



The following comments on the 2018 free-response questions for AP<sup>®</sup> Calculus AB and Calculus BC were written by the Chief Reader, Stephen Davis of Davidson College. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student preparation in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.





**What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?**

- The *AP Calculus AB and Calculus BC Course and Exam Description (CED)* includes instructional resources for AP Calculus teachers to develop students' broader skills. Please see page 28 of the *CED* for examples of MPACs, questioning, and instructional strategies designed to develop the broader skill of "Justification," which was important in this question. A table of representative instructional strategies, including definitions and explanations of each, is included on pages 33–37 of the *CED*. The strategy "Critique reasoning," for example, may be helpful in developing students' reasoning and communication skills at multiple points across the curriculum, including when learning to use a candidate's test to justify a conclusion about an absolute minimum value.
- AP Central's course pages for AP Calculus AB and AP Calculus BC include a "Classroom Resources" tab, where you will find a variety of teaching modules developed by the College Board over the years. For this question, you might refer to the module *Extrema*, which includes commentary, related previous AP Exam questions, student worksheets, teacher notes, and teaching examples.
- AP Central's course pages for AP Calculus AB and AP Calculus BC include "The Exam" tab, where you (and your students) will find questions from previous AP Exams and reflections of chief readers. In addition to end-of-course review, these resources are extremely useful for low-stakes, formative assessment, from which you may base high-quality feedback and responsive instruction. Careful study of 2017 question AB2 part (a), for example, would have been excellent preparation for 2018 question AB1/BC1 part (a). Consistently holding students accountable for clear mathematical communication, including attention to parentheses and placement of differentials, is the best way to develop such skills.
- AP Central's course pages for AP Calculus AB and AP Calculus BC include a "Professional Development" tab, where you will find:
  - Links to Online Modules for Teaching and Assessing AP Calculus. The module *Justifying Properties and Behaviors of Functions Using Derivatives* would be relevant to this question.
  - A link to Davidson Next, an initiative that, "aims to supplement Advanced Placement (AP) instruction with online modules designed for in-class, blended instruction."
- Finally, the Online Teacher Community is a great place to ask a question, share a strategy, or hear from other AP teachers.









































course review, these resources are extremely useful for low-stakes, formative assessment, from which you may base high-quality feedback and responsive instruction. Question BC2 from the 2017 exam and the corresponding chief reader notes would have been very helpful in developing the concepts and skills necessary to succeed on question BC5 on the 2018 exam.

- Finally, the Online Teacher Community is a great place to ask a question, share a strategy, or hear from other AP teachers.





- AP Central’s course pages for AP Calculus AB and AP Calculus BC include “The Exam” tab, where you (and your students) will find items from previous AP Exams and reflections of chief readers. In addition to end-of-course review, these resources are extremely useful for low-stakes, formative assessment, from which you may base high-quality feedback and responsive instruction. The series questions (often question BC6) from many previous exams and the corresponding chief reader notes would have been very helpful in developing the concepts and skills necessary to succeed on question BC6 on the 2018 exam.
- AP Central’s course pages for AP Calculus AB and AP Calculus BC include the “Professional Development” tab, where you will find a link to Davidson Next, an initiative that, “aims to supplement Advanced Placement (AP) instruction with online modules designed for in-class, blended instruction.” Topics include *Series*, *Series Convergence*, and *Series Manipulations*, which are all relevant to this question.
- Finally, the Online Teacher Community is a great place to ask a question, share a strategy, or hear from other AP teachers.