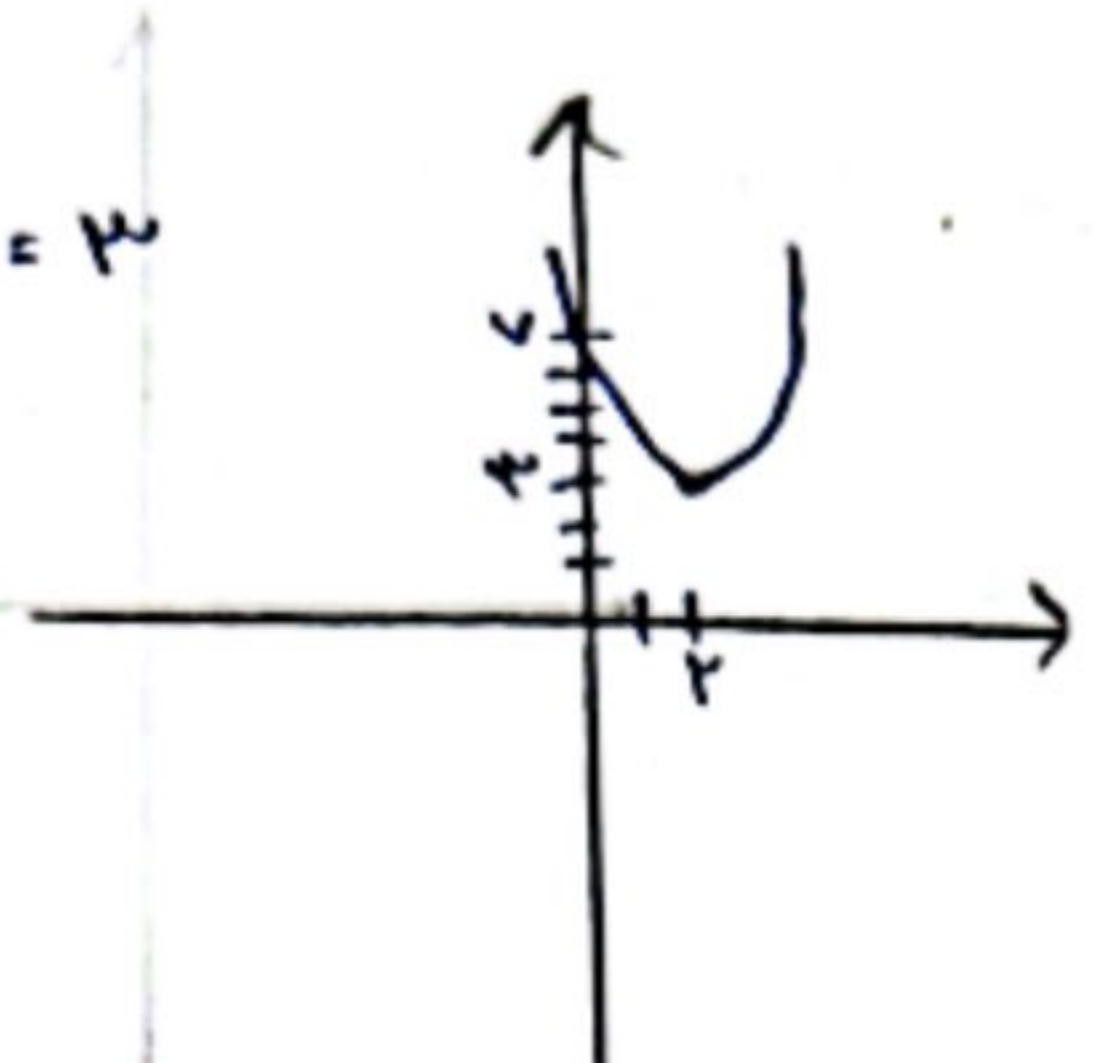
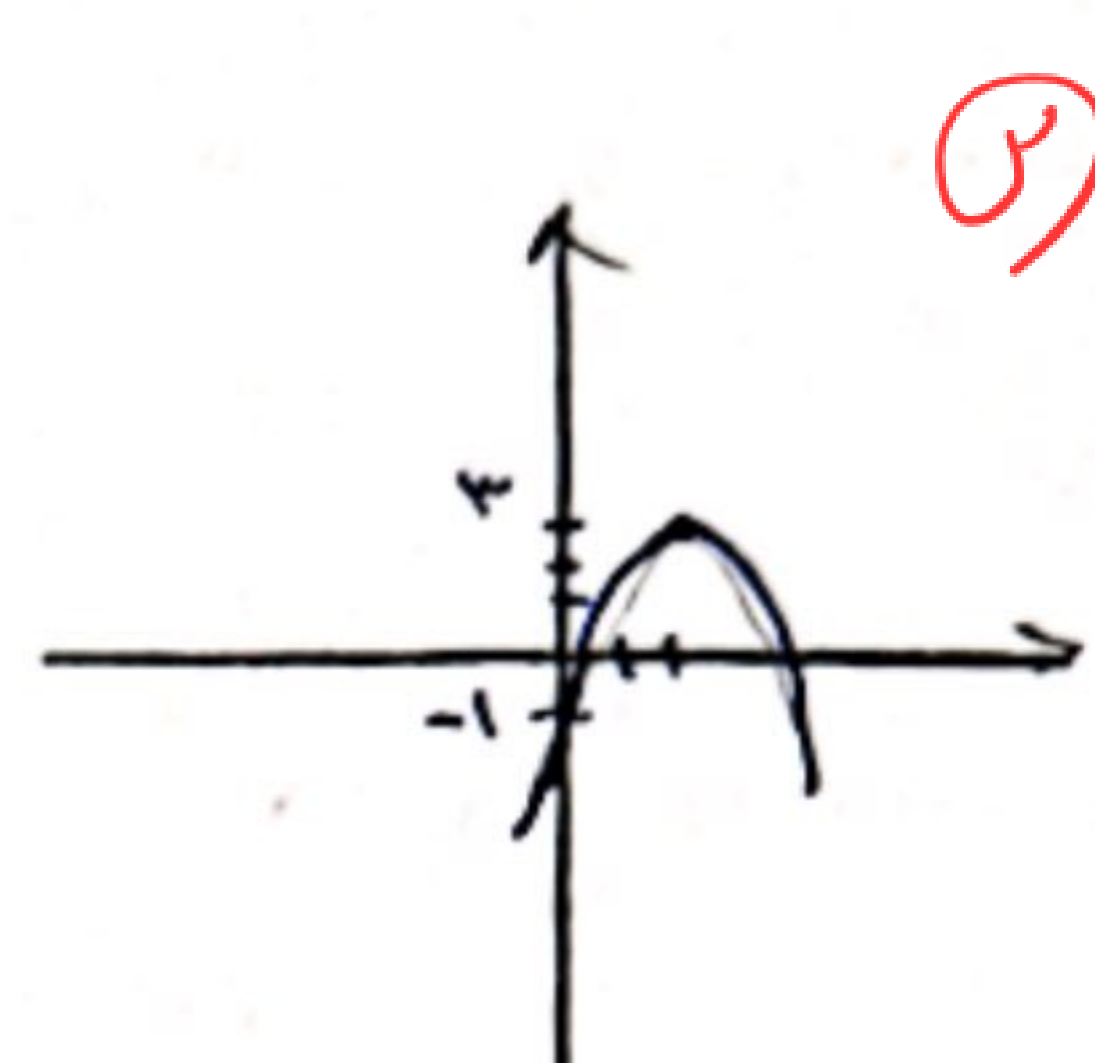


الف) $y = u^2 - 2u + 1$ $\star a > 0 \rightarrow \min$
 ext $\left| \begin{array}{l} u = -\frac{b}{2a} = 1 \\ y = (1)^2 - 2 \times 1 + 1 = 0 \end{array} \right.$



ب) $y = -u^2 + 2u - 1$ $\star a < 0 \rightarrow \max$
 ext $\left| \begin{array}{l} -\frac{b}{2a} = u = 1 \\ y = -(1)^2 + 2 \times 1 - 1 = 0 \end{array} \right.$



الف) $\Delta > 0 \Rightarrow b^2 - 4ac > 0 \Rightarrow (m+1)^2 - (2 \times 2 \times (\frac{1}{m+2})) > 0$
 $\Rightarrow m^2 + 1 + 2m - 4 > 0 \Rightarrow m^2 + 2m - 3 > 0 \Rightarrow (m-1)(m+3) > 0 \Rightarrow m < -3 \text{ or } m > 1$
 ب) $\Delta = 0 \Rightarrow b^2 - 4ac = 0 \Rightarrow (m+1)^2 - (2 \times 2 \times (\frac{1}{m+2})) = 0 \Rightarrow m^2 + 2m - 3 = 0$
 $\Rightarrow (m-1)(m+3) = 0 \Rightarrow m = 1 \text{ or } m = -3$
 ج) $\Delta < 0 \Rightarrow b^2 - 4ac < 0 \Rightarrow (m+1)^2 - (2 \times 2 \times (\frac{1}{m+2})) < 0$
 $\Rightarrow m^2 + 2m - 3 < 0 \Rightarrow (m-1)(m+3) < 0 \Rightarrow -3 < m < 1$
 د) $\Delta \geq 0 \Rightarrow b^2 - 4ac \geq 0 \Rightarrow (m+1)^2 - (2 \times 2 \times (\frac{1}{m+2})) \geq 0 \Rightarrow m^2 + 2m - 3 \geq 0$
 $\Rightarrow (m-1)(m+3) \geq 0 \Rightarrow m \leq -3 \text{ or } m \geq 1$

در دو دسته داریم: $\Delta > 0$ و $\Delta = 0$

در دسته $\Delta > 0$ داریم: $m < -3$ و $m > 1$

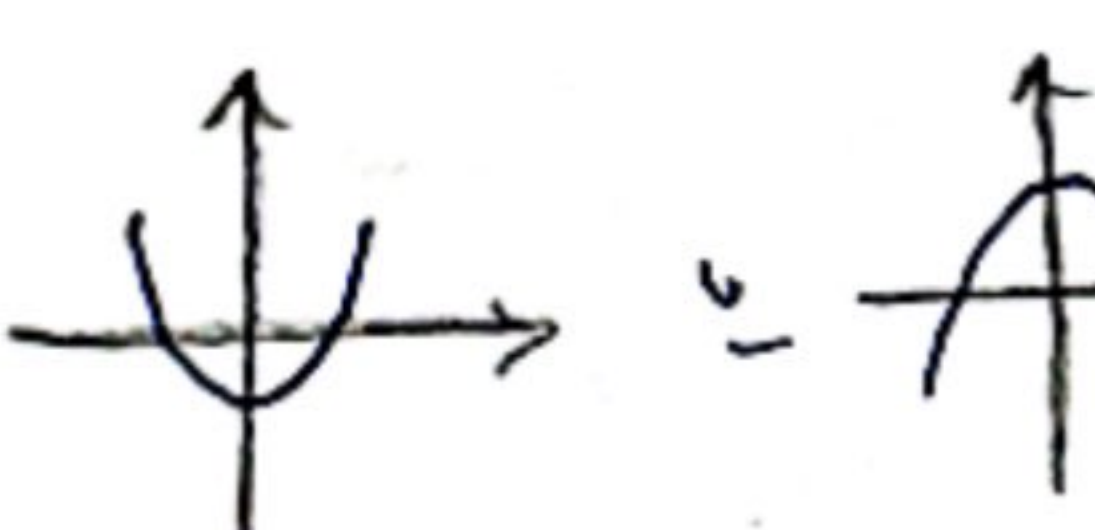
در دسته $\Delta = 0$ داریم: $m = -3$ و $m = 1$

پس جواب: $m \in (-\infty, -3) \cup (1, +\infty)$

الف) $\Delta > 0 \Rightarrow (2m+2)^2 - 4 \times (m-2) > 0 \Rightarrow 4m^2 + 8m + 4 - 4m + 8 > 0$
 $\Rightarrow 4m^2 + 4m + 12 > 0 \Rightarrow m^2 + m + 3 > 0$
 $\Delta = 1 - 12 < 0$ پس همیشه $\Delta > 0$ است.
 ب) $\Delta < 0 \Rightarrow (2m+2)^2 - 4 \times (m-2) < 0 \Rightarrow m^2 + m + 3 < 0$
 $\Delta = 1 - 12 < 0$ پس هیچگاه $\Delta < 0$ نیست.
 ج) $\Delta = 0 \Rightarrow (2m+2)^2 - 4 \times (m-2) = 0 \Rightarrow m^2 + m + 3 = 0$
 $\Delta = 1 - 12 < 0$ پس هیچگاه $\Delta = 0$ نیست.
 د) $\Delta \geq 0 \Rightarrow (2m+2)^2 - 4 \times (m-2) \geq 0 \Rightarrow m^2 + m + 3 \geq 0$
 $\Delta = 1 - 12 < 0$ پس همیشه $\Delta \geq 0$ است.
 ه) $\Delta \leq 0 \Rightarrow (2m+2)^2 - 4 \times (m-2) \leq 0 \Rightarrow m^2 + m + 3 \leq 0$
 $\Delta = 1 - 12 < 0$ پس هیچگاه $\Delta \leq 0$ نیست.

پس جواب: $m \in (-\infty, +\infty)$

الف) $y = (m-2)u^2 - 2(m+1)u + 10$



ب) $\Delta > 0 \Rightarrow b^2 - 4ac > 0 \Rightarrow 4(m+1)^2 - 4(m-2) \times 10 > 0$
 $\Rightarrow (m+1)^2 - 10(m-2) > 0 \Rightarrow m^2 + 2m + 1 - 10m + 20 > 0$
 $\Rightarrow m^2 - 8m + 21 > 0 \Rightarrow (m-3)(m-7) > 0 \Rightarrow m < 3 \text{ or } m > 7$
 ج) $\Delta = 0 \Rightarrow b^2 - 4ac = 0 \Rightarrow (m+1)^2 - 10(m-2) = 0 \Rightarrow m^2 - 8m + 21 = 0$
 $\Rightarrow (m-3)(m-7) = 0 \Rightarrow m = 3 \text{ or } m = 7$
 د) $\Delta < 0 \Rightarrow b^2 - 4ac < 0 \Rightarrow (m+1)^2 - 10(m-2) < 0 \Rightarrow m^2 - 8m + 21 < 0$
 $\Rightarrow (m-3)(m-7) < 0 \Rightarrow 3 < m < 7$
 ه) $\Delta \geq 0 \Rightarrow b^2 - 4ac \geq 0 \Rightarrow (m+1)^2 - 10(m-2) \geq 0 \Rightarrow m^2 - 8m + 21 \geq 0$
 $\Rightarrow (m-3)(m-7) \geq 0 \Rightarrow m \leq 3 \text{ or } m \geq 7$
 و) $\Delta \leq 0 \Rightarrow b^2 - 4ac \leq 0 \Rightarrow (m+1)^2 - 10(m-2) \leq 0 \Rightarrow m^2 - 8m + 21 \leq 0$
 $\Rightarrow (m-3)(m-7) \leq 0 \Rightarrow 3 < m < 7$

پس جواب: $m \in (-\infty, 3) \cup (7, +\infty)$

الف) $y = \frac{x}{2}u^2 - (2\sin\alpha)u + \frac{2}{3}$
 $\Delta > 0 \Rightarrow b^2 - 4ac > 0 \Rightarrow 4\sin^2\alpha - (2 \times \frac{x}{2} \times \frac{2}{3}) > 0 \Rightarrow 4\sin^2\alpha - \frac{2x}{3} > 0$
 $\Rightarrow \sin^2\alpha > \frac{x}{6}$
 ب) $\Delta = 0 \Rightarrow b^2 - 4ac = 0 \Rightarrow 4\sin^2\alpha - \frac{2x}{3} = 0 \Rightarrow \sin^2\alpha = \frac{x}{6}$
 $\Rightarrow \sin\alpha = \pm \sqrt{\frac{x}{6}}$
 ج) $\Delta < 0 \Rightarrow b^2 - 4ac < 0 \Rightarrow 4\sin^2\alpha - \frac{2x}{3} < 0 \Rightarrow \sin^2\alpha < \frac{x}{6}$
 $\Rightarrow \sin\alpha < \pm \sqrt{\frac{x}{6}}$
 د) $\Delta \geq 0 \Rightarrow b^2 - 4ac \geq 0 \Rightarrow 4\sin^2\alpha - \frac{2x}{3} \geq 0 \Rightarrow \sin^2\alpha \geq \frac{x}{6}$
 $\Rightarrow \sin\alpha \geq \pm \sqrt{\frac{x}{6}}$
 ه) $\Delta \leq 0 \Rightarrow b^2 - 4ac \leq 0 \Rightarrow 4\sin^2\alpha - \frac{2x}{3} \leq 0 \Rightarrow \sin^2\alpha \leq \frac{x}{6}$
 $\Rightarrow \sin\alpha \leq \pm \sqrt{\frac{x}{6}}$

پس جواب: $\sin\alpha \geq \pm \sqrt{\frac{x}{6}}$

$$y = \frac{(2u^2 - 2u - 1)(2u^2 - 2u - 2)}{1 - u^2} = \frac{2u^2 - 2u - 1}{1 - u^2} \cdot \frac{u - 1}{u + 1} = \frac{2u^2 - 2u - 2}{-u^2 + 1} \cdot \frac{u - 1}{u + 1}$$

$$\Rightarrow \frac{(u-1)(2u+1)(u+1)(2u-2)}{(u-1)(u+1)} \Rightarrow u \neq 1 \rightarrow \frac{2u+1}{2u-2} \Rightarrow (2u+1)(2u-2) \Rightarrow$$

$$y = 2u^2 - 2u - 2 \Rightarrow y_{\max} = \frac{-\Delta}{2a} = \frac{149 - 2(-2)}{4} = \frac{153}{4} \Rightarrow \text{جواب}$$

6

$$r(\alpha + \beta) = \omega(\alpha\beta) + v \quad (*)$$

$$\alpha^2 + \beta^2 = 5^2 - 2p \xrightarrow{(*)} \frac{9}{2} - 2x - \frac{1}{x} = \frac{9}{2} + 1 = \frac{11}{2} \rightarrow \text{جواب}$$

$$(*) \rightarrow r(\alpha + \beta) - \omega(\alpha\beta) = v \Rightarrow r(s) - \omega(p) \Rightarrow r\left(\frac{m+y}{m}\right) - \omega\left(-\frac{y}{m}\right) = v \Rightarrow \frac{m+y}{m} + \frac{10}{m} = v$$

$$\Rightarrow \frac{m+10+y}{m} = v \Rightarrow m+y+10 = vm \Rightarrow 2m = 18 \Rightarrow m = 9 \quad \text{جواب}$$

$$mu^2 - (m+y)u - y = 0 \quad \text{جواب} \quad 2u^2 - 2u - 2 = 0 \Rightarrow s = -\frac{b}{a} = \frac{2}{2} = 1, p = \frac{c}{a} = -\frac{1}{2} \quad \text{جواب}$$

7

$$y = u^2 - \omega u + r \Rightarrow s = -\frac{b}{a} = \omega, p = \frac{c}{a} = r \Rightarrow \alpha\beta = r \Rightarrow \beta = \frac{r}{\alpha}, \omega\beta^2 \Rightarrow a \times \frac{r}{\alpha^2} = \frac{r_0}{\alpha^2} \quad \text{جواب}$$

$$\frac{(\alpha + \beta)^2}{\omega\beta^2} \Rightarrow \frac{\alpha^2}{\omega\beta^2} + \frac{\beta^2}{\omega\beta^2} \Rightarrow \frac{\alpha^2}{\omega\beta^2} + \frac{\beta^2}{\omega} \Rightarrow \frac{\alpha^2}{\frac{r_0}{\alpha^2}} + \frac{\beta^2}{\omega} \Rightarrow \frac{\alpha^4}{r_0} + \frac{\beta^2}{\omega}$$

$$\Rightarrow \frac{1}{\omega} (\alpha^4 + \beta^4) \Rightarrow \frac{1}{\omega} (s^4 - 4ps^2 + 2p^2) = \frac{1}{\omega} (12\omega - 2r_0) = \frac{19}{\omega} \rightarrow \text{جواب}$$

8

$$\begin{cases} y_1 = 2u + 10 \\ y_2 = au^2 + bu + c \end{cases} \xrightarrow{\text{مقایسه}} \begin{cases} (2a - 2b + c = 10) \\ (2a + 2b + c = 10) \end{cases} \Rightarrow \begin{cases} -\omega a + \omega b = 10 \Rightarrow a + b = 10 \\ 2a - 2b = 10 - 10 \Rightarrow a = b \end{cases}$$

$$\Rightarrow 2a = 10 \Rightarrow a = \frac{10}{2} = 5, b = 5 \Rightarrow 5u^2 + 5u + 10 = 0 \Rightarrow u = -\frac{b}{2a} = -\frac{5}{10} = -\frac{1}{2} \quad \text{جواب}$$

9

$$y = 2u^2 + (m+1)u + m+2 \Rightarrow y = u \Rightarrow 2u^2 + (m+1)u + m+2 = u \Rightarrow 2u^2 + mu + m+2 = 0$$

$$\Rightarrow \Delta = m^2 - 4 \times 2(m+2) = m^2 - 8m - 16 = 0 \Rightarrow (m-12)(m+4) = 0 \Rightarrow m = 12 \text{ و } m = -4$$

$$① m = 12 \Rightarrow 2u^2 + 13u + 14 = 0 \Rightarrow u^2 + 6.5u + 7 = 0 \Rightarrow (u+5)(u+1.5) = 0 \Rightarrow u = -5 \text{ و } u = -1.5$$

$$② m = -4 \Rightarrow 2u^2 - 3u + 2 = 0 \Rightarrow u^2 - 1.5u + 1 = 0 \Rightarrow (u-1)^2 = 0 \Rightarrow u = 1 \rightarrow 1 > 0 \quad \text{جواب}$$

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