

AP Calculus

MC/FR Extra Practice

Calculator

1)

The velocity, in ft/sec, of a particle moving along the x -axis is given by the function $v(t) = e^t + te^t$. What is the average velocity of the particle from time $t = 0$ to time $t = 3$?

- (A) 20.086 ft/sec
(B) 26.447 ft/sec
(C) 32.809 ft/sec
(D) 40.671 ft/sec
(E) 79.342 ft/sec

2)

A pizza, heated to a temperature of 350 degrees Fahrenheit ($^{\circ}\text{F}$), is taken out of an oven and placed in a 75°F room at time $t = 0$ minutes. The temperature of the pizza is changing at a rate of $-110e^{-0.4t}$ degrees Fahrenheit per minute. To the nearest degree, what is the temperature of the pizza at time $t = 5$ minutes?

- (A) 112°F (B) 119°F (C) 147°F (D) 238°F (E) 335°F

3)

The function f has first derivative given by $f'(x) = \frac{\sqrt{x}}{1+x+x^3}$. What is the x -coordinate of the inflection point of the graph of f ?

- (A) 1.008 (B) 0.473 (C) 0 (D) -0.278 (E) The graph of f has no inflection point.

4)

A particle moves along the x -axis so that at any time $t > 0$, its acceleration is given by $a(t) = \ln(1 + 2^t)$. If the velocity of the particle is 2 at time $t = 1$, then the velocity of the particle at time $t = 2$ is

- (A) 0.462 (B) 1.609 (C) 2.555 (D) 2.886 (E) 3.346

5)

Let f be the function with derivative given by $f'(x) = \sin(x^2 + 1)$. How many relative extrema does f have on the interval $2 < x < 4$?

- (A) One (B) Two (C) Three (D) Four (E) Five

6)

The number of bacteria in a culture is given by $N(t) = 200 \ln(t^2 + 36)$, where t is measured in days. On what day is the change in growth a maximum?

- (A) 4 (B) 6 (C) 8 (D) 10 (E) 12

7)

A particle moves along the x -axis so that at time $t \geq 0$, its position is given by $x(t) = (t + 1)(t - 3)^3$. For what values of t is the velocity of the particle increasing?

- (A) all t (B) $0 < t < 1$ (C) $0 < t < 3$ (D) $1 < t < 3$ (E) $t < 1$ or $t > 3$

8)

Water is pumped into an empty tank at a rate of $r(t) = 20e^{0.02t}$ gallons per minute. Approximately how many gallons of water have been pumped into the tank in the first five minutes?

- (A) 20 gal
(B) 22 gal
(C) 85 gal
(D) 105 gal
(E) 150 gal

NonCalculator

9)

Let f be the function defined by $f(x) = x^3 + x$. If $g(x) = f^{-1}(x)$ and $g(2) = 1$, what is the value of $g'(2)$?

- (A) $\frac{1}{13}$ (B) $\frac{1}{4}$ (C) $\frac{7}{4}$ (D) 4 (E) 13

10)

Let f be the function given by $f(x) = 2xe^x$. The graph of f is concave down when

- (A) $x < -2$ (B) $x > -2$ (C) $x < -1$ (D) $x > -1$ (E) $x < 0$

11)

If $f(x) = \ln(x + 4 + e^{-3x})$, then $f'(0)$ is

- (A) $-\frac{2}{5}$ (B) $\frac{1}{5}$ (C) $\frac{1}{4}$ (D) $\frac{2}{5}$ (E) nonexistent

12)

What is the slope of the line tangent to the curve $y = \arctan(4x)$ at the point at which $x = \frac{1}{4}$?

- (A) 2 (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{1}{2}$ (E) -2

13)

An equation for a tangent line to the graph of $y = \text{Arctan} \frac{x}{3}$ at the origin is:

- (A) $x - 3y = 0$
 (B) $x - y = 0$
 (C) $x = 0$
 (D) $y = 0$
 (E) $3x - y = 0$

14)

$$\int \frac{x}{x^2 - 4} dx =$$

- (A) $\frac{-1}{4(x^2 - 4)^2} + C$
 (B) $\frac{1}{2(x^2 - 4)} + C$
 (C) $\frac{1}{2} \ln|x^2 - 4| + C$
 (D) $2 \ln|x^2 - 4| + C$
 (E) $\frac{1}{2} \arctan\left(\frac{x}{2}\right) + C$

15)

$$\int \frac{e^{x^2} - 2x}{e^{x^2}} dx$$

- (A) $x - e^{x^2} + C$
 (B) $x - e^{-x^2} + C$
 (C) $x + e^{-x^2} + C$
 (D) $-e^{x^2} + C$
 (E) $e^{-x^2} + C$

16)

Let $f(x) = \frac{\ln e^{2x}}{x-1}$ for $x > 1$. If g is the inverse of f , then $g'(3) =$

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

17)

Let $f(x) = \ln x + e^{-x}$. Which of the following is TRUE at $x = 1$?

- (A) f is increasing
 (B) f is decreasing
 (C) f is discontinuous
 (D) f has a relative minimum
 (E) f has a relative maximum

18)

A relative maximum of the function $f(x) = \frac{(\ln x)^2}{x}$ occurs at

- (A) 0
 (B) 1
 (C) 2
 (D) e
 (E) e^2

19)

$$\int_2^6 \left(\frac{1}{x} + 2x \right) dx =$$

- (A) $\ln 4 + 32$
 (B) $\ln 3 + 40$
 (C) $\ln 3 + 32$
 (D) $\ln 4 + 40$
 (E) $\ln 12 + 32$

20)

$$\int \frac{x-2}{x-1} dx =$$

- (A) $-\ln|x-1| + C$
 (B) $x + \ln|x-1| + C$
 (C) $x - \ln|x-1| + C$
 (D) $x + \sqrt{x-1} + C$
 (E) $x - \sqrt{x-1} + C$

21)

The acceleration of a particle at time t moving along the x -axis is given by: $a = 4e^{2t}$.
At the instant when $t = 0$, the particle is at the point $x = 2$ moving with velocity $v = -2$.

The position of the particle at $t = \frac{1}{2}$ is

- (A) $e - 3$ (B) $e - 2$ (C) $e - 1$ (D) e (E) $e + 1$

22)

$$\int_{\pi/4}^{\pi/3} \frac{\sec^2 x}{\tan x} dx =$$

- (A) $\ln \sqrt{3}$ (B) $-\ln \sqrt{3}$ (C) $\ln \sqrt{2}$ (D) $\sqrt{3} - 1$ (E) $\ln \frac{\pi}{3} - \ln \frac{\pi}{4}$

Answers

- 1 A
2 A
3 B
4 E
5 D
6 B
7 E
8 D

9 B
10 A
11 A
12 A
13 A
14 C
15 C
16 E
17 A
18 E
19 C
20 C
21 C
22 A

FRQ Calculator

1. A particle moves along the y -axis with velocity given by $v(t) = t \sin(t^2)$ for $t \geq 0$.

- In which direction (up or down) is the particle moving at time $t = 1.5$? Why?
- Find the acceleration of the particle at time $t = 1.5$. Is the velocity of the particle increasing at $t = 1.5$? Why or why not?
- Given that $y(t)$ is the position of the particle at time t and that $y(0) = 3$, find $y(2)$.
- Find the total distance traveled by the particle from $t = 0$ to $t = 2$.

2.

The rate at which water flows into a tank, in gallons per hour, is given by a continuous, increasing function R . A table of selected values of $R(t)$ for the time interval $0 \leq t \leq 24$ as shown in the table below.

t (hours)	0	4	8	12	16	20	24
$R(t)$ (gallons per hour)	25	28	33	42	46	50	52

- Use a right-hand Riemann sum with 6 subintervals to approximate $\int_0^{24} R(t) dt$. Is your approximation greater or less than the true value? Give a reason for your answer.
- A model for the rate at which water flows into the tank is given by the function

$$w(t) = 27e^{0.03t},$$

where t is measured in hours and $w(t)$ is measured in gallons per hour. Use this model to find the average rate at which water flows into the tank from $t = 0$ to $t = 24$.

- The tank contained 125 gallons at time $t = 0$. Use the model in part b) to find the amount of water in the tank at $t = 24$ hours.

Answers

- 1a up because $v(1.5) > 0$
- 1b No, v is decreasing at 1.5 because $v'(1.5) < 0$
- 1c 3.826 or 3.827
- 1d 1.173

- 2a 1004 gallons
- 2b 39.541 gallons per hour
- 2c 1073.989 or 1073.99 gallons