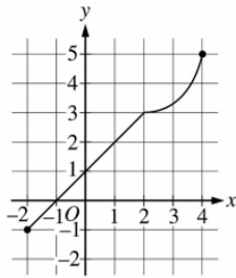


Multiple Choice: Section I, Part A

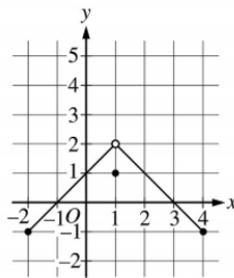
A calculator may not be used on questions on this part of the exam.

x	0	1	2
$f(x)$	5	2	-7
$f'(x)$	-2	-5	-14

1. The table above gives selected values of a differentiable and decreasing function f and its derivative. If g is the inverse function of f , what is the value of $g'(2)$?
- (A) $-\frac{1}{5}$
(B) $-\frac{1}{14}$
(C) $\frac{1}{5}$
(D) 5
-



Graph of f

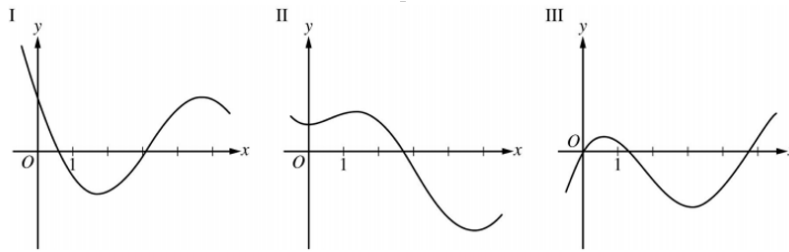


Graph of g

2. The graphs of the functions f and g are shown above. The value of $\lim_{x \rightarrow 1} f(g(x))$ is
- (A) 1
(B) 2
(C) 3
(D) nonexistent
-
3. $\lim_{x \rightarrow 0} \frac{7x - \sin x}{x^2 + \sin(3x)} =$
- (A) 6
(B) 2
(C) 1
(D) 0
-

4. If $f(x) = \sin(\ln(2x))$, then $f'(x) =$
- (A) $\frac{\sin(\ln(2x))}{2x}$
(B) $\frac{\cos(\ln(2x))}{x}$
(C) $\frac{\cos(\ln(2x))}{2x}$
(D) $\cos\left(\frac{1}{2x}\right)$

5.



Three graphs labeled I, II, and III are shown above. One is the graph of f , one is the graph of f' , and one is the graph of f'' . Which of the following correctly identifies each of the three graphs?

	f	f'	f''
(A)	I	II	III
(B)	II	I	III
(C)	II	III	I
(D)	III	I	II

6. The local linear approximation to the function g at $x = \frac{1}{2}$ is $y = 4x + 1$. What is the value of $g\left(\frac{1}{2}\right) + g'\left(\frac{1}{2}\right)$?

- (A) 4
 (B) 5
 (C) 6
 (D) 7

7. For time $t \geq 0$, the velocity of a particle moving along the x -axis is given by $v(t) = (t-5)(t-2)^2$. At what values of t is the acceleration of the particle equal to 0?

- (A) 2 only
 (B) 4 only
 (C) 2 and 4
 (D) 2 and 5

8. The cost, in dollars, to shred the confidential documents of a company is modeled by C , a differentiable function of the weight of documents in pounds. Of the following, which is the best interpretation of $C'(500) = 80$?

- (A) The cost to shred 500 pounds of documents is \$80.
 (B) The average cost to shred documents is $\frac{80}{500}$ dollar per pound.
 (C) Increasing the weight of documents by 500 pounds will increase the cost to shred the documents by approximately \$80.
 (D) The cost to shred documents is increasing at a rate of \$80 per pound when the weight of the documents is 500 pounds.

9. Which of the following integral expressions is equal to $\lim_{n \rightarrow \infty} \sum_{k=1}^n \left(\sqrt{1 + \frac{3k}{n} \cdot \frac{1}{n}} \right)$?

- (A) $\int_0^1 \sqrt{1 + 3x} \, dx$
 - (B) $\int_0^3 \sqrt{1 + x} \, dx$
 - (C) $\int_1^4 \sqrt{x} \, dx$
 - (D) $\frac{1}{3} \int_0^3 \sqrt{x} \, dx$
-

10. $f(x) = \begin{cases} x & \text{for } x < 2 \\ 3 & \text{for } x \geq 2 \end{cases}$

If f is the function defined above, then $\int_{-1}^4 f(x) \, dx$ is

- (A) $\frac{9}{2}$
 - (B) $\frac{15}{2}$
 - (C) $\frac{17}{2}$
 - (D) undefined
-

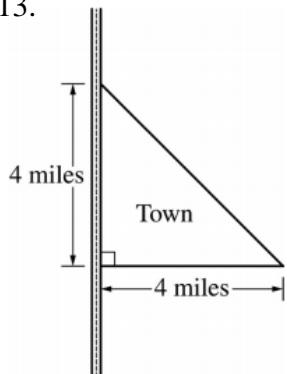
11. $\int e^x \cos(e^x + 1) \, dx =$

- (A) $\sin(e^x + 1) + C$
 - (B) $e^x \sin(e^x + 1) + C$
 - (C) $e^x \sin(e^x + x) + C$
 - (D) $\frac{1}{2} \cos^2(e^x + 1) + C$
-

12. At time t , a population of bacteria grows at the rate of $5e^{0.2t} + 4t$ grams per day, where t is measured in days. By how many grams has the population grown from time $t = 0$ days to $t = 10$ days?

- (A) $5e^2 + 40$
- (B) $5e^2 + 195$
- (C) $25e^2 + 175$
- (D) $25e^2 + 375$

13.



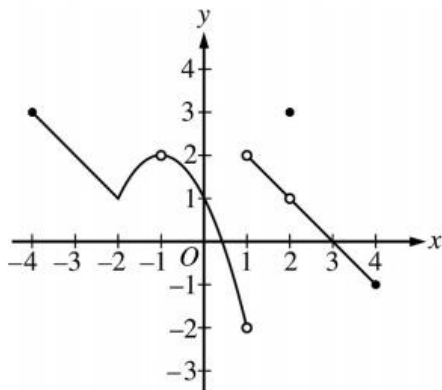
The right triangle shown in the figure above represents the boundary of a town that is bordered by a highway. The population density of the town at a distance of x miles from the highway is modeled by $D(x) = \sqrt{x+1}$, where $D(x)$ is measured in thousands of people per square mile. According to the model, which of the following expressions gives the total population, in thousands, of the town?

- (A) $\int_0^4 \sqrt{x+1} \, dx$
 (B) $\int_0^4 8\sqrt{x+1} \, dx$
 (C) $\int_0^4 x\sqrt{x+1} \, dx$
 (D) $\int_0^4 (4-x)\sqrt{x+1} \, dx$

14. Which of the following is the solution to the differential equation $\frac{dy}{dx} = y \sec^2 x$ with the initial condition $y\left(\frac{\pi}{4}\right) = -1$?

- (A) $y = -e^{\tan x}$
 (B) $y = -e^{(-1+\tan x)}$
 (C) $y = -e^{(\sec^3 x - 2\sqrt{2})/3}$
 (D) $y = -\sqrt{2 \tan x - 1}$

15.

Graph of f

The graph of the function f is shown in the figure above. For how many values of x in the open interval $(-4, 4)$ is f discontinuous?

- (A) one
 (B) two
 (C) three
 (D) four

Multiple Choice: Section I, Part B

A graphing calculator is required for some questions on this part of the exam.

16. Let h be the function defined by $h(x) = \frac{1}{\sqrt{x^5 + 1}}$. If g is an antiderivative of h and $g(2) = 3$, what is the value of $g(4)$?
- (A) -0.020
(B) 0.152
(C) 3.031
(D) 3.152
-
17. The derivative of the function f is given by $f'(x) = -\frac{x}{3} + \cos(x^2)$. At what values of x does f have a relative minimum on the interval $0 < x < 3$?
- (A) 1.094 and 2.608
(B) 1.798
(C) 2.372
(D) 2.493
-
18. The second derivative of a function g is given by $g''(x) = 2^{-x^2} + \cos x + x$. For $-5 < x < 5$, on what open intervals is the graph of g concave up?
- (A) $-5 < x < -1.016$ only
(B) $-1.016 < x < 5$ only
(C) $0.463 < x < 2.100$ only
(D) $-5 < x < 0.463$ and $2.100 < x < 5$

19. The temperature, in degrees Fahrenheit ($^{\circ}\text{F}$), of water in a pond is modeled by the function H given by $H(t) = 55 - 9 \cos\left(\frac{2\pi}{365}(t+10)\right)$, where t is the number of days since January 1 ($t = 0$). What is the instantaneous rate of change of the temperature of the water at time $t = 90$ days?
- (A) $0.114^{\circ}\text{F}/\text{day}$
 (B) $0.153^{\circ}\text{F}/\text{day}$
 (C) $50.252^{\circ}\text{F}/\text{day}$
 (D) $56.350^{\circ}\text{F}/\text{day}$

20.

x	0	2	4	8
$f(x)$	3	4	9	13
$f'(x)$	0	1	1	2

The table above gives values of a differentiable function f and its derivative at selected values of x . If h is the function given by $h(x) = f(2x)$, which of the following statements must be true?

- (I) h is increasing on $2 < x < 4$.
 (II) There exists c , where $0 < c < 4$, such that $h(c) = 12$.
 (III) There exists c , where $0 < c < 2$, such that $h'(c) = 3$.
- (A) II only
 (B) I and III only
 (C) II and III only
 (D) I, II, and III