

$$x f(x) \geq 0 \quad \bullet \quad x f(x) = 0 \Rightarrow x = -1, 0, 2, 4 \Rightarrow \begin{array}{c|c|c|c|c} -1 & 0 & 2 & 4 & \\ \hline - & + & - & + & - \end{array}$$

$$\Rightarrow P_f = [-1, 0] \cup [2, 4]$$

② ✓

$$\frac{-x}{f(x)} \geq 0, \quad \frac{-x}{f(x)} \rightarrow 0 \Rightarrow \begin{array}{c|c|c|c|c} -4 & -3 & 2 & 4 & \\ \hline - & + & + & - & + \end{array}$$

$P_f = (-3, 0) \cup (0, 2) \cup (4, +\infty) \Rightarrow$ ادامه ندارد
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$$x=2 \Rightarrow f(2) - 2f(2) \leq f - 4 + f = 2 \Rightarrow -f(2) \leq 2 \Rightarrow f(2) \geq -2$$

$$x=-2 \Rightarrow f(-2) + f \leq f + 4 + f = 10 \Rightarrow f(-2) \leq 10$$

② ✓

$$\left. \begin{array}{l} f(4) = 4 - \sqrt{9} = 4 - 3 = 1 \\ f(1) = 2 \times 1 + 3 = 5 \end{array} \right\} \Rightarrow f(1) + f(4) \Rightarrow f(1) \leq 2 \times 2 + 3 = 7, f(4) = 4 - \sqrt{9} = 1$$

$$\Rightarrow f(1) + f(4) = 7 + 1 = 8$$

② ✓

$$f(x) = ax^2 - bx + c$$

$$f(n-1) = a(n-1)^2 - b(n-1) + c = an^2 - 2an + a - bn + b + c$$

$$f(n-1) - f(n) = an^2 - 2an + a - bn + b + c - (an^2 - bn + c) = -2an + a + b = -2a + a + b = -a + b$$

$$\Rightarrow -2a = 9 \Rightarrow a = -\frac{9}{2}, a + b = 2 \Rightarrow -\frac{9}{2} + b = 2 \Rightarrow b = \frac{13}{2} \Rightarrow a - b = -\frac{22}{2} = -11$$

② ✓

$\frac{r(9-9+1) + (1+r+1)}{(r-9+1)^r} = \frac{r+1}{1} = V$ (P) ✓	6
$\frac{r(r \times r + 1) - r(r+1)}{r \times r + 1} = \frac{r^2 - 1}{r^2 + 1} = \frac{r-1}{r+1}$ (P) ✓	7
$\left. \begin{array}{l} f(f) = 1 \\ f(r) = r \\ f(1) = 9 \end{array} \right\} \Rightarrow \frac{f(1) - f(r)}{f} \Rightarrow \left\{ \begin{array}{l} f(1) = 9 \\ f(r) = 9 \end{array} \right\} \Rightarrow \frac{9-9}{9} = \frac{0}{9} = 0$ (P) ✓	8
$f(n) = \frac{n^r + r n + 9}{n^r + r n + 1} = \frac{(n+r)^r + 1}{(n+r)^r + 1} \xrightarrow{n = \sqrt{r} - r}$ $\Rightarrow f(\sqrt{r} - r) = \frac{(\sqrt{r})^r + 1}{(\sqrt{r})^r + 1} = \frac{1}{1} = 1 \Rightarrow f(r) = \frac{r^r + r \times r + 9}{r^r + r \times r + 1} = \frac{r+1}{r}$ (P) ✓	9
$f(\sqrt{n}) = (\sqrt{n})^r + \frac{1}{(\sqrt{n})^r} = n + \frac{1}{n} \Rightarrow (f(\sqrt{n}))^r = (n + \frac{1}{n})^r = n^r + \frac{1}{n^r} + r$ $(f(\sqrt{n}))^r - f(n) = n^r + \frac{1}{n^r} + r - n^r - \frac{1}{n^r} = r$ (P) ✓	10