Short Answer

Teaching Tips

To help foster a supportive environment for feedback, introduce the importance of feedback and how to give empathetic feedback with our mini-lessons.

The best questions are open-ended and ask students to **justify** opinions, **analyze** material, **articulate** a thought process, or **evaluate** a claim.

⚠ **Avoid** fact-based recall questions.

The best feedback criteria are **positively oriented** and relevant to learning objectives. Criteria can focus on both **content knowledge** and **writing structure.**

- Make students aware of the criteria so they know how to craft their response. Or, have students decide what appropriate criteria would be.
- Emphasize that students have to make a choice about assigning feedback. *Both* or *neither* aren't options!

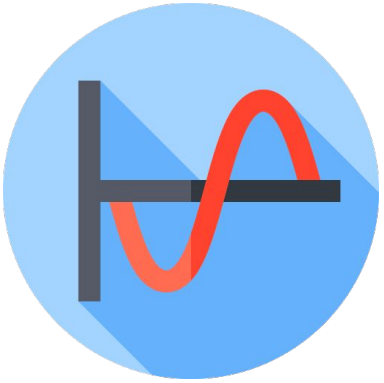
The best discussion questions ask students to **verbalize their thought process** about the feedback they gave. For example: "93% you said Response 1 explained the concept of photosynthesis better. Can someone share what aspect of the response made you think that?"

- Have students **predict** what results will be.
- Focus discussion on the qualities of the **responses** rather than on the students who wrote the responses.

To promote students' **metacognitive development**:

- Encourage students to **ask themselves questions** during the activity:
  - "Does my response meet all the criteria?"
  - "How did giving feedback improve my understanding of the content?"
  - "How can I improve my response using the feedback I got?"
- Provide clear **time signals** throughout the activity.

To **incorporate feedback in the moment,** ask students to reflect on how they can improve their response after receiving feedback. You may want to take time to have them **revise** their responses, either in class or for homework.



Calculus

In all Short Answer activities, your students **create** responses, **compare** peer responses and provide scaffolded feedback, then **converse** results as a class.

Short Answer gets your students the immediate feedback they need through social, engaging peer feedback activities and gets you deeper insight into what your students know.

Short Answer can be used at every stage of your Calculus lesson plan from lectures to in-class practice.

Bellringer	Get students engaged by using Short Answer to prompt written responses about what stands out from yesterday's class or to preview new material with a warm-up problem.
Check for understanding	Break up lectures with quick feedback activities that get students interacting with one another. Deepen understanding while getting a quicker, more accurate pulse of what they know on an individual level.
Guided practice	Group students together to write responses, solve problems, and give feedback to other groups, or provide a model response in Short Answer.
Independent practice	During Short Answer activities, encourage students to reflect on how their response matches up to the ones voted as the strongest by the class. Invite revision and iteration of responses as another in-class activity, exit ticket, or homework.
Exit Ticket	Complete a quick, one-round Short Answer activity to leave students thinking about the most important points of the day.
Homework	Have students complete writing assignments about core content and bring them in next class for peer feedback activities and discussion to deepen understanding.

See the following page for two detailed Calculus use cases with example questions, feedback criteria for students to evaluate responses with, and standards alignments.

Sample Use Cases: Calculus

Note: Short Answer doesn't support equation formatting yet, but works well when discussing generalized problem solving strategies and procedures.

Procedural Knowledge and Problem Solving
Activity Time: 5-10 minutes
Use Short Answer to nail down foundational calculus skills and crowdsource strategies for solving problems, opening up discussion to address common mistakes and misconceptions.

Sample Questions

- Explain the difference between integrals and derivatives and how they are related.
- Describe how to determine whether a given function is continuous or not.
- In words, describe why the chain rule is used and how to use it.
- How are terms like *displacement*, *acceleration* and *velocity* related from a differentiation and integration perspective?

Feedback criteria: efficient; easy to understand; detailed procedure; accurate

Standards Alignment Examples

- Connecting differentiability and continuity *(AP Calculus AB, Unit 2)*
- The chain rule for differentiating composite functions *(AP Calculus AB, Unit 3)*
- Applying understandings of differentiation to problems involving motion *(AP Calculus AB, Unit 4)*

COMING SOON: Solving Equations and Showing Work
Activity Time: 10-15 minutes
Have students solve any calculus problem in Short Answer, then give feedback to peers on how their solution can improve. Bonus points for asking students to write how they solved the problem! (In the future, students will be able to upload a photo of their work.)

Sample Questions:

- Calculate the volume of a solid with a base bounded by the circle $x^2 + y^2 = 9$ and square cross sections perpendicular to the y-axis. Explain your thought process.
- Without actually solving the problem, describe the steps you would take to solve the problem: "Vicky's art gallery has a profit function $25t^2 - 10t + 34$. What is her minimum profit, in thousands of dollars?"

Feedback Criteria: efficient; creative approach; clear explanation of thought process; accurate

Standards Alignment Examples

- How to use the first derivative test, second derivative test, and candidates test *(AP Calculus AB, Unit 5)*
- Determining volume with cross-sections, the disc method, and the washer method *(AP Calculus AB, Unit 8)*