Uncommon Schools | Change History.

# AP Calculus BC

## Q1 Interim Assessment

## Test Booklet 1

## Multiple Choice - Non-Calc

## October 2016

School: _____

Student Name: _____

Teacher: _____

Period: _____

# AP® Calculus BC Exam

## SECTION I: Multiple Choice

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.**

### At a Glance

**Total Time**
1 hour, 45 minutes
**Number of Questions**
45
**Percent of Total Score**
50%
**Writing Instrument**
Pencil required

**Part A**

**Number of Questions**
30
**Time**
60 minutes
**Electronic Device**
None allowed

**Part B**

**Number of Questions**
15
**Time**
45 minutes
**Electronic Device**
Graphing calculator required

### Instructions

Section I of this exam contains 45 multiple-choice questions. For Part A, fill in only the boxes for numbers 1 through 30 on the answer sheet. For Part B, fill in only the boxes for numbers 76 through 90 on the answer sheet.

Indicate all of your answers to the multiple-choice questions on the answer sheet. No credit will be given for anything written in this exam booklet, but you may use the booklet for notes or scratch work. After you have decided which of the suggested answers is best, place the letter of your choice in the corresponding box on the answer sheet. Give only one answer to each question.

Use your time effectively, working as quickly as you can without losing accuracy. Do not spend too much time on any one question. Go on to other questions and come back to the ones you have not answered if you have time. It is not expected that everyone will know the answers to all of the multiple-choice questions.

Your total score on the multiple-choice section is based only on the number of questions answered correctly. Points are not deducted for incorrect answers or unanswered questions.

**CALCULUS BC**

**SECTION I, Part A**

**Time – 60 minutes**

**Number of questions – 30**

**NO CALCULATOR IS ALLOWED FOR THIS PART OF THE EXAM.**

**Directions:** Solve each of the following problems, using the available space for scratch work. After examining the form for the choices, decide which of the choices given and place the letter of your choice in the corresponding box on the answer sheet. No credit will be given for anything written in this exam booklet. Do not spend too much time on any one problem.

**In this exam:**

(1) Unless otherwise specified, the domain of a function $f$ is assumed to be the set of all real numbers $x$ for which $f(x)$ is a real number.

(2) The inverse of a trigonometric function $f$ may be indicated using the inverse function notation $f^{-1}$ or with the prefix "arc" (e.g., $\sin^{-1} x = \arcsin x$).

| $x$ | 2 | 3 | 5 | 8 | 13 |
|---|---|---|---|---|---|
| $f(x)$ | 6 | $-2$ | $-1$ | 3 | 9 |

1. The function $f$ is continuous on the closed interval $[2, 13]$ and has values as shown in the table above. Using the interval $[2, 3]$, $[3, 5]$, $[5, 8]$, and $[8, 13]$, what is the approximation of $\int_2^{13} f(x)\,dx$ obtained from a left rectangular approximation?

(A) 6 (B) 14 (C) 28 (D) 50

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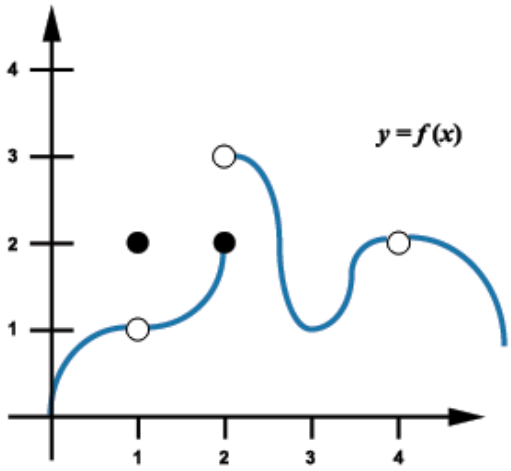


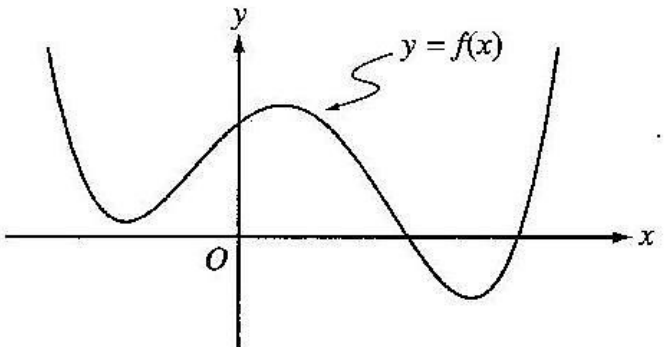

2. The graph of a function $f$ is shown above. For which of the following values of $c$ does $\lim_{x \to c} f(x) = 2$?

(A) 1 only

(B) 4 only

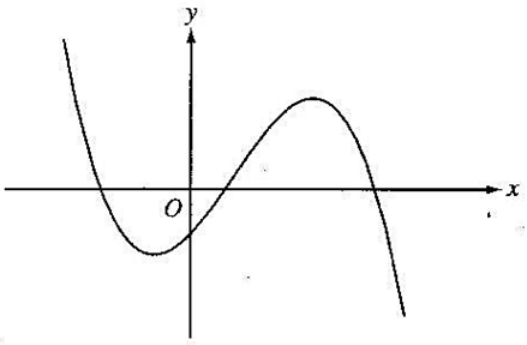
(C) 1 and 4 only

(D) 1, 2, and 4




3. The graph of $f(x)$ is shown above. Which of the following could be the graph of $f'(x)$?

(A)

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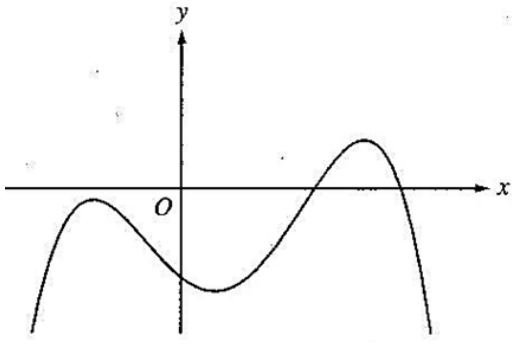
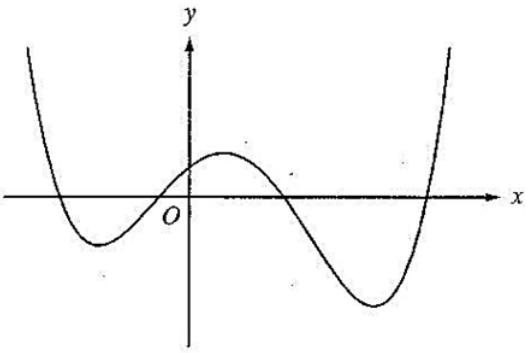
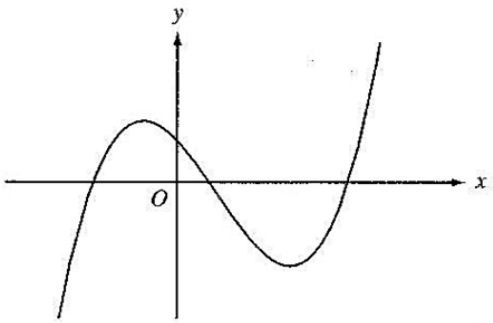



(C)




(D)



4. The function $f$ is defined by $f(x) = \frac{x}{x+2}$. What points $(x, y)$ on the graph of $f$ have the property that the line tangent to $f$ at $(x, y)$ has slope $\frac{1}{2}$?

(A) $(0, 0)$ only

(B) $\left(\frac{1}{2}, \frac{1}{5}\right)$ only

(C) $(0, 0)$ and $(-4, 2)$

(D) $(0, 0)$ and $\left(4, \frac{2}{3}\right)$

---

5. The function $f$ is twice differentiable with $f(4) = 6$, $f'(4) = 3$, and $f''(4) = 2$. What is the value of the approximation of $f(3.9)$ using the line tangent to the graph of $f$ at $x = 4$?

(A) 5.7 (B) 5.8 (C) 5.9 (D) 6.2

---

6. If $f'(x) = x(x-9)^2(x+15)$, then $f$ has which of the following extrema?

I. A relative maximum at $x = -15$
II. A relative minimum at $x = 0$
III. A relative maximum at $x = 9$

(A) I only

(B) II only

(C) I and II

(D) I, II, and III

7. A particle moves along the $x$-axis with velocity given by $v(t) = 4t^3 - 2t$ for time $t \geq 0$. If the particle is at position $x = 3$ at time $t = 0$, what is the position of the particle at time $t = 2$?

(A) 9
(B) 15
(C) 72
(D) 106

---

8. $\int_1^4 |x - 3|\, dx =$

(A) $-\frac{3}{2}$ (B) $\frac{3}{2}$ (C) $\frac{5}{2}$ (D) $\frac{9}{2}$

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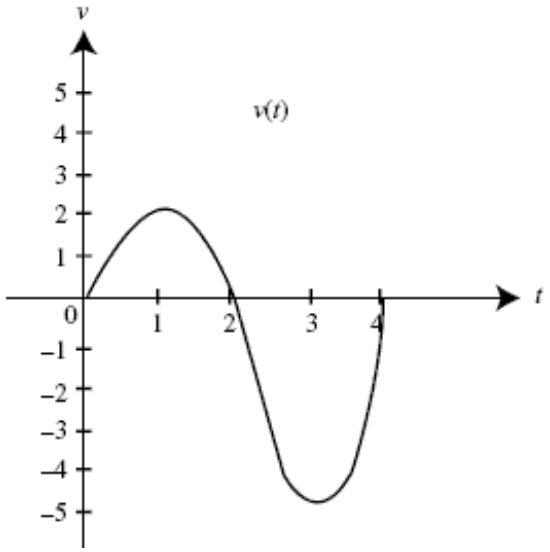
9. $\lim_{x \to 0} \frac{x}{\cos x \sin x}$ is

(A) $-1$ (B) 0 (C) 1 (D) nonexistent




10. The velocity of a particle moving along the $x$-axis is shown above for $0 < t < 4$. The graph has horizontal tangents at $t = 1$ and $t = 3$, and a zero at $t = 2$. For what values of $t$ is the speed of the particle decreasing?

(A) $1 < t < 3$ only
(B) $2 < t < 4$ only
(C) $0 < t < 1$ and $3 < t < 4$
(D) $1 < t < 2$ and $3 < t < 4$

---

11. If $y = x^4 \tan(3x)$, then $\frac{dy}{dx} =$

(A) $12x^3 \sec^2(3x)$
(B) $4x^3 \tan(3x) + x^4 \sec^2(3x)$
(C) $x^3[4 \tan(3x) + 3x \sec^2(3x)]$
(D) $x^3[x \tan(3x) + 12 \sec^2(3x)]$

12. If $f(x) = 12xe^x$, on which of the following intervals is $f(x)$ concave down?

(A) $(-\infty, -2)$

(B) $(-\infty, -1)$

(C) $(-1, +\infty)$

(D) $(-2, +\infty)$

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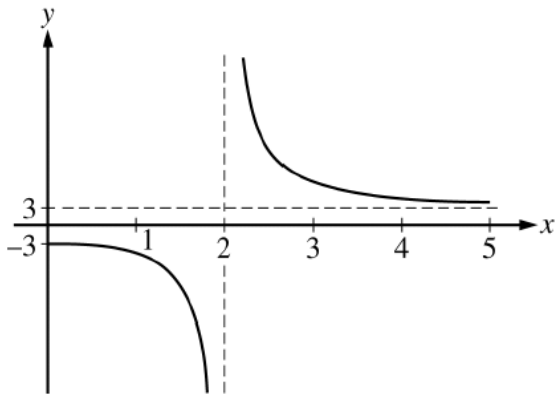


13. The function $f$ is given by $f(x) = \frac{ax^2+12}{x^2+b}$. The figure above shows a portion of the graph of $f$. Which of the following could be the values of the constants $a$ and $b$?

(A) $a = 3, b = 2$

(B) $a = 2, b = -2$

(C) $a = 3, b = -4$

(D) $a = 3, b = 4$

---

14. $\lim_{h\to 0} \frac{\csc\left(\frac{3\pi}{4}+h\right)-\csc\left(\frac{3\pi}{4}\right)}{h} =$

(A) $-2$ (B) $-\sqrt{2}$ (C) $\sqrt{2}$ (D) $2$

15. For $t \geq 0$ hours, $H$ is a differentiable function of $t$ that gives the temperature, in degrees Celcius, at an arctic weather station. Which of the follow is the best interpretation of $H'(24)$?

(A) The change in temperature during the 24th hour.

(B) The average rate at which the temperature changed during the 24th hour.

(C) The rate at which the temperature is changing during the first day.

(D) The rate at which the temperature is changing at the end of the 24th hour.

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16. $\lim_{x\to\infty} \frac{(x-3)(2x-2)}{(6-x)(x-1)} =$

(A) $-2$ (B) $-1$ (C) $0$ (D) $\infty$

---

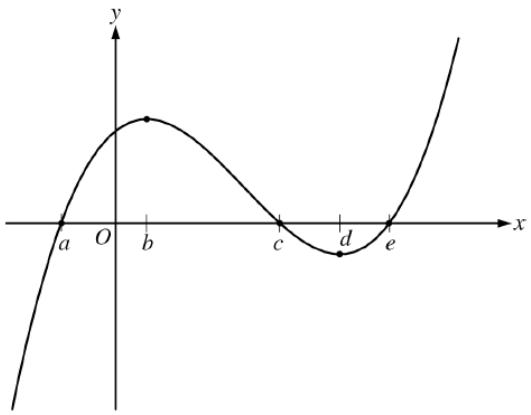
17. A particle moves along the $x$-axis with its position at time $t$ given by $x(t) = (t-a)(t-b)$, where $a$ and $b$ are constants and $a \neq b$. For which of the following values of $t$ is the particle at rest?

(A) $t = ab$

(B) $t = \frac{a+b}{2}$

(C) $t = a + b$

(D) $t = a$ and $t = b$




Graph of $f$

18. The figure above shows the graph of the polynomial function $f$. For which value of $x$ is it true that $f''(x) < f'(x) < f(x)$?

(A) $a$

(B) $b$

(C) $c$

(D) $d$

---

19. In the $xy$-plane, what is the slope of the line tangent to the graph of $x^2 + xy + y^2 = 7$ at the point $(2, 1)$?

(A) $-\frac{4}{3}$ (B) $-\frac{5}{4}$ (C) $-\frac{4}{5}$ (D) $-\frac{3}{4}$

---

20. Let $f$ be the function defined by $f(x) = 2x^3 - 8x + 6$. Which of the following is the equation of the line normal to the graph of $f$ at the point where $x = -1$?

(A) $y = -2x - 2$

(B) $y = -2x + 10$

(C) $y = \frac{1}{2}x + 10$

(D) $y = \frac{1}{2}x + 12.5$

21. If $f$ is differentiable at $x = a$, which of the following could be false?

(A) $f$ is continuous at $x = a$.

(B) $\lim_{x \to a} f(x)$ exists.

**(C)** $\lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ exists.

**(D)** $\lim_{x \to a} \frac{f'(x) - f'(a)}{x - a}$ exists

---

22. If $f(x) = x^2 e^x$, then the absolute maximum value of $f$ on the closed interval $[-3,1]$ occurs when $x =$

(A) $-3$

(B) $-2$

(C) 0

(D) 1

---

23. Let $f$ be the function given by $f(x) = \tan^{-1} x$. What is the value of $c$ that satisfies the conclusion of the Mean Value Theorem of differential calculus on the closed interval $[0, 1]$?

(A) $\frac{\pi}{4}$ (B) $\sqrt{\frac{4}{\pi} + 1}$ (C) $\sqrt{\frac{4}{\pi} - 1}$ (D) $\sqrt{\frac{\pi}{4} - 1}$

24. $\int_0^3 8x^3 - 2e^x \, dx$

(A) $108 - 2e^3$

(B) $160 - 2e^3$

(C) $162 - 2e^3$

(D) $164 - 2e^3$

---

$$f(x) = \begin{cases} \dfrac{x^2 - 4}{x - 2} & \text{if } x \neq 2 \\ 1 & \text{if } x = 2 \end{cases}$$

25. Let $f$ be the function defined above. Which of the following statements about $f$ are true?

I. $f$ has a limit at $x = 2$.

II. $f$ is continuous at $x = 2$.

III. $f$ is differentiable at $x = 2$.

(A) I only

(B) I and II only

(C) I, II, and III

(D) None

26. The function $f$ is continuous on the closed interval $[7,9]$ and twice differentiable on the open interval $(7,9)$. If $f'(x) < 0$ and $f''(x) < 0$ on the open interval $(7,9)$, which of the following could be a table of values for $f$ ?

(A)

| $x$ | $f(x)$ |
|---|---|
| 7 | 1 |
| 8 | 9 |
| 9 | 13 |

(B)

| $x$ | $f(x)$ |
|---|---|
| 7 | 9 |
| 8 | 8 |
| 9 | 7 |

(C)

| $x$ | $f(x)$ |
|---|---|
| 7 | 12 |
| 8 | 8 |
| 9 | 0 |

(D)

| $x$ | $f(x)$ |
|---|---|
| 7 | 20 |
| 8 | 12 |
| 9 | 10 |

---

27. If $f'(x) = 4e^x - 6\sin x$ and $f(0) = 12$, then $f(\pi) =$

(A) $4e^\pi - 6$

(B) $4e^\pi - 4$

(C) $4e^\pi$

(D) $4e^\pi + 6$

---

28. Let $f(x) = (2x+1)^3$ and let $g$ be the inverse function of $f$. Given that $f(0) = 1$, what is the value of $g'(1)$?

(A) $\frac{1}{54}$

(B) $\frac{1}{27}$

(C) $\frac{1}{6}$

(D) $6$

29. $\int_6^7 \frac{2x^2-4x-14}{x-4}dx$

(A) $\frac{5}{3}$ (B) $17 + 2\ln\left(\frac{2}{3}\right)$ (C) $17 + 2\ln\left(\frac{3}{2}\right)$ (D) $33 + 2\ln\left(\frac{2}{3}\right)$

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30. For small values of $h$, the function $\sqrt[3]{27+h}$ is best approximated by which of the following?

(A) $3 + \frac{h}{27}$

(B) $3 + \frac{h}{9}$

(C) $9 + \frac{h}{27}$

(D) $9 + \frac{h}{9}$

**END OF PART A**

**IF YOU FINISH BEFORE TIME IS CALLED,**
**YOU MAY CHECK YOUR WORK ON PART A ONLY.**

**DO NOT GO ON TO PART B UNTIL YOU ARE TOLD TO DO SO**