

AP CALCULUS AB AND BC

UNIT 5

Analytical
Applications of
Differentiation



Remember to go to [AP Classroom](#)
to assign students the online

SAMPLE INSTRUCTIONAL ACTIVITIES

7KH VDP SOH DFWLYLWLHV RQ WKLV SDJH DUH RSWLRQDO DQG DUH R-HUHG WR SU
LQFRUSRUDWH YDULRXV LQVWUXFWLRQDO DSSURDFKHV LQWR WKH FODVVURRP 7H
WKHVH DFWLYLWLHV RU LQVWUXFWLRQDO DSSURDFKHV DQG DUH IUHH WR DOWHU

Activity	Topic	Suggested Activity
1	5.3	<p>Critique Reasoning</p> <p>Arrange students in groups of four to six, provide them with a function's derivative $g'(x) = 5x + 3$, and ask them to determine if $g(x)$ is increasing or decreasing at a specific x.</p>
2	5.4 5.7	<p>Think-Pair-Share</p> <p>Provide students with a graph of f and a graph of f'.</p>
3	5.5	<p>Create a Plan</p> <p>to discuss and write x.</p> <p>they have established the viable candidates, ask them to design a method for analyzing</p>
4	5.8 5.9	<p>the rule for $f(x)$.</p> <p>$f(x) = x^3 - 4x^2 + 4x + 1$</p> <p>graph $f(x)$ and</p>

UNIT
5

Analytical Applications of Differentiation

SUGGESTED SKILL

✓ - X V W L fi F D W L R Q

3.E

Provide reasons or
rationales for solutions

D Q G F R Q F O X V L R Q V

TOPIC 5.2

Extreme Value Theorem, Global Versus Local Extrema, and Critical Points

SUGGESTED SKILL



- X V W L f i F D W L R Q

3.E

Provide reasons or
rationales for solutions and
FR Q F O X V L R Q V



AVAILABLE RESOURCES

f Classroom
Resource > [Why
We Use Theorem in
Calculus](#)

f Professional
Development >

SUGGESTED SKILL

 & R Q Q H F W L Q J
5 H S U H V H Q W D W L R Q V

2.E

Describe the relationships among different representations of functions and their
G H U L Y D W L Y H V



AVAILABLE RESOURCE

- f* The Exam > [Commentary on the Instructions for the Free Response Section of the AP Calculus Exams](#)
- f* On the Role of Sign Charts in AP Calculus Exams

TOPIC 5.3

Determining Intervals on Which a Function Is Increasing or Decreasing

Required Course Content

ENDURING UNDERSTANDING

FUN-4

\$ I X Q F W L R Q o V G H U L Y D W L Y H F D Q E H X V H G W R X Q G H U V W D Q G V

LEARNING OBJECTIVE

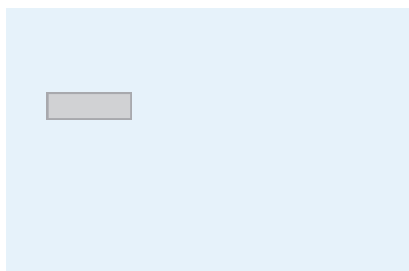
FUN-4.A

Justify conclusions about the behavior of a function based on the behavior of its
G H U L Y D W L Y H V

ESSENTIAL KNOWLEDGE

FUN-4.A.1

7 K H @ U V W G H U L Y D W L Y H R I D I X Q F W L R Q
information about the function and its graph, including intervals where the function is
L Q F U H D V L Q J R U G H F U H D V L Q J



ENDURING UNDERSTANDING

FUN-4

LEARNING OBJECTIVE

FUN-4.A

Justify conclusions about the behavior of a function based on the behavior of its

G H U L Y D W L Y H V

ESSENTIAL KNOWLEDGE

FUN-4.A.3

Absolute (global) extrema of a function on a closed interval can only occur at critical points

R U D W H Q G S R L Q W V

LEARNING OBJECTIVE

FUN-4.A

Justify conclusions about
the behavior of a function
based on the behavior of its
GHULYDWLYHV

LEARNING OBJECTIVE

FUN-4.A

Justify conclusions about the behavior of a function based on the behavior of its
GHULYDWLYHV

ESSENTIAL KNOWLEDGE

FUN-4.A.7

The second derivative of a function may determine whether a critical point is the location of a relative (local) maximum or
PLQLPX P

FUN-4.A.8

When a continuous function has only one

TOPIC 5.8

Sketching Graphs of Functions and Their Derivatives

SUGGESTED SKILL

 & R Q Q H F W L Q J
5 H S U H V H Q W D W L F

2.D

Identify how mathematical characteristics or properties of functions are related in different UHSUHVHQWDWLRQV

ENDURING UNDERSTANDING

FUN-4

\$ IXQFWLRQoV GHULYDWLYH FDQ EH XVHG WR XQGHUVWDQG VRRPH EHKDYLRUV

LEARNING OBJECTIVE

FUN-4.A

Justify conclusions about the behavior of a function based on the behavior of its GHULYDWLYHV

ESSENTIAL KNOWLEDGE

FUN-4.A.9

Key features of functions and their derivatives
FDQ EH LGHQWLHG DQG UHODWHG WR WKHLU JUDSKLFDQ
QXPULFDQ DQG DQDO\WLFDO UHSUHVHQWDWLRQV

FUN-4.A.10

Graphical, numerical, and analytical information from f' and f'' can be used to predict and explain the behavior of f

SUGGESTED SKILL

& R Q Q H F W L Q J
5 H S U H V H Q W D W L R Q V

2.D

Identify how mathematical characteristics or properties of functions are related in different UHSUHVHQWDWLRQV

TOPIC 5.9

Connecting a Function, Its First Derivative, and Its Second Derivative

ENDURING UNDERSTANDING

FUN-4

\$ IXQFWLRQoV GHULYDWLYH FDQ EH XVHG WR XQGHUVWDQG V

LEARNING OBJECTIVE

FUN-4.A

Justify conclusions about the behavior of a function based on the behavior of LWV{GHULYDWLYHV

ESSENTIAL KNOWLEDGE

FUN-4.A.11

Key features of the graphs of f , f' , and f'' are UHODWHG WR RQH DQRWKHU

TOPIC 5.10

Introduction to Optimization Problems

SUGGESTED SKILL

& R Q Q H F W L Q J
5 H S U H V H Q W D W L F

2.A

ENDURING UNDERSTANDING

FUN-4

\$ IXQFWLRQoV GHULYDWLYH FDQ EH XVHG WR XQGHUVWDQG VRPH EHKDYLRUV

LEARNING OBJECTIVE

FUN-4.B

Calculate minimum and maximum values in applied contexts or analysis of
IXQFWLRQV

ESSENTIAL KNOWLEDGE

FUN-4.B.1

The derivative can be used to solve
RSWLPLJDWLRQ SUREOHPV WKDW LV @QGLQJ D
JLYHQ LQWHUYDO

TOPIC 5.11

Solving Optimization Problems

TOPIC 5.12

Exploring Behaviors of Implicit Relations

SUGGESTED SKILLS

 , P S O H P H Q W L Q J
O D W K H P D W L F D O
3 U R F H V V H V

1.E

Apply appropriate mathematical rules or procedures, with and Z L W K R X W W H F K Q R O R J

 - X V W L f i F D W L R Q

3.E

Provide reasons or rationales for solutions and F R Q F O X V L R Q V

Required Course Content

ENDURING UNDERSTANDING

FUN-4

\$ I X Q F W L R Q o V G H U L Y D W L Y H F D Q E H X V H G W R X Q G H U V W D Q G V R P H E H K D Y L R U V

LEARNING OBJECTIVE

FUN-4.D

Determine critical points of L P S O L F L W U H O D W L R Q

FUN-4.E

Justify conclusions about the behavior of an implicitly G H @ Q H G I X Q F W L R Q H Y L G H Q F H I U R P L W V

ESSENTIAL KNOWLEDGE

FUN-4.D.1

\$ S R L Q W R Q D Q L P S O L F L W U H O D W L R Q Z K H U H W K H @ U V W
Derivative equals zero or does not exist is a F U L W L F D O S R L Q W R I W K H I X Q F W L R Q

FUN-4.E.1

Applications of derivatives can be extended to L P S O L F L W O \ G H @ Q H G I X Q F W L R Q V

FUN-4.E.2

Second derivatives involving implicit G L - H U H Q W L D W L R Q P X Y , a n d $\frac{dy}{dx}$ U H O D W L R Q V R I

