \frac{2}{\omega})^2 = 4$

$\alpha - \frac{2}{\omega} = \pm 2$ $\alpha = \pm 2 + \frac{2}{\omega}$



$$A(\alpha, \beta) \rightarrow y = 1 - r f(r\alpha + r) \quad \alpha\beta = ?$$

$$r\alpha + r = 1 \rightarrow \alpha = -\frac{1}{r}$$

$$\alpha\beta = -\frac{1}{r} \cdot 1 - r = -\frac{1}{r} - r$$

$$y = 1 - r f(r\alpha + r) = 1 - 1 = -r \rightarrow \beta = -r$$

(7)

$$D_f = (a, c)$$

$$D_g = [-1, b)$$

$$y = f(u-1) + g(u+1) \quad (r, a) \quad (1)$$

$$a < u-1 \leq c$$

$$-1 \leq u+1 < b$$

$$(a+1, c] \cap [-r, b-1) = (-r, c)$$

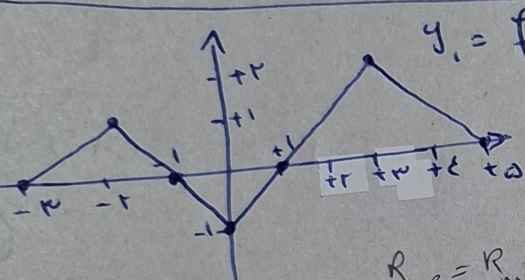
$$a+1 < u \leq c$$

$$-r \leq u < b-1$$

$$a+1 = -r \rightarrow a = -r$$

$$b-1 = c \rightarrow b = c$$

$$a-b = -r - (c) = -9$$



$$y_i = f\left(\frac{u}{r} + 1\right)$$

$$y_r = \sqrt{1 - r f(u) - r}$$

$$R_{y_r} = ?$$

$$D_{y_r} = ?$$

(9)

$$R_{f(u)} = R_{f(u/r + 1)}$$

$$r f(u) - r > 0 \rightarrow \text{حدود برای } r f(u) - r$$

$$R_{f(u)} = R_{y_i} = [-1, r]$$

$$D_{y_r} = [-r, c] \quad D_{y_i} = D_{y_r}$$

$$R_{y_r} = [0, \sqrt{5}]$$

$$-1 \leq f(u) \leq r \rightarrow -a \leq r f(u) - r \leq 1$$

$$0 \leq |r f(u) - r| \leq a \rightarrow 0 \leq \sqrt{|r f(u) - r|} \leq \sqrt{a}$$

$$f(u) = \left| \frac{u+1}{r u + 1} \right|$$

$$\frac{u+1}{r u + 1}$$

$$g(u) = \left| \frac{\frac{u-1}{(u-r)+1}}{\frac{r(u-r)+1}{(r u - r)}} \right| + 1$$

(10)

$$u + g(u) < 0 \rightarrow u + \left| \frac{u-1}{r u - r} \right| + 1 < 0$$

$$u < -1 \rightarrow \text{بسیار قدر مطلق را مثبت می‌کنیم}$$

$$u+1 + \frac{u-1}{r u - r} < 0$$

$$\frac{(u+1)(r u - r) + (u-1)}{r u - r} < 0 \rightarrow \frac{r(u^2 - r)}{r u - r} < 0$$

$$u < -1$$

$$u^2 - r > 0 \rightarrow u^2 > r \quad \left(\begin{array}{l} u < -1 \\ u > \sqrt{r} \\ u < -\sqrt{r} \end{array} \right)$$

$$\Rightarrow (-\infty, -\sqrt{r})$$