CALCULUS AB
SECTION I, Part A
Time—55 minutes
Number of questions—28

Name ____________________
Periods ______

A CALCULATOR MAY NOT BE USED ON THIS PART OF THE EXAM.

1. $\lim_{x\to 2} \dfrac{x^2+x-6}{x^2-4}$ is

(A) $-\dfrac{1}{4}$ (B) 0 (C) 1 (D) $\dfrac{5}{4}$ (E) nonexistent

2. If $f(x) = x^3 - x^2 + x - 1$, then $f'(2) =$

(A) 10 (B) 9 (C) 7 (D) 5 (E) 3

3. Which of the following definite integrals has the same value as $\int_0^4 xe^{x^2}\,dx$?

(A) $\dfrac{1}{2}\int_0^4 e^u\,du$

(B) $\dfrac{1}{2}\int_0^{16} e^u\,du$

(C) $2\int_0^2 e^u\,du$

(D) $2\int_0^4 e^u\,du$

(E) $2\int_0^{16} e^u\,du$

4. Which of the following is an equation of the line tangent to the graph of $x^2 - 3xy = 10$ at the point $(1, -3)$?

(A) $y+3 = -11(x-1)$

(B) $y+3 = -\dfrac{7}{3}(x-1)$

(C) $y+3 = \dfrac{1}{3}(x-1)$

(D) $y+3 = \dfrac{7}{3}(x-1)$

(E) $y+3 = \dfrac{11}{3}(x-1)$

5. If g is the function given by $g(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 70x + 5$, on which of the following intervals is g decreasing?

(A) $(-\infty, -10)$ and $(7, \infty)$

(B) $(-\infty, -7)$ and $(10, \infty)$

(C) $(-\infty, 10)$

(D) $(-10, 7)$

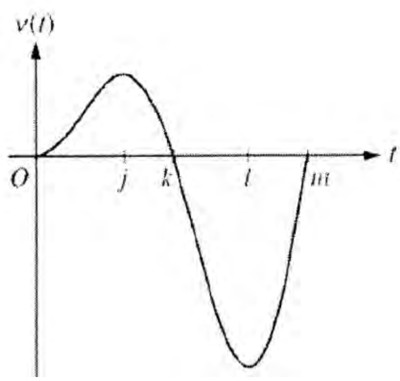
(E) $(-7, 10)$

6. $\displaystyle\int_2^4 \frac{dx}{5-3x} =$

(A) $-\ln 7$ (B) $-\frac{\ln 7}{3}$ (C) $\frac{\ln 7}{3}$ (D) $\ln 7$ (E) $3\ln 7$

7. Let f be the function given by $f(x) = x^3 - 6x^2 + 8x - 2$. What is the instantaneous rate of change of f at $x = 3$?

(A) -5 (B) $-\frac{15}{4}$ (C) -1 (D) 6 (E) 17



8. A particle moves along a straight line. The graph of the particle's velocity $v(t)$ at time t is shown above for $0 \le t \le m$, where j, k, l, and m are constants. The graph intersects the horizontal axis at $t = 0$, $t = k$, and $t = m$ and has horizontal tangents at $t = j$ and $t = l$. For what values of t is the speed of the particle decreasing?

(A) $j \le t \le l$

(B) $k \le t \le m$

(C) $j \le t \le k$ and $l \le t \le m$

(D) $0 \le t \le j$ and $k \le t \le l$

(E) $0 \le t \le j$ and $l \le t \le m$

9. Let f be the function given by $f(x) = \dfrac{(x-2)^2(x+3)}{(x-2)(x+1)}$. For which of the following values of x is f not continuous?

(A) -3 and -1 only

(B) -3, -1, and 2

(C) -1 only

(D) -1 and 2 only

(E) 2 only

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

(A) 13 (B) 15 (C) 16 (D) 17 (E) 25

11. Let f be the function defined by $f(x) = \int_0^x \left(2t^3 - 15t^2 + 36t\right) dt$. On which of the following intervals is the graph of $y = f(x)$ concave down?

(A) $(-\infty, 0)$ only

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

(C) $(0, \infty)$

(D) $(2, 3)$ only

(E) $(3, \infty)$ only

12. For which of the following does $\lim_{x \to \infty} f(x) = 0$?

I. $f(x) = \dfrac{\ln x}{x^{99}}$

II. $f(x) = \dfrac{e^x}{\ln x}$

III. $f(x) = \dfrac{x^{99}}{e^x}$

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I and III only

13. Let f be a differentiable function such that $f(0) = -5$ and $f'(x) \leq 3$ for all x. Of the following, which is not a possible value for $f(2)$?

(A) -10 (B) -5 (C) 0 (D) 1 (E) 2

$$f(x) = \begin{cases} x + b & \text{if } x \leq 1 \\ ax^2 & \text{if } x > 1 \end{cases}$$

14. Let f be the function given above. What are all values of a and b for which f is differentiable at $x = 1$?

(A) $a = \frac{1}{2}$ and $b = -\frac{1}{2}$

(B) $a = \frac{1}{2}$ and $b = \frac{3}{2}$

(C) $a = \frac{1}{2}$ and b is any real number

(D) $a = b + 1$, where b is any real number

(E) There are no such values of a and b.

$f(3)$	$g(3)$	$f'(3)$	$g'(3)$
-1	2	5	-2

15. The table above gives values for the functions f and g and their derivatives at $x = 3$. Let k be the function given by $k(x) = \dfrac{f(x)}{g(x)}$, where $g(x) \neq 0$. What is the value of $k'(3)$?

(A) $-\frac{5}{2}$ (B) -2 (C) 2 (D) 3 (E) 8

16. If $y = 5x\sqrt{x^2 + 1}$, then $\dfrac{dy}{dx}$ at $x = 3$ is

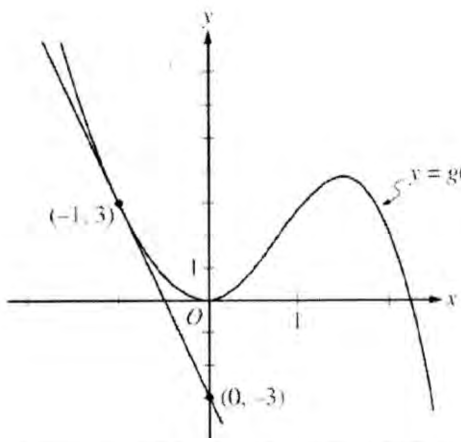
(A) $\dfrac{5}{2\sqrt{10}}$ (B) $\dfrac{15}{\sqrt{10}}$ (C) $\dfrac{15}{2\sqrt{10}} + 5\sqrt{10}$ (D) $\dfrac{45}{\sqrt{10}} + 5\sqrt{10}$ (E) $\dfrac{45}{\sqrt{10}} + 15\sqrt{10}$

17. If $\lim_{h \to 0} \dfrac{\arcsin(a+h) - \arcsin(a)}{h} = 2$, which of the following could be the value of a ?

(A) $\dfrac{\sqrt{2}}{2}$ (B) $\dfrac{\sqrt{3}}{2}$ (C) $\sqrt{3}$ (D) $\dfrac{1}{2}$ (E) 2

18. If $\ln(2x+y) = x+1$, then $\dfrac{dy}{dx} =$

(A) -2 (B) $2x+y-2$ (C) $2x+y$ (D) $4x+2y-2$ (E) $y - \dfrac{y}{x}$



19. The figure above shows the graph of the function g and the line tangent to the graph of g at $x = -1$. Let h be the function given by $h(x) = e^x \cdot g(x)$. What is the value of $h'(-1)$?

(A) $\dfrac{9}{e}$ (B) $\dfrac{-3}{e}$ (C) $\dfrac{-6}{e}$ (D) $\dfrac{-6}{e} - \dfrac{3}{e^2}$ (E) -6

20. For $x > 0$, $\frac{d}{dx}\left(\int_0^{2x} \ln\left(t^3 + 1\right) dt\right) =$

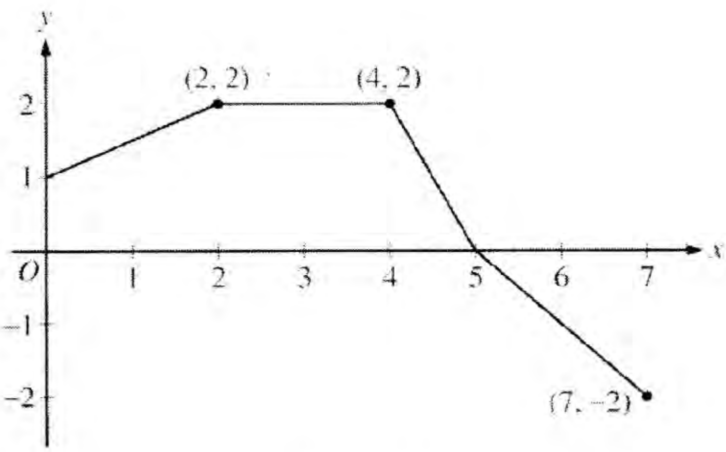
(A) $\ln\left(x^3 + 1\right)$

(B) $\ln\left(8x^3 + 1\right)$

(C) $2\ln\left(x^3 + 1\right)$

(D) $2\ln\left(8x^3 + 1\right)$

(E) $24x^2 \ln\left(8x^3 + 1\right)$



Graph of f

21. The graph of a function f is shown above. What is the value of $\int_0^7 f(x)\,dx$?

(A) 6 (B) 8 (C) 10 (D) 14 (E) 18

22. The function f is continuous for all real numbers, and the average rate of change of f on the closed interval $[6, 9]$ is $-\frac{3}{2}$. For $6 < c < 9$, there is no value of c such that $f'(c) = -\frac{3}{2}$. Of the following, which must be true?

(A) $\frac{1}{3}\int_6^9 f(x)\,dx = -\frac{3}{2}$

(B) $\int_6^9 f(x)\,dx$ does not exist.

(C) $\frac{f'(6) + f'(9)}{2} = -\frac{3}{2}$

(D) $f'(x) < 0$ for all x in the open interval $(6, 9)$.

(E) f is not differentiable on the open interval $(6, 9)$.

23. Let f be the function defined by $f(x) = 2x + e^x$. If $g(x) = f^{-1}(x)$ for all x and the point $(0, 1)$ is on the graph of f, what is the value of $g'(1)$?

(A) $\frac{1}{2+e}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) 3 (E) $2 + e$

24. The function g is given by $g(x) = 4x^3 + 3x^2 - 6x + 1$. What is the absolute minimum value of g on the closed interval $[-2, 1]$?

(A) -7 (B) $-\frac{3}{4}$ (C) 0 (D) 2 (E) 6

25. Which of the following is the solution to the differential equation $\frac{dy}{dx} = e^{y+x}$ with the initial condition $y(0) = -\ln 4$?

(A) $y = -x - \ln 4$

(B) $y = x - \ln 4$

(C) $y = -\ln\left(-e^x + 5\right)$

(D) $y = -\ln\left(e^x + 3\right)$

(E) $y = \ln\left(e^x + 3\right)$

26. Which of the following is an antiderivative of $f(x) = \sqrt{1 + x^3}$?

(A) $\frac{2}{3}\left(1 + x^3\right)^{3/2}$

(B) $\dfrac{\frac{2}{3}\left(1 + x^3\right)^{3/2}}{3x^2}$

(C) $\int_0^{1+x^3} \sqrt{t}\, dt$

(D) $\int_0^{x^3} \sqrt{1 + t}\, dt$

(E) $\int_0^{x} \sqrt{1 + t^3}\, dt$

27. For time $t \geq 0$, the height h of an object suspended from a spring is given by $h(t) = 16 + 7\cos\left(\frac{\pi t}{4}\right)$. What is the average height of the object from $t = 0$ to $t = 2$?

(A) 16 (B) $\frac{39}{2}$ (C) $16 - \frac{14}{\pi}$ (D) $16 + \frac{14}{\pi}$ (E) $32 + \frac{28}{\pi}$

28. The function f is defined by $f(x) = \sin x + \cos x$ for $0 \leq x \leq 2\pi$. What is the x-coordinate of the point of inflection where the graph of f changes from concave down to concave up?

(A) $\frac{\pi}{4}$ (B) $\frac{3\pi}{4}$ (C) $\frac{5\pi}{4}$ (D) $\frac{7\pi}{4}$ (E) $\frac{9\pi}{4}$

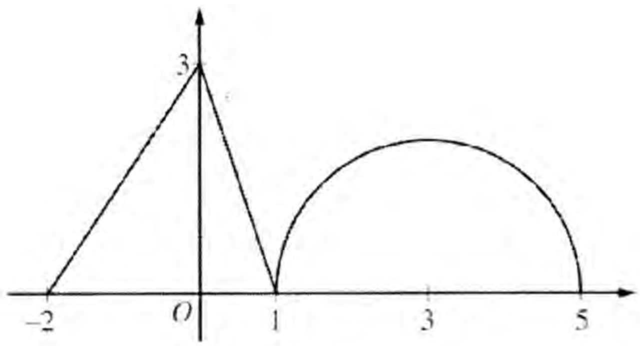
END OF PART A OF SECTION I

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.

CALCULUS AB
SECTION I, Part B
Time—50 minutes
Number of questions—17

A GRAPHING CALCULATOR IS REQUIRED FOR SOME QUESTIONS ON THIS PART OF THE EXAM.



Graph of f

29. The graph of the function f shown above consists of two line segments and a semicircle. Let g be defined by $g(x) = \int_0^x f(t)\,dt$. What is the value of $g(5)$?

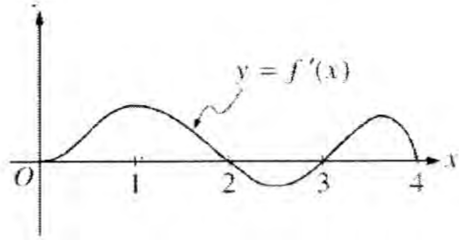
(A) 0 (B) $-1.5 + 2\pi$ (C) 2π (D) $1.5 + 2\pi$ (E) $4.5 + 2\pi$

30. The volume of a sphere is decreasing at a constant rate of 3 cubic centimeters per second. At the instant when the radius of the sphere is decreasing at a rate of 0.25 centimeter per second, what is the radius of the sphere? (The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.)

(A) 0.141 cm (B) 0.244 cm (C) 0.250 cm (D) 0.489 cm (E) 0.977 cm

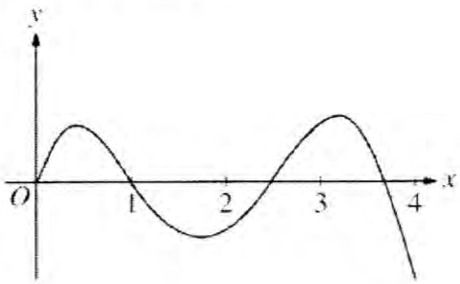
31. Let f and g be continuous functions such that $\int_0^{10} f(x)\,dx = 21$, $\int_0^{10} \frac{1}{2} g(x)\,dx = 8$, and $\int_3^{10} (f(x) - g(x))\,dx = 2$. What is the value of $\int_0^{3} (f(x) - g(x))\,dx$?

(A) 3 (B) 7 (C) 11 (D) 15 (E) 19

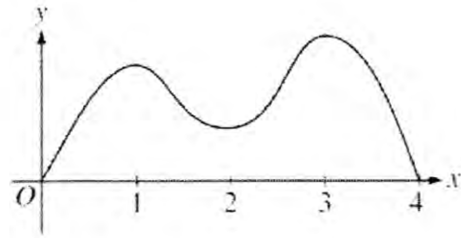


32. The figure above shows the graph of f', the derivative of the function f. If $f(0) = 0$, which of the following could be the graph of f?

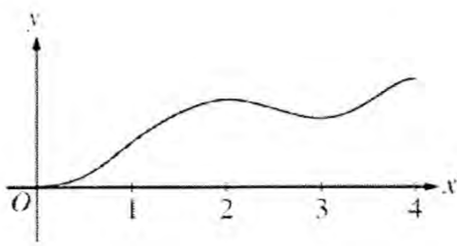
(A)



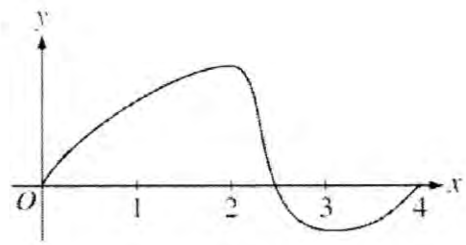
(B)



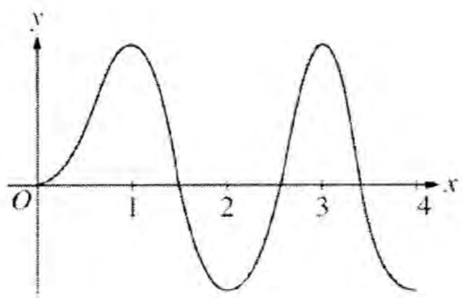
(C)



(D)



(E)



33. For time $t \geq 0$, the position of a particle traveling along a line is given by a differentiable function s. If s is increasing for $0 \leq t < 2$ and s is decreasing for $t > 2$, which of the following is the total distance the particle travels for $0 \leq t \leq 5$?

(A) $s(0) + \int_0^2 s'(t)\,dt - \int_2^5 s'(t)\,dt$

(B) $s(0) + \int_2^5 s'(t)\,dt - \int_0^2 s'(t)\,dt$

(C) $\int_2^5 s'(t)\,dt - \int_0^2 s'(t)\,dt$

(D) $\left|\int_0^5 s'(t)\,dt\right|$

(E) $\int_0^5 |s'(t)|\,dt$

34. A cup of tea is cooling in a room that has a constant temperature of 70 degrees Fahrenheit (°F). If the initial temperature of the tea, at time $t = 0$ minutes, is 200°F and the temperature of the tea changes at the rate $R(t) = -6.89e^{-0.053t}$ degrees Fahrenheit per minute, what is the temperature, to the nearest degree, of the tea after 4 minutes?

(A) 175°F (B) 130°F (C) 95°F (D) 70°F (E) 45°F

35. The derivative of the function f is given by $f'(x) = x^3 - 4\sin\left(x^2\right) + 1$. On the interval $(-2.5, 2.5)$, at which of the following values of x does f have a relative maximum?

(A) -1.970 and 0

(B) -1.467 and 1.075

(C) -0.475, 0.542, and 1.396

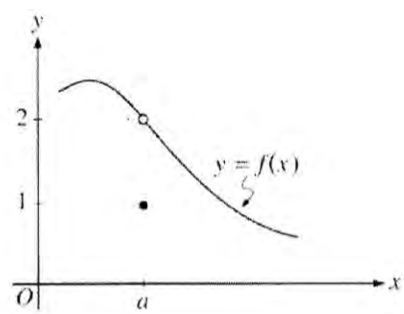
(D) -0.475 and 1.396 only

(E) 0.542 only

x	0	0.5	1	1.5	2	2.5	3
$f(x)$	0	4	10	18	28	40	54

36. The table above gives selected values for a continuous function f. If f is increasing over the closed interval $[0, 3]$, which of the following could be the value of $\int_0^3 f(x)\,dx$?

(A) 50 (B) 62 (C) 77 (D) 100 (E) 154



37. The graph of a function f is shown in the figure above. Which of the following statements is true?

(A) $f(a) = 2$

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

(C) $\lim_{x\to a} f(x) = 1$

(D) $\lim_{x\to a} f(x) = 2$

(E) $\lim_{x\to a} f(x)$ does not exist.

38. A particle moves along the x-axis so that at time $t \geq 0$ its position is given by $x(t) = \cos\sqrt{t}$. What is the velocity of the particle at the first instance the particle is at the origin?

(A) -1 (B) -0.624 (C) -0.318 (D) 0 (E) 0.065

39. If $f'(x) > 0$ for all x and $f''(x) < 0$ for all x, which of the following could be a table of values for f?

(A)

x	$f(x)$
-1	4
0	3
1	1

(B)

x	$f(x)$
-1	4
0	4
1	4

(C)

x	$f(x)$
-1	4
0	5
1	6

(D)

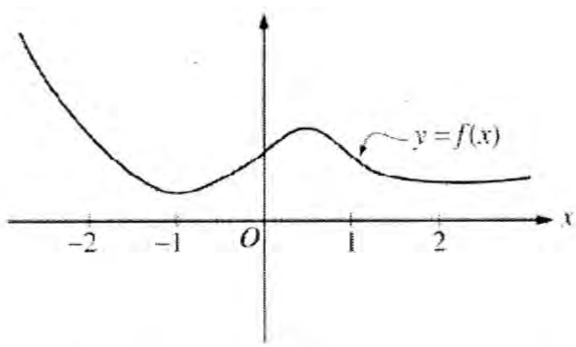
x	$f(x)$
-1	4
0	5
1	7

(E)

x	$f(x)$
-1	4
0	6
1	7

40. Let f be the function with first derivative given by $f'(x) = \left(3 - 2x - x^2\right)\sin(2x - 3)$. How many relative extrema does f have on the open interval $-4 < x < 2$?

(A) Two (B) Three (C) Four (D) Five (E) Six



41. The graph of a twice-differentiable function f is shown in the figure above. Which of the following is true?

(A) $f'(-1) < f'(1) < f'(0)$

(B) $f'(-1) < f'(0) < f'(1)$

(C) $f'(0) < f'(-1) < f'(1)$

(D) $f'(1) < f'(-1) < f'(0)$

(E) $f'(1) < f'(0) < f'(-1)$

42. What is the volume of the solid generated when the region bounded by the graph of $x = \sqrt{y-2}$ and the lines $x = 0$ and $y = 5$ is revolved about the y-axis?

(A) 3.464 (B) 4.500 (C) 7.854 (D) 10.883 (E) 14.137

43. The population P of a city grows according to the differential equation $\frac{dP}{dt} = kP$, where k is a constant and t is measured in years. If the population of the city doubles every 12 years, what is the value of k ?

(A) 0.058 (B) 0.061 (C) 0.167 (D) 0.693 (E) 8.318

44. The function f is continuous and $\int_0^8 f(u)\,du = 6$. What is the value of $\int_1^3 xf(x^2-1)\,dx$?

(A) $\frac{3}{2}$ (B) 3 (C) 6 (D) 12 (E) 24

45. The function f is defined for all x in the closed interval $[a, b]$. If f does not attain a maximum value on $[a, b]$, which of the following must be true?

(A) f is not continuous on $[a, b]$.

(B) f is not bounded on $[a, b]$.

(C) f does not attain a minimum value on $[a, b]$.

(D) The graph of f has a vertical asymptote in the interval $[a, b]$.

(E) The equation $f'(x) = 0$ does not have a solution in the interval $[a, b]$.

Name ___________________

Periods _____

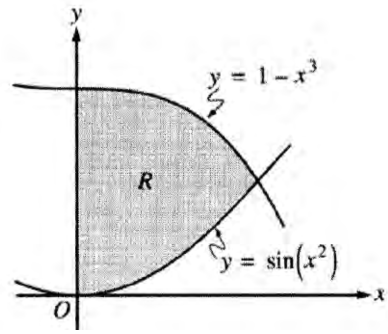
CALCULUS AB

SECTION II, Part A

Time—30 minutes

Number of problems—2

A graphing calculator is required for these problems.



1. Let R be the shaded region in the first quadrant enclosed by the y-axis and the graphs of $y = 1 - x^3$ and $y = \sin\left(x^2\right)$, as shown in the figure above.

(a) Find the area of R.

(b) A horizontal line, $y = k$, is drawn through the point where the graphs of $y = 1 - x^3$ and $y = \sin\left(x^2\right)$ intersect. Find k and determine whether this line divides R into two regions of equal area. Show the work that leads to your conclusion.

(c) Find the volume of the solid generated when R is revolved about the line $y = -3$.

2. The penguin population on an island is modeled by a differentiable function P of time t, where $P(t)$ is the number of penguins and t is measured in years, for $0 \le t \le 40$. There are 100,000 penguins on the island at time $t = 0$. The birth rate for the penguins on the island is modeled by

$$B(t) = 1000e^{0.06t} \text{ penguins per year}$$

and the death rate for the penguins on the island is modeled by

$$D(t) = 250e^{0.1t} \text{ penguins per year.}$$

(a) What is the rate of change of the penguin population on the island at time $t = 0$?

(b) To the nearest whole number, what is the penguin population on the island at time $t = 40$?

(c) To the nearest whole number, what is the average rate of change of the penguin population on the island for $0 \le t \le 40$?

(d) To the nearest whole number, find the absolute minimum penguin population and the absolute maximum penguin population on the island for $0 \le t \le 40$. Show the analysis that leads to your answers.

Do not go on to Part B until you are told to do so. You will be able to work more on these first two problems but you will not be allowed to use your calculator.

CALCULUS AB
SECTION II, Part B

Time—60 minutes
Number of problems—4

No calculator is allowed for these problems.

t (days)	0	10	22	30
$W'(t)$ (GL per day)	0.6	0.7	1.0	0.5

3. The twice-differentiable function W models the volume of water in a reservoir at time t, where $W(t)$ is measured in gigaliters (GL) and t is measured in days. The table above gives values of $W'(t)$ sampled at various times during the time interval $0 \le t \le 30$ days. At time $t = 30$, the reservoir contains 125 gigaliters of water.

(a) Use the tangent line approximation to W at time $t = 30$ to predict the volume of water $W(t)$, in gigaliters, in the reservoir at time $t = 32$. Show the computations that lead to your answer.

(b) Use a left Riemann sum, with the three subintervals indicated by the data in the table, to approximate $\int_0^{30} W'(t)\,dt$. Use this approximation to estimate the volume of water $W(t)$, in gigaliters, in the reservoir at time $t = 0$. Show the computations that lead to your answer.

(c) Explain why there must be at least one time t, other than $t = 10$, such that $W'(t) = 0.7$ GL/day.

(d) The equation $A = 0.3W^{2/3}$ gives the relationship between the area A, in square kilometers, of the surface of the reservoir, and the volume of water $W(t)$, in gigaliters, in the reservoir. Find the instantaneous rate of change of A, in square kilometers per day, with respect to t when $t = 30$ days.

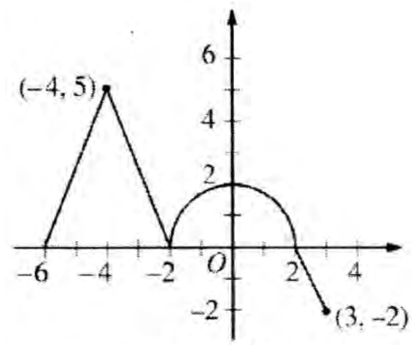
4. Let f be the function given by $f(x) = \left(x^2 - 2x - 1\right)e^x$.

(a) Find $\lim\limits_{x \to \infty} f(x)$ and $\lim\limits_{x \to -\infty} f(x)$.

$\lim\limits_{x \to \infty} f(x) =$ ____________ $\lim\limits_{x \to -\infty} f(x) =$ ____________

(b) Find the intervals on which f is increasing. Show the analysis that leads to your answer.

(c) Find the intervals on which the graph of f is concave down. Show the analysis that leads to your answer.



Graph of f

5. The graph of the continuous function f, consisting of three line segments and a semicircle, is shown above. Let g be the function given by $g(x) = \int_{-2}^{x} f(t)\,dt$.

(a) Find $g(-6)$ and $g(3)$.

(b) Find $g'(0)$.

(c) Find all values of x on the open interval $-6 < x < 3$ for which the graph of g has a horizontal tangent. Determine whether g has a local maximum, a local minimum, or neither at each of these values. Justify your answers.

(d) Find all values of x on the open interval $-6 < x < 3$ for which the graph of g has a point of inflection. Explain your reasoning.

6. Let f be a function with $f(2) = -8$ such that for all points (x, y) on the graph of f, the slope is given by $\dfrac{3x^2}{y}$.

(a) Write an equation of the line tangent to the graph of f at the point where $x = 2$ and use it to approximate $f(1.8)$.

(b) Find an expression for $y = f(x)$ by solving the differential equation $\dfrac{dy}{dx} = \dfrac{3x^2}{y}$ with the initial condition $f(2) = -8$.

Answer Key for AP Calculus AB Practice Exam, Section I

Question 1: D
Question 2: B
Question 3: B
Question 4: E
Question 5: D
Question 6: B
Question 7: C
Question 8: C
Question 9: D
Question 10: A
Question 11: D
Question 12: E
Question 13: E
Question 14: A
Question 15: C
Question 16: D
Question 17: B
Question 18: B
Question 19: B
Question 20: D
Question 21: A
Question 22: E
Question 23: B
Question 24: A
Question 25: C
Question 26: E
Question 27: D
Question 28: B
Question 29 D
Question 30 E
Question 31 A
Question 32 C
Question 33 E
Question 34 A
Question 35 E
Question 36 B
Question 37 D
Question 38 C
Question 39 E
Question 40 E
Question 41 D
Question 42 E
Question 43 A
Question 44 B
Question 45 A

2013 AB MC Solutions

1. Method 1 (factoring)

$$\lim_{x\to 2}\frac{(x+3)\cancel{(x-2)}}{(x+2)\cancel{(x-2)}}$$

$$\frac{5}{4}$$ $\boxed{D}$

Method 2 (L'Hop.)

$$\lim_{x\to 2}\frac{2x+1}{2x}$$

$$\frac{5}{4}$$

2. $f'(x)=3x^2-2x+1$

$f'(2)=12-4+1$

$=9$ $\boxed{B}$

3. u-sub

$u=x^2$

$du=2x\,dx$

$x=4\to u=16$

$x=0\to u=0$

$\frac{1}{2}\int_0^4 2x e^{x^2}dx$

$\frac{1}{2}\int_0^{16} e^u\,du$ $\boxed{B}$

4. $x^2-3xy=10$

$2x-3xy'+y(-3)=0$

$-3xy'=3y-2x$

$y'=\frac{3y-2x}{-3}$

$y'\big|_{(1,-3)}=\frac{-9-2}{-3}$

$=\frac{11}{3}$

T.L.

$y+3=\frac{11}{3}(x-1)$ $\boxed{E}$

5. $g'(x)=x^2+3x-70$

$0=(x+10)(x-7)$

CN $x=-10,\ 7$

g': $+$ on $(-\infty,-10)$, $-$ on $(-10,7)$, $+$ on $(7,\infty)$ $\boxed{D}$

6. $-\frac{1}{3}\int_2^4 \frac{1(-3)}{5-3x}\,dx$

$-\frac{1}{3}\ln|5-3x|\Big|_2^4$

$-\frac{1}{3}\ln|-7|+\frac{1}{3}\ln|-1|$

$-\frac{1}{3}\ln 7+\frac{1}{3}\ln 1$

$-\frac{1}{3}\ln 7+0$ $\boxed{B}$

7. $f'(x)=3x^2-12x+8$

$f'(3)=27-36+8$

$=-1$ $\boxed{C}$

8. Method 1

Speed decr. when v and acc. have opposite signs

v: $+$ on $(0,k)$, $-$ on (k,m)

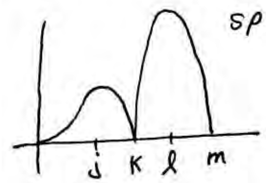
a: $+$ on $(0,j)$, $-$ on (j,l), $+$ on (l,m)

$j<t<k,\ l<t<m$

$\boxed{C}$

Method 2

speed $=|v(t)|$



dec. on $(j,k),\ (l,m)$

Note: including the endpoints is questionable but there was no other option

9. $f_{red}(x) = \dfrac{(x-2)(x+3)}{x+1}$

f has a hole @ $x = 2$ and a V.A. @ $x = -1$ $\boxed{D}$

10. $x(3) = x(0) + \int_0^3 (3t^2-4)\,dt$

$= -2 + (t^3 - 4t)\Big|_0^3$

$= -2 + 27 - 12 - 0$

$= 13$ $\boxed{A}$

11. $f'(x) = 2x^3 - 15x^2 + 36x$

$f''(x) = 6x^2 - 30x + 36$

$0 = 6(x^2 - 5x + 6)$

$0 = 6(x-3)(x-2)$

PPI $x = 2, 3$

f'' $\quad + \quad | \quad - \quad | \quad +$ (2, 3)

$\boxed{D}$

12. I $\lim_{x\to\infty} \dfrac{\ln x}{x^{99}}$ $\quad \dfrac{\infty}{\infty}$

$\lim_{x\to\infty} \dfrac{\frac{1}{x}}{99x^{98}}$

$\lim_{x\to\infty} \dfrac{1}{99x^{99}} = 0$ Yes

II $\lim_{x\to\infty} \dfrac{e^x}{\ln x}$ $\quad \dfrac{\infty}{\infty}$

$\lim_{x\to\infty} \dfrac{e^x}{\frac{1}{x}}$

$\lim_{x\to\infty} xe^x = \infty$ No

12 continued

III $\lim_{x\to\infty} \dfrac{x^{99}}{e^x}$

$\lim_{x\to\infty} \dfrac{99x^{98}}{e^x}$

after 98 more derivatives

$\lim_{x\to\infty} \dfrac{\text{constant}}{e^x} = 0$ Yes

Note: This constant is 99 factorial.

$\boxed{E}$

13. $f(2) = f(0) + \int_0^2 f'(x)\,dx$

$\leq -5 + \int_0^2 3\,dx$

$= -5 + 3x\Big|_0^2$

$= -5 + 6$

$= 1$ $\boxed{E}$

14. diff. $\rightarrow$ continuous

$1 + b = a \cdot 1^2$

$1 + b = a$

$f'(x) = \begin{cases} 1, & x \leq 1 \\ 2ax, & x > 1 \end{cases}$

$1 = 2a \cdot 1$

$\frac{1}{2} = a$

$1 + b = \frac{1}{2}$

$b = -\frac{1}{2}$ $\boxed{A}$

15. $K'(x) = \dfrac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$

$K'(3) = \dfrac{g(3)f'(3) - f(3)g'(3)}{(g(3))^2}$

$= \dfrac{2 \cdot 5 - (-1)(-2)}{2^2}$

$= 2$ $\boxed{C}$

16. $y = 5x(x^2+1)^{\frac{1}{2}}$

$y' = 5x \cdot \frac{1}{2}(x^2+1)^{-\frac{1}{2}} \cdot 2x + (x^2+1)^{\frac{1}{2}} \cdot 5$

$y'(3) = 15 \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{10}} \cdot 6 + \sqrt{10} \cdot 5$

$= \frac{45}{\sqrt{10}} + 5\sqrt{10}$ $\boxed{D}$

17. this is the limit def. of the derivative of arcsin x evaluated @ $x = a$.

$\frac{d}{dx} \arcsin x \Big|_{x=a} = 2$

$\frac{1}{\sqrt{1-x^2}} \Big|_{x=a} = 2$

This could also be done with L'Hopital's.

$\frac{1}{\sqrt{1-a^2}} = 2$

$\sqrt{1-a^2} = \frac{1}{2}$

$1-a^2 = \frac{1}{4}$

$a^2 = \frac{3}{4}$

$a = \frac{\sqrt{3}}{2}$ $\boxed{B}$

18. $\frac{2+y'}{2x+y} = 1$

$2 + y' = 2x + y$

$y' = 2x + y - 2$ $\boxed{B}$

19. $h(x) = e^x g(x)$

$h'(x) = e^x g'(x) + g(x) e^x$

$h'(-1) = e^{-1} g'(-1) + g(-1) e^{-1}$

slope of tan. point on tangent

$= \frac{1}{e}(-6) + 3 \cdot \frac{1}{e}$

$= \frac{-3}{e}$ $\boxed{B}$

20. $\ln((2x)^3+1) \cdot 2$

$2\ln(8x^3+1)$ $\boxed{D}$

21. $\int_0^7 f(x)\,dx$

use areas of triangles, rectangles and/or trapezoids

$\frac{1}{2}(2)(1+2) + \frac{1}{2} \cdot 2(2+3) - \frac{1}{2} \cdot 2 \cdot 2$

6 $\boxed{A}$

22. If MVT does not apply, f is not differentiable.

$\boxed{E}$

23.

f	g
$(0,1)$ $m=3$	$(1,0)$ $m=\frac{1}{3}$

$f'(x) = 2 + e^x$

$f'(0) = 2+1$
$= 3$

$g'(1) = \frac{1}{3}$ $\boxed{B}$

24. $g'(x) = 12x^2 + 6x - 6$

$0 = 6(2x^2 + x - 1)$

$0 = 6(2x-1)(x+1)$

CN $x = \frac{1}{2}, -1$

candidate test

$g(-2) = -32+12+12+1 = -7$

$g(-1) = -4+3+6+1 = 6$

$g(\frac{1}{2}) = \frac{1}{2} + \frac{3}{4} - 3 + 1 = -\frac{3}{4}$

$g(1) = 4+3-6+1 = 2$

min. $g = -7$ $\boxed{A}$

25. It is impossible to separate and integrate.

Check to see if $(0, -\ln 4)$ is a point on the choices.

A. $-\ln 4 = 0 - \ln 4$ (yes)

B. $-\ln 4 = 0 - \ln 4$ (yes)

C. $-\ln 4 = -\ln(-1+5)$ (yes)

D. $-\ln 4 = -\ln(1+3)$ (yes)

E $-\ln 4 \neq \ln(1+3)$ (no)

$$\left.\frac{dy}{dx}\right|_{(0,-\ln 4)} = \left.e^{y+x}\right|_{(0,-\ln 4)}$$
$$= e^{-\ln 4}$$
$$= e^{\ln 4^{-1}}$$
$$= \frac{1}{4}$$

Differentiate each choice A-D

A. $y' = -1$

$y'(0) \neq \frac{1}{4}$

B. $y' = 1$

$y'(0) \neq \frac{1}{4}$

C. $y' = -\dfrac{-e^x}{-e^x+5}$

$y'(0) = \dfrac{1}{-1+5}$ $\boxed{C}$

$= \frac{1}{4}$ yes

26. $\int \sqrt{1+x^3}\,dx$

cannot be integrated but

$\int_0^x \sqrt{1+t^3}\,dt$ is equivalent

Note: their derivatives are =

$\boxed{E}$

27. $$h_{avg} = \frac{\int_0^2 \left(16 + 7\cos\frac{\pi t}{4}\right)dt}{2}$$
$$= \frac{\int_0^2 16\,dt + 7\cdot\frac{4}{\pi}\int_0^{\frac{\pi}{4}2} \cos\frac{\pi t}{4}\,dt}{2}$$
$$= \frac{\left(16t + \frac{28}{\pi}\sin\frac{\pi t}{4}\right)_0^2}{2}$$
$$= \frac{32 + \frac{28}{\pi}\sin\frac{\pi}{2} - 0}{2}$$
$$= 16 + \frac{14}{\pi} \quad \boxed{D}$$

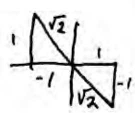
28. $f'(x) = \cos x - \sin x$

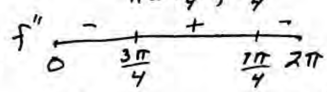
$f''(x) = -\sin x - \cos x$

$0 = -\sin x - \cos x$

$\sin x = -\cos x$

$x = \frac{3\pi}{4}, \frac{7\pi}{4}$





ccd to ccu @ $x = \frac{3\pi}{4}$

$\boxed{B}$

29. $g(5) = \int_0^5 f(t)\,dt$

$= \text{area }\Delta + \text{area semicircle}$

$= \frac{1}{2}\cdot 1\cdot 3 + \frac{1}{2}\pi(2)^2$

$= \frac{3}{2} + 2\pi$ $\boxed{D}$

30. $\frac{dV}{dt} = -3$ $\quad \frac{dr}{dt} = -.25$

$V = \frac{4}{3}\pi r^3$

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

$-3 = 4\pi r^2(-.25)$

$\frac{-3}{4\pi(-.25)} = r^2$ $\boxed{E}$

$.977 = r$

31. $\int_0^{10} \frac{1}{2} g(x)\,dx = 8$

$\int_0^{10} g(x)\,dx = 16$

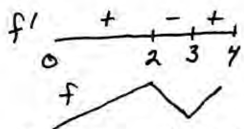
$\int_0^3 (f(x) - g(x))\,dx = \int_0^{10} (f(x) - g(x))\,dx - \int_3^{10} (f(x) - g(x))\,dx$

$= \int_0^{10} f(x)\,dx - \int_0^{10} g(x)\,dx - 2$

$= 21 - 16 - 2$

$= 3$ $\boxed{A}$

32.



f has a rel. max. @ $x = 2$

f has a rel. min. @ $x = 3$

only C and D are possible

$f(3) = f(0) + \int_0^3 f'(x)\,dx$

$= 0 +$ some positive #

$\boxed{C}$

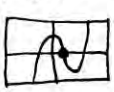
33. $\boxed{E}$ T.D. $= \int_a^b |v(t)|\,dt$

34. $Temp(4) = Temp(0) + \int_0^4 R(t)\,dt$

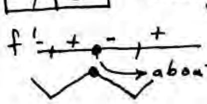
$= 200 + \int_0^4 -6.89e^{-.053t}\,dt$

$= 175$ $\boxed{A}$

35. $f'(x) = x^3 - 4\sin(x^2) + 1$



rel. max. where f' changes from pos. to neg.



about $x = \frac{1}{2}$ $\boxed{E}$

36. Since f is increasing

left Riemann Sum $< \int_0^3 f'(x)\,dx <$ Right Riemann Sum

$\frac{1}{2}(0+4+10+18+28+40) < \int_0^3 f'(x)\,dx < \frac{1}{2}(4+10+18+28+40+54)$

$50 < \int_0^3 f'(x)\,dx < 77$

$\boxed{B}$

37. A False $f(a) = 1$

B False f has a hole

C False $\lim_{x \to a} f(x) = 2$

D True

E False

38. $x(t) = \cos\sqrt{t}$

$0 = \cos\sqrt{t}$

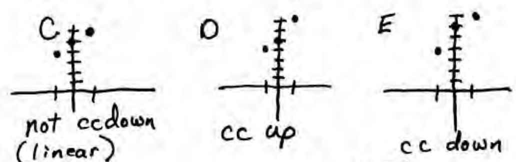
$t = 2.467$ (first time)

$x'(2.467) = -.318$ $\boxed{C}$

39. $f'(x) > 0 \rightarrow f$ is increasing

Could be C, D, or E

$f''(x) < 0 \rightarrow f$ is concave down



$\boxed{E}$

40. graph $f'(x)$ on $-4 < x < 2$

look for sign changes

6 times $\boxed{E}$

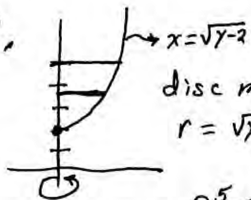
41. $f'(-1) \approx 0$
$f'(0) > 0$
$f'(1) < 0$

$\left.\begin{array}{l} f'(-1) \approx 0 \\ f'(0) > 0 \\ f'(1) < 0 \end{array}\right\}$ slopes on f graph

$f'(1) < f'(-1) < f'(0)$

$\boxed{D}$

42.



disc method
$r = \sqrt{y-2}$

$$V = \pi \int_2^5 \left(\sqrt{y-2}\right)^2 dy$$

$= 14.137$ $\boxed{E}$

43. $\frac{dP}{dt} = kP$ Recognize exponential growth or separate and integrate.

$P = Ce^{kt}$

$2C = Ce^{k \cdot 12}$

$2 = e^{12k}$

$\ln 2 = 12k$

$\frac{\ln 2}{12} = k$

$k = .058$ $\boxed{A}$

44. $u = x^2 - 1$
$du = 2x\,dx$
$x = 1 \rightarrow u = 0$
$x = 3 \rightarrow u = 8$

$\int_1^3 x\, f(x^2-1)\,dx$

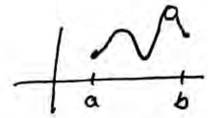
$\frac{1}{2}\int_1^3 2x\, f(x^2-1)\,dx$

$\frac{1}{2}\int_0^8 f(u)\,du$

$\frac{1}{2} \cdot 6$

3 $\boxed{B}$

45. A True
B False



C False
D False
E False

Each of the others might be true.

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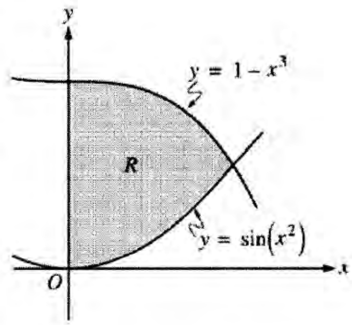
Question 1

Let R be the shaded region in the first quadrant enclosed by the y-axis and the graphs of $y = 1 - x^3$ and $y = \sin(x^2)$, as shown in the figure above.



(a) Find the area of R.

(b) A horizontal line, $y = k$, is drawn through the point where the graphs of $y = 1 - x^3$ and $y = \sin(x^2)$ intersect. Find k and determine whether this line divides R into two regions of equal area. Show the work that leads to your conclusion.

(c) Find the volume of the solid generated when R is revolved about the line $y = -3$.

The graphs of $y = 1 - x^3$ and $y = \sin(x^2)$ intersect in the first quadrant at the point $(A, B) = (0.764972, 0.552352)$.	1 : correct limits in an integral in (a), (b), or (c)
(a) Area $= \int_0^A \left(1 - x^3 - \sin(x^2)\right) dx$ $= 0.533$ (or 0.534)	$2 : \begin{cases} 1 : \text{integrand} \\ 1 : \text{answer} \end{cases}$
(b) $k = B = 0.552352$ $\int_0^A \left(1 - x^3 - k\right) dx = 0.257$ (or 0.256) $\int_0^A \left(k - \sin(x^2)\right) dx = 0.277$ (or 0.276) The two regions have unequal areas.	$3 : \begin{cases} 1 : \text{integral(s) with } k \text{ value} \\ 1 : \text{value(s) of integral(s)} \\ 1 : \text{conclusion tied to part (a)} \\ \quad \text{or comparison of two integrals} \end{cases}$ Note: Stating k value only does not earn a point.
(c) Volume $= \pi \int_0^A \left(\left(1 - x^3 + 3\right)^2 - \left(\sin(x^2) + 3\right)^2\right) dx$ $= 11.841$ (or 11.840)	$3 : \begin{cases} 2 : \text{integrand} \\ 1 : \text{answer} \end{cases}$

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Question 2

The penguin population on an island is modeled by a differentiable function P of time t, where $P(t)$ is the number of penguins and t is measured in years, for $0 \le t \le 40$. There are 100,000 penguins on the island at time $t = 0$. The birth rate for the penguins on the island is modeled by

$$B(t) = 1000e^{0.06t} \text{ penguins per year}$$

and the death rate for the penguins on the island is modeled by

$$D(t) = 250e^{0.1t} \text{ penguins per year.}$$

(a) What is the rate of change of the penguin population on the island at time $t = 0$?

(b) To the nearest whole number, what is the penguin population on the island at time $t = 40$?

(c) To the nearest whole number, what is the average rate of change of the penguin population on the island for $0 \le t \le 40$?

(d) To the nearest whole number, find the absolute minimum penguin population and the absolute maximum penguin population on the island for $0 \le t \le 40$. Show the analysis that leads to your answers.

(a) $P'(0) = B(0) - D(0) = 1000 - 250 = 750$ penguins per year	1 : answer
(b) $P(40) = 100000 + \int_0^{40} (B(t) - D(t))\,dt$ $= 100000 + 33057.56459$ There are 133,058 penguins on the island.	3 : $\begin{cases} 1 : \text{limits} \\ 1 : \text{integrand} \\ 1 : \text{answer} \end{cases}$
(c) $\frac{1}{40}\int_0^{40} (B(t) - D(t))\,dt = 826.439$ OR $\frac{P(40) - P(0)}{40 - 0} = \frac{133058 - 100000}{40} = 826.45$ The average rate of change is 826 penguins per year.	1 : answer
(d) $B(t) - D(t) = 0$ $1000e^{0.06t} = 250e^{0.1t} \Rightarrow t = A = \frac{\ln 4}{0.04} = 34.657359$ The absolute minimum and absolute maximum occur at a critical point or at an endpoint. $P(0) = 100000$ $P(A) = 100000 + \int_0^{A} (B(t) - D(t))\,dt = 139166.667$ $P(40) = 133058$ The minimum population is 100,000 and the maximum population is 139,167 penguins.	4 : $\begin{cases} 1 : B(t) - D(t) = 0 \\ 1 : \text{solves for } t \\ 1 : \text{minimum value} \\ 1 : \text{maximum value} \end{cases}$

Question 3

t (days)	0	10	22	30
$W'(t)$ (GL per day)	0.6	0.7	1.0	0.5

The twice-differentiable function W models the volume of water in a reservoir at time t, where $W(t)$ is measured in gigaliters (GL) and t is measured in days. The table above gives values of $W'(t)$ sampled at various times during the time interval $0 \le t \le 30$ days. At time $t = 30$, the reservoir contains 125 gigaliters of water.

(a) Use the tangent line approximation to W at time $t = 30$ to predict the volume of water $W(t)$, in gigaliters, in the reservoir at time $t = 32$. Show the computations that lead to your answer.

(b) Use a left Riemann sum, with the three subintervals indicated by the data in the table, to approximate $\int_0^{30} W'(t)\,dt$. Use this approximation to estimate the volume of water $W(t)$, in gigaliters, in the reservoir at time $t = 0$. Show the computations that lead to your answer.

(c) Explain why there must be at least one time t, other than $t = 10$, such that $W'(t) = 0.7$ GL/day.

(d) The equation $A = 0.3W^{2/3}$ gives the relationship between the area A, in square kilometers, of the surface of the reservoir, and the volume of water $W(t)$, in gigaliters, in the reservoir. Find the instantaneous rate of change of A, in square kilometers per day, with respect to t when $t = 30$ days.

(a) An equation of the tangent line is $y = 0.5(t - 30) + 125$.
$W(32) \approx 0.5(32 - 30) + 125 = 126$

1 : answer

(b) $\int_0^{30} W'(t)\,dt \approx (10)(0.6) + (12)(0.7) + (8)(1.0) = 22.4$

$W(0) = W(30) - \int_0^{30} W'(t)\,dt = 125 - 22.4 = 102.6$

$3 : \begin{cases} 1 : \text{left Riemann sum} \\ 1 : \text{approximation} \\ 1 : \text{answer} \end{cases}$

(c) W' is differentiable $\Rightarrow$ W' is continuous.

$W'(30) = 0.5 < 0.7 < 1.0 = W'(22)$

By the Intermediate Value Theorem, there must be at least one time t, $22 \le t \le 30$, such that $W'(t) = 0.7$.

2 : explanation

(d) $\frac{dA}{dt} = (0.3)\frac{2}{3}W^{-1/3} \cdot \frac{dW}{dt} = \frac{0.2}{\sqrt[3]{W}} \cdot \frac{dW}{dt}$

$\left.\frac{dA}{dt}\right|_{t=30} = \frac{0.2}{\sqrt[3]{125}} \cdot 0.5 = 0.02$

$3 : \begin{cases} 2 : \frac{dA}{dt} \\ 1 : \text{answer} \end{cases}$

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Question 4

Let f be the function given by $f(x) = \left(x^2 - 2x - 1\right)e^x$.

(a) Find $\lim\limits_{x \to \infty} f(x)$ and $\lim\limits_{x \to -\infty} f(x)$.

(b) Find the intervals on which f is increasing. Show the analysis that leads to your answer.

(c) Find the intervals on which the graph of f is concave down. Show the analysis that leads to your answer.

(a) $\lim\limits_{x \to \infty} f(x) = \infty$ or does not exist

$\lim\limits_{x \to -\infty} f(x) = 0$

1 : answers

(b) $f'(x) = (2x - 2)e^x + \left(x^2 - 2x - 1\right)e^x$
$= \left(x^2 - 3\right)e^x$

$f'(x) = 0$ when $x = -\sqrt{3}$, $x = \sqrt{3}$

$f'(x) > 0$ for $-\infty < x < -\sqrt{3}$ and $\sqrt{3} < x < \infty$.

f is increasing on the intervals $-\infty < x \le -\sqrt{3}$ and $\sqrt{3} \le x < \infty$.

$4 : \begin{cases} 2 : f'(x) \\ 1 : \text{analysis} \\ 1 : \text{intervals} \end{cases}$

(c) $f''(x) = 2xe^x + \left(x^2 - 3\right)e^x$
$= \left(x^2 + 2x - 3\right)e^x = (x + 3)(x - 1)e^x$

$f''(x) < 0$ for $-3 < x < 1$

The graph of f is concave down on the interval $-3 < x < 1$.

$4 : \begin{cases} 2 : f''(x) \\ 1 : \text{analysis} \\ 1 : \text{interval} \end{cases}$

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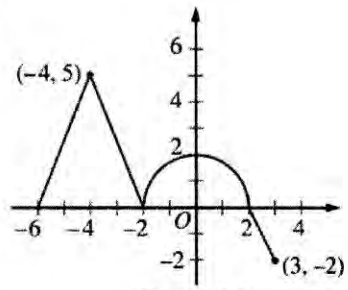
Question 5

The graph of the continuous function f, consisting of three line segments and a semicircle, is shown above. Let g be the function given by $g(x) = \int_{-2}^{x} f(t)\,dt$.



Graph of f

(a) Find $g(-6)$ and $g(3)$.

(b) Find $g'(0)$.

(c) Find all values of x on the open interval $-6 < x < 3$ for which the graph of g has a horizontal tangent. Determine whether g has a local maximum, a local minimum, or neither at each of these values. Justify your answers.

(d) Find all values of x on the open interval $-6 < x < 3$ for which the graph of g has a point of inflection. Explain your reasoning.

(a) $g(-6) = \int_{-2}^{-6} f(t)\,dt = -\int_{-6}^{-2} f(t)\,dt = -\frac{1}{2}\cdot 4\cdot 5 = -10$

$g(3) = \int_{-2}^{3} f(t)\,dt = \frac{1}{2}\pi\cdot 2^2 - \frac{1}{2}\cdot 1\cdot 2 = 2\pi - 1$

$2 : \begin{cases} 1 : g(-6) \\ 1 : g(3) \end{cases}$

(b) $g'(0) = f(0) = 2$

$1 : g'(0)$

(c) The graph of g has a horizontal tangent at $x = -2$ and $x = 2$ where $g'(x) = f(x) = 0$.

The graph of g has neither a local maximum nor a local minimum at $x = -2$ because $g'(x) = f(x)$ does not change sign at $x = -2$.

The graph of g has a local maximum at $x = 2$ because $g'(x) = f(x)$ changes sign from positive to negative at $x = 2$.

$3 : \begin{cases} 1 : \text{horizontal tangent at } x = -2 \text{ and } x = 2 \\ 2 : \text{answers with justifications} \end{cases}$

(d) The graph of g has a point of inflection at $x = -4$, $x = -2$, and $x = 0$.
$g'(x) = f(x)$ changes from increasing to decreasing at $x = -4$ and $x = 0$, and changes from decreasing to increasing at $x = -2$.

OR

$g''(x) = f'(x)$ changes from positive to negative at $x = -4$ and $x = 0$, and changes from negative to positive at $x = -2$.

$3 : \begin{cases} 2 : \text{values of } x \\ 1 : \text{explanation} \end{cases}$

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Question 6

Let f be a function with $f(2) = -8$ such that for all points (x, y) on the graph of f, the slope is given by $\frac{3x^2}{y}$.

(a) Write an equation of the line tangent to the graph of f at the point where $x = 2$ and use it to approximate $f(1.8)$.

(b) Find an expression for $y = f(x)$ by solving the differential equation $\frac{dy}{dx} = \frac{3x^2}{y}$ with the initial condition $f(2) = -8$.

(a) Slope $= \frac{(3)(4)}{-8} = -\frac{3}{2}$

An equation for the tangent line is $y = -\frac{3}{2}(x - 2) - 8$.

$f(1.8) \approx -\frac{3}{2}(1.8 - 2) - 8 = -7.7$

$$3 : \begin{cases} 1 : \text{slope} \\ 1 : \text{tangent line equation} \\ 1 : \text{approximation} \end{cases}$$

(b) $\int y\,dy = \int 3x^2\,dx$

$\frac{1}{2}y^2 = x^3 + C$

$\frac{1}{2}(-8)^2 = 2^3 + C \Rightarrow C = 24$

$y^2 = 2\left(x^3 + 24\right) = 2x^3 + 48$

$y = -\sqrt{2x^3 + 48}$

Note: This solution is valid for $x > -\sqrt[3]{24}$.

$$6 : \begin{cases} 1 : \text{separation of variables} \\ 2 : \text{antiderivatives} \\ 1 : \text{constant of integration} \\ 1 : \text{uses initial condition} \\ 1 : \text{solves for } y \end{cases}$$

Note: max $3/6$ [1-2-0-0-0] if no constant of integration

Note: $0/6$ if no separation of variables

2013 AP Calculus AB Scoring Worksheet

Section I: Multiple Choice

__________ × 1.2000 = __________

Number Correct (out of 45) — Weighted Section I Score (Do not round)

Section II: Free Response

Question 1 ________ (out of 9) × 1.0000 = ________ (Do not round)

Question 2 ________ (out of 9) × 1.0000 = ________ (Do not round)

Question 3 ________ (out of 9) × 1.0000 = ________ (Do not round)

Question 4 ________ (out of 9) × 1.0000 = ________ (Do not round)

Question 5 ________ (out of 9) × 1.0000 = ________ (Do not round)

Question 6 ________ (out of 9) × 1.0000 = ________ (Do not round)

Sum = ________
Weighted Section II Score (Do not round)

Composite Score

________ + ________ = ________

Weighted Section I Score + Weighted Section II Score = Composite Score (Round to nearest whole number)

AP Score Conversion Chart
Calculus AB

Composite Score Range	AP Score
69-108	5
55-68	4
44-54	3
36-43	2
0-35	1