

$$y = \sqrt{x f(x)} \rightarrow x f(x) \geq 0 \xrightarrow{2 \leq x \leq 5} f(x) \geq 0 \rightarrow x f(x) \geq 0$$

$$\xrightarrow{-5 \leq x \leq 0} f(x) \leq 0 \rightarrow x f(x) \geq 0$$

$$\Rightarrow D_f = [2, 5] \cup [-5, 0] \quad \textcircled{2} \checkmark$$

$$y = \sqrt{\frac{-x}{f(x)}} \rightarrow f(x) \neq 0 \rightarrow x \neq \{0, 1, 0, -2\}$$

$$\left. \begin{array}{l} \xrightarrow{\frac{-x}{f(x)} \geq 0} \begin{array}{l} x \geq 0 \rightarrow f(x) < 0 \rightarrow (0, 2] \\ x \leq 0 \rightarrow f(x) > 0 \rightarrow [-2, 0) \end{array} \end{array} \right\} D_f = (-2, 0) \cup (0, 2] \quad \textcircled{2} \checkmark$$

$$\underbrace{f(2) - 2f(2)}_{-f(2)} = \underbrace{2^2 - 2 + 2}_2 \Rightarrow f(2) = -2 \quad \textcircled{1, 2} \checkmark$$

$$f(-2) - 2f(2) = \underbrace{(-2)^2 + 2 + 2}_{2+2+2=6} \rightarrow f(-2) = 12 + 2(-2) = 12 - 4 = 8 \quad \textcircled{1, 2} \checkmark$$

$$f(f(5)) + f(f(1)) \leq f(5 - \sqrt{5+2}) + f(2 \times 1 + 2) \leq f(2) + f(5) \leq$$

$$\rightarrow (2 \times 2 + 2) + (5 - \sqrt{5+2}) \leq 7 + 2 \leq 9 \quad \textcircled{2} \checkmark$$

$$\underbrace{(a(n-1)^2 - b(n-1) + 2)}_{n^2 - 2n + 1} - (an^2 - bn + 2) = 9n + 2$$

$$an^2 - 2an + a - bn + b + 1 - an^2 + bn - 2 = 9n + 2 \quad \textcircled{2} \checkmark$$

$$-2an + a + b = 9n + 2 \Rightarrow -2a = 9, a + b = 2 \Rightarrow a = -\frac{9}{2}, b = \frac{13}{2}$$

$$a - b = -\frac{9}{2} - \frac{13}{2} = -11 \quad \textcircled{1} \checkmark$$

$$\frac{r f(r) + f(-1)}{f'(r)} = \frac{r(r-1+1) + (1+r+1)}{(r-1+1)^r} = \frac{r+1+2}{(-1)^r} = \frac{r+3}{1} = r+3$$

(P) ✓

$$\frac{r f(r) - r f(-r)}{f(r)} = \frac{r(1r+1) - r((-r)^r)}{r+1} = \frac{r^2 - 1}{r+1} = \frac{r-1}{1} = r-1$$

(P) ✓

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

(P) ✓

$$x^r + r x + 1 = (x+r)^r + 1 \quad x^r + r x + 1 = (x+r)^r + 1$$

$$f(\sqrt{r-1}) = \frac{(\sqrt{r-1})^r + 1}{(\sqrt{r-1})^{r+1}} = \frac{(\sqrt{r})^r + 1}{(\sqrt{r})^{r+1}} = \frac{r + 1}{r+1} = 1$$

$$f(r) = \frac{(r+1)^r + 1}{(r+1)^{r+1}} = \frac{r^r + 1}{r+1} = \frac{r}{r+1}$$

(P) ✓

$$f(\sqrt{x}) = (\sqrt{x})^r + \frac{1}{(\sqrt{x})^r} = x + \frac{1}{x}$$

$$(f(\sqrt{x}))^r = \left(x + \frac{1}{x}\right)^r = x^r + r x^{r-1} + \frac{1}{x^r}$$

$$(f(\sqrt{x}))^r - f(x) = x^r + r x^{r-1} + \frac{1}{x^r} - x^r - \frac{1}{x^r} = r x^{r-1}$$

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