

$$11.) \quad \frac{dQ}{dt} = \frac{k}{t^2}$$

$$\int dQ = \int \frac{k}{t^2} dt$$

$$Q = -\frac{k}{t} + C$$

$$\text{or} \\ Q = \frac{k}{t} + C$$

$$25.) (0, 2)$$

$$\frac{dy}{dx} = \frac{x}{4y}$$

$$2 \frac{y^2}{2} = \frac{x^2}{8} + 2$$

$$y^2 = \frac{1}{4}x^2 + 4$$

$$y = \pm \sqrt{\frac{1}{4}x^2 + 4}$$

$$\boxed{y = \sqrt{\frac{1}{4}x^2 + 4}}$$

$$\int y dy = \int \frac{1}{4} x dx$$

$$\frac{y^2}{2} = \frac{x^2}{8} + C$$

$$2 = C$$

$$17.) \quad y(x+1) + \frac{dy}{dx} = 0 \quad (-2, 1)$$

$$\frac{dy}{dx} = -y(x+1)$$

$$\int \frac{dy}{y} = \int -(x+1) dx$$

$$\ln|y| = -\frac{x^2}{2} - x + C$$

Calculator MCs



1.

Let g be the function given by $g(x) = \int_0^x \sin(t^2) dt$ for $-1 \leq x \leq 3$. On which of the following intervals is g decreasing?

- (A) $-1 \leq x \leq 0$
- (B) $0 \leq x \leq 1.772$
- (C) $1.253 \leq x \leq 2.171$
- (D) $1.772 \leq x \leq 2.507$
- (E) $2.802 \leq x \leq 3$

*Finding zero(s) of a function
and
choosing an appropriate window*

$$g'(x) = \sin x^2$$

*See printout.



2.

Evaluating a definite integral

$$v(1) = 2$$

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

$$v(2) = 2 + \int_1^2 a(t) dt$$

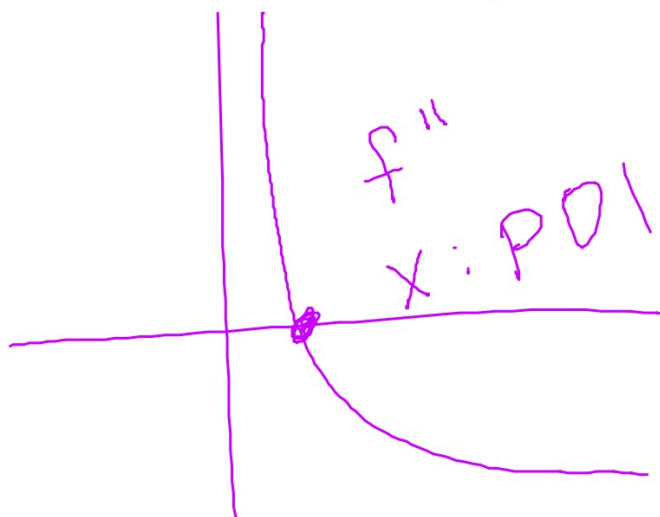


3.

Graphing a derivative

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.

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



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.

Evaluating a derivative at a point

A particle moves along the x -axis so that at any time $t \geq 0$, its velocity is given by $v(t) = 3 + 4.1 \cos(0.9t)$. What is the acceleration of the particle at time $t = 4$?

- (A) -2.016 (B) -0.677 (C) 1.633 (D) 1.814 (E) 2.978



7.

The rate of change of the altitude of a hot-air balloon is given by $r(t) = t^3 - 4t^2 + 6$ for $0 \leq t \leq 8$. Which of the following expressions gives the change in altitude of the balloon during the time the altitude is decreasing?

(A) $\int_{1.572}^{3.514} r(t) \, dt$

(B) $\int_0^8 r(t) \, dt$

(C) $\int_0^{2.667} r(t) \, dt$

(D) $\int_{1.572}^{3.514} r'(t) \, dt$

(E) $\int_0^{2.667} r'(t) \, dt$



8.

At time $t \geq 0$, the acceleration of a particle moving on the x -axis is $a(t) = t + \sin t$. At $t = 0$, the velocity of the particle is -2 . For what value t will the velocity of the particle be zero?

- (A) 1.02 (B) 1.48 (C) 1.85 (D) 2.81 (E) 3.14



9.

If the derivative of f is given by $f'(x) = e^x - 3x^2$, at which of the following values of x does f have a relative maximum value?

- (A) -0.46 (B) 0.20 (C) 0.91 (D) 0.95 (E) 3.73



10.

Find the intersection of two graphs

Let f be the function given by $f(x) = 2e^{4x^2}$. For what value of x is the slope of the line tangent to the graph of f at $(x, f(x))$ equal to 3?

(A) 0.168

(B) 0.276

(C) 0.318

(D) 0.342

(E) 0.551

graph $f'(x)$
and 3



11.

Graph the second derivative

The graph of the function $y = x^3 + 6x^2 + 7x - 2\cos x$ changes concavity at $x =$

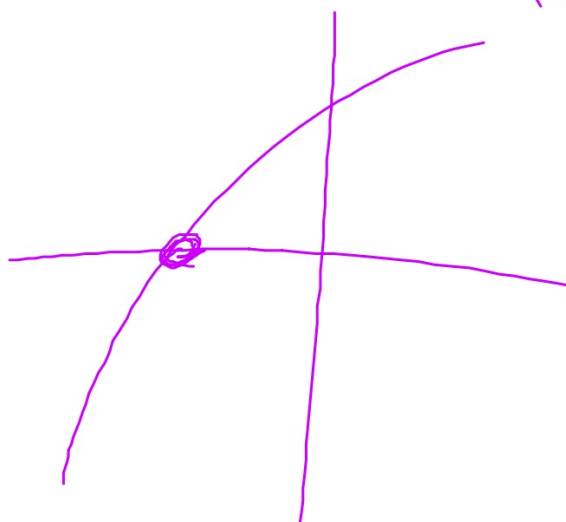
(A) -1.58

(B) -1.63

(C) -1.67

(D) -1.89

(E) -2.33





12.

Let $F(x)$ be an antiderivative of $\frac{(\ln x)^3}{x}$. If $F(1) = 0$, then $F(9) =$

- (A) 0.048 (B) 0.144 (C) 5.827 (D) 23.308 (E) 1,640.250



13.

The first derivative of the function f is given by $f'(x) = \frac{\cos^2 x}{x} - \frac{1}{5}$. How many critical values does f have on the open interval $(0, 10)$?

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



14.

Let f be the function given by $f(x) = 3e^{2x}$ and let g be the function given by $g(x) = 6x^3$. At what value of x do the graphs of f and g have parallel tangent lines?

- (A) -0.701
- (B) -0.567
- (C) -0.391
- (D) -0.302
- (E) -0.258



15.

The first derivative of the function f is defined by $f'(x) = \sin(x^3 - x)$ for $0 \leq x \leq 2$. On what interval(s) is f increasing?

- (A) $1 \leq x \leq 1.445$
- (B) $1 \leq x \leq 1.691$
- (C) $1.445 \leq x \leq 1.875$
- (D) $0.577 \leq x \leq 1.445$ and $1.875 \leq x \leq 2$
- (E) $0 \leq x \leq 1$ and $1.691 \leq x \leq 2$



16.

The derivative of the function f is given by $f'(x) = x^2 \cos(x^2)$. How many points of inflection does the graph of f have on the open interval $(-2, 2)$?

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



17.

A particle moves along a straight line with velocity given by $v(t) = 7 - (1.01)^{-t^2}$ at time $t \geq 0$. What is the acceleration of the particle at time $t = 3$?

- (A) -0.914 (B) 0.055 (C) 5.486 (D) 6.086 (E) 18.087



18.

An object traveling in a straight line has position $x(t)$ at time t . If the initial position is $x(0) = 2$ and the velocity of the object is $v(t) = \sqrt[3]{1+t^2}$, what is the position of the object at time $t = 3$?

- (A) 0.431 (B) 2.154 (C) 4.512 (D) 6.512 (E) 17.408



19.

What is the average value of $y = \frac{\cos x}{x^2 + x + 2}$ on the closed interval $[-1, 3]$?

- (A) -0.085 (B) 0.090 (C) 0.183 (D) 0.244 (E) 0.732



20.

A particle moves along the x -axis so that its velocity at any time $t \geq 0$ is given by $v(t) = 5te^{-t} - 1$. At $t = 0$, the particle is at position $x = 1$. What is the total distance traveled by the particle from $t = 0$ to $t = 4$?

- (A) 0.366 (B) 0.542 (C) 1.542 (D) 1.821 (E) 2.821