

Please show **all** your work! Answers without supporting work will not be given credit.  
Write answers in spaces provided.

Name: \_\_\_\_\_

Let

$$f(x) = \begin{cases} x + 42, & \text{if } x \leq -42 \\ x - 42, & \text{if } -42 < x < 49 \\ \sqrt{x}, & \text{if } x \geq 49 \end{cases}$$

1. Find the following limits analytically if it exists:

(a) [3 points]  $\lim_{x \rightarrow -42} f(x)$

**Solution:** To find the  $\lim_{x \rightarrow -42} f(x)$ , we need to first find the left and right limit at  $-42$ . i.e.

$$\lim_{x \rightarrow -42^-} f(x) = \lim_{x \rightarrow -42} x + 42 = -42 + 42 = 0 \quad [1\text{pt}]$$

$$\lim_{x \rightarrow -42^+} f(x) = \lim_{x \rightarrow -42} x - 42 = -42 - 42 = -84 \quad [1\text{pt}]$$

Since the left and right limits don't match, we have  $\lim_{x \rightarrow -42} f(x) = \boxed{DNE}$  [1pt]

(b) [3 points]  $\lim_{x \rightarrow 49} f(x)$

**Solution:** To find the  $\lim_{x \rightarrow 49} f(x)$ , we need to first find the left and right limit at  $49$ . i.e.

$$\lim_{x \rightarrow 49^-} f(x) = \lim_{x \rightarrow 49} x - 42 = 49 - 42 = 7 \quad [1\text{pt}]$$

$$\lim_{x \rightarrow 49^+} f(x) = \lim_{x \rightarrow 49} \sqrt{x} = \sqrt{49} = 7 \quad [1\text{pt}]$$

Since the left and right limits do match, we have  $\lim_{x \rightarrow 49} f(x) = \boxed{7}$  [1pt]

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2. [4 points] Find value(s) where  $f(x)$  is discontinuous (if they exist). Classify each discontinuity.

**Solution:** Using Problem 1, we can see that  $f(x)$  is discontinuous only at  $x = -42$  (since the limit at  $x = -42$  is DNE). [3 pt]

The discontinuity at  $x = -42$  is a jump. [1pt]