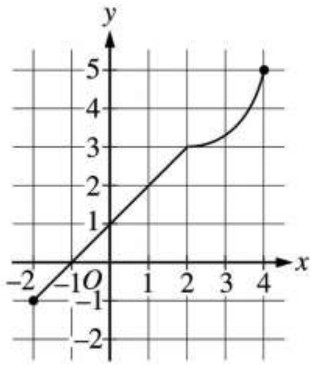
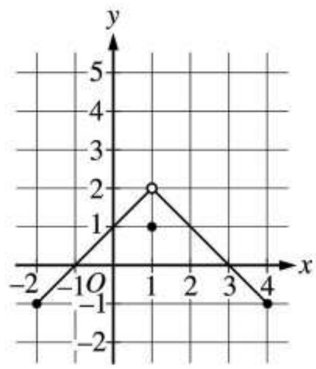
2017+ AP Sample Problems
No Calculator #1-15
Yes Calculator #16-20



Graph of f

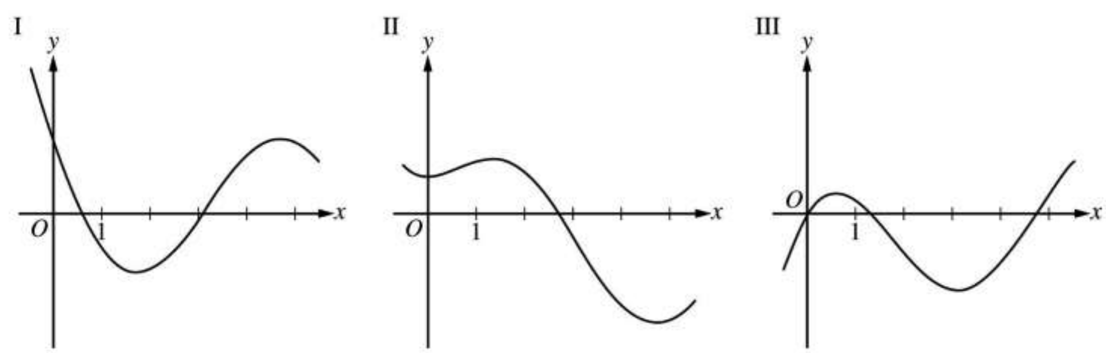


Graph of g

1. The graphs of the functions f and g are shown above. The value of $\lim_{x \to 1} f(g(x))$ is
   (A) 1
   (B) 2
   (C) 3
   (D) nonexistent

2. $\lim_{x \to 0} \dfrac{7x - \sin x}{x^2 + \sin(3x)} =$
   (A) 6
   (B) 2
   (C) 1
   (D) 0

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



4. 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

5. 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

6. 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

7. 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.

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

(A) $\int_0^1 \sqrt{1 + 3x}\, dx$

(B) $\int_0^3 \sqrt{1 + x}\, dx$

(C) $\int_1^4 \sqrt{x}\, dx$

(D) $\frac{1}{3}\int_0^3 \sqrt{x}\, dx$

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

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

10. $\int e^x \cos\left(e^x + 1\right) dx =$

(A) $\sin\left(e^x + 1\right) + C$

(B) $e^x \sin\left(e^x + 1\right) + C$

(C) $e^x \sin\left(e^x + x\right) + C$

(D) $\frac{1}{2}\cos^2\left(e^x + 1\right) + C$

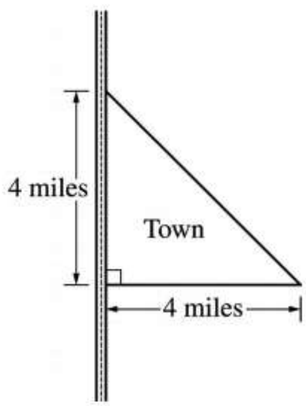
11. At time t, a population of bacteria grows at the rate of $5e^{0.2t} + 4t$ grams per day, where t is measured in days. By how many grams has the population grown from time $t = 0$ days to $t = 10$ days?

(A) $5e^2 + 40$

(B) $5e^2 + 195$

(C) $25e^2 + 175$

(D) $25e^2 + 375$



13. 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) $y = -e^{\left(\sec^3 x - 2\sqrt{2}\right)/3}$

(D) $y = -\sqrt{2\tan x - 1}$

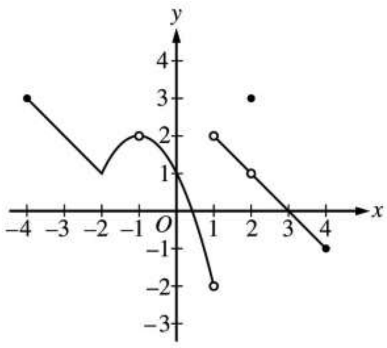
12. The right triangle shown in the figure above represents the boundary of a town that is bordered by a highway. The population density of the town at a distance of x miles from the highway is modeled by $D(x) = \sqrt{x+1}$, where $D(x)$ is measured in thousands of people per square mile. According 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) $\int_0^4 (4 - x)\sqrt{x+1}\,dx$



Graph of f

14. 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

15.

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

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

16. The derivative of the function f is given by $f'(x) = -\frac{x}{3} + \cos\left(x^2\right)$. 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

17. 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 $2.100 < x < 5$

18. The temperature, in degrees Fahrenheit $(°\text{F})$, 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°F/day

(B) 0.153°F/day

(C) 50.252°F/day

(D) 56.350°F/day

20. 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

19.

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