6. [12 points]

    a. [6 points] For each of the following sequences, defined for $n \geq 1$, decide whether the sequence is monotone increasing, monotone decreasing, or neither, and whether it is bounded or unbounded. Circle your answers. No justification is required.

(i) $a_n = \dfrac{\sin(n)}{n}$

Circle all which apply:

        Monotone Increasing   **Monotone Decreasing**   **Neither** ✓

                Bounded ✓   **Unbounded**

(ii) $b_n = \displaystyle\int_{\frac{1}{n}}^{2} \frac{1}{x^{1/2}}\ \mathrm{d}x$

Circle all which apply:

        Monotone Increasing ✓   **Monotone Decreasing**   **Neither**

                Bounded ✓   **Unbounded**

(iii) $c_n = \displaystyle\sum_{k=1}^{n} \frac{1}{k}$

Circle all which apply:

        Monotone Increasing ✓   **Monotone Decreasing**   **Neither**

                Bounded   **Unbounded** ✓

    b. [6 points] For each of the following sequences or series described below, determine whether they must converge, must diverge, or whether there is not enough information. Circle your answers. No justification is required.

(i) A sequence given by $d_n = P(1 - n)$ where $P(x)$ is a cumulative distribution function.

Circle one: **Converges** ✓   **Diverges**   **Not Enough Information**

(ii) An increasing sequence of positive numbers which are all smaller than 4.

Circle one: **Converges** ✓   **Diverges**   **Not Enough Information**

(iii) An infinite geometric series whose 2022nd term is 102 and whose 2023rd term is -204.

Circle one: **Converges**   **Diverges** ✓   **Not Enough Information**