Task 3: Time to Cyclic Transformation

In this task, we need to convert a given hour (from 0 to 23) into two cyclic features: **sine** and **cosine** of the time. This is commonly done in machine learning when working with time data, as it transforms the hour of the day into a continuous representation that captures the cyclic nature of time (e.g., 23:00 is close to 00:00).

Revised Solution and Explanation

Changes and Improvements:

1. **Added input validation**: Ensured that the hour is within the valid range of 0 to 23.
2. **Sine and cosine transformation**: These transformations map the hour to the unit circle, where the sine and cosine values represent its position on the circle.
3. **Unit tests**: Added tests for specific hours such as midnight (00:00), noon (12:00), and other key times to ensure correctness.

Explanation of Changes

1. **Function time_to_cyclic()**:
    - **Input validation**: The function ensures that the input hour is within the valid range of 0 to 23. If the hour is outside this range, it raises a ValueError.
2. **Unit Tests**:
    - **Test for midnight (00:00)**: At midnight, the sine value should be 0, and the cosine value should be 1.
    - **Test for noon (12:00)**: At noon, the sine value should be 0, and the cosine value should be -1.
    - **Test for 6:00 AM (06:00)**: The sine value should be 1, and the cosine value should be 0.
    - **Test for 6:00 PM (18:00)**: The sine value should be -1, and the cosine value should be 0.
    - **Wrap-around test**: We test the continuity between hours like 23:00 and 01:00, ensuring they are close on the cyclic scale.
    - **Invalid hour tests**: Ensure that hours outside the valid range (like -1 or 24) raise a ValueError.

Test Cases Covered

- **Case 1**: Midnight (00:00) conversion.
- **Case 2**: Noon (12:00) conversion.
- **Case 3**: 6:00 AM and PM conversion (quarter and three-quarters).
- **Case 4**: Wrap-around check for 23:00 and 01:00.
- **Case 5**: Invalid hour input test.