Calculators ARE NOT Permitted On This Portion Of The Exam
28 Questions - 55 Minutes

1) Give $f(g(1))$, given that

$$\left[f(x) = 2x + 2, g(x) = -\frac{x}{2 + x^2} \right]$$

a) $\frac{-8}{9}$

b) $\frac{7}{3}$

c) 2

d) $\frac{4}{3}$

e) $\frac{-2}{9}$

2) Find the slope of the tangent line to the graph of f at $x = 4$, given that

$$f(x) = -x^2 + 4\sqrt{x}$$

a) -8

b) -10

c) -9

d) -5

e) -7

3) Determine

$$\lim_{x \to \infty} \left(\frac{-2x^3 + x}{-4x^5 + 2x^2 + 2} \right)$$

a) ∞

b) 0

c) $\frac{1}{2}$

d) $\frac{3}{10}$

e) 1

4) Let

$$f(x) = x^3$$

A region is bounded between the graphs of $y = -1$ and $y = f(x)$ for x between -1 and 0, and between the graphs of $y = 1$ and $y = f(x)$ for x between 0 and 1. Give an integral that corresponds to the area of this region.

a) $\int_{-1}^{1} \left(1 - x^3\right) dx$

b) $\int_{0}^{1} 2\left(1 - x^3\right) dx$

c) $\int_{0}^{1} 2\left(1 + x^3\right) dx$

d) $\int_{-1}^{1} \left(1 + x^3\right) dx$

e) $\int_{0}^{1} \left(-x^3 - 1\right) dx$

5) Given that

$$5x^3 - 4xy - 2y^2 = 1$$

Determine the change in y with respect to x.

a) $-\frac{15x^2 - 4}{-4 - 4y}$

b) $-\dfrac{15x^2-4y}{-4-4y}$

c) $-\dfrac{15x^2-4}{-4x-4y}$

d) $-\dfrac{10x-4y}{-4x-2}$

e) $-\dfrac{15x^2-4y}{-4x-4y}$

6) Compute the derivative of

$$-4\sec(x)+2\csc(x)$$

a) $-4\sec(x)\tan(x)-2\csc(x)\cot(x)$

b) $-4\csc(x)-2\sec(x)$

c) $-4\,(\sec(x))^2-2\,(\csc(x))^2$

d) $-4\sec(x)\tan(x)+2\csc(x)\cot(x)$

e) $-4\,(\tan(x))^2-2\,(\cot(x))^2$

7) Compute

$$\int_0^{\frac{1}{2}} \frac{4}{1+4t^2}\,dt$$

a) $-\pi$

b) $\dfrac{3}{2}\pi$

c) $\dfrac{1}{2}\pi$

d) π

e) 0

8) Determine

$$\frac{d}{dx}\left(\frac{4x^4 - 2x}{4x^4 + 2x}\right)$$

a) $\dfrac{24x^2 - 1}{(4x^3 + 2)^2}$

b) $\dfrac{48x^2 - 1}{(4x^3 + 2)^2}$

c) $\dfrac{12x^2}{(2x^3 + 1)^2}$

d) $\dfrac{24x^2}{(4x^3 + 2)^2}$

e) $\dfrac{6x^2}{(4x^3 + 2)^2}$

9) Give the equation of the normal line to the graph of

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

at the point (0 , 2).

a) $x - 4\sqrt{2}\,y = -8\sqrt{2}$

b) $x + 4\sqrt{2}\,y = 8\sqrt{2}$

c) $4\sqrt{2}\,x + y = 2$

d) $-4\sqrt{2}\,x + y = 2$

e) $x + 4\sqrt{2}\,y = 2$

10) Determine the concavity of the graph of

$$f(x) = 3\sin(x) + 4\,(\cos(x))^2$$

at $x = \pi$.

a) 8

b) -10

c) 4

d) -8

e) -6

11) Compute

$$\int 4x^2\sqrt{x^3+4}\,dx$$

a) $\frac{8}{3}\left(x^3+4\right)^{(3/2)}+C$

b) $\frac{16}{9}\left(x^3+4\right)^{(3/2)}+C$

c) $\frac{8}{9}\left(x^3+4\right)^{(3/2)}+C$

d) $\frac{4}{3}\frac{1}{\sqrt{x^3+4}}+C$

e) $\frac{8}{3}\frac{1}{\sqrt{x^3+4}}+C$

12) Give the value of x where the function

$$f(x)=x^3-9x^2+24x+4$$

has a local maximum.

a) 4

b) -2

c) 2

d) -4

e) 3

13) The slope of the tangent line to the graph of

$$4x^2 + cx - 2e^y = -2$$

at $x = 0$ is 4. Give the value of c.

a) -2

b) 4

c) 8

d) -4

e) -8

14) Compute

$$\int \left(5^x + 2e^{(5\ln(x))}\right) dx$$

a) $\frac{5^x}{\ln(5)} + \frac{2}{5}e^{(5\ln(x))} + C$

b) $5^x \ln(5) + \frac{2}{5}e^{(5\ln(x))} + C$

c) $5^x \ln(5) + \frac{2}{5}\frac{e^{(5\ln(x))}}{x} + C$

d) $\frac{5^x}{\ln(5)} + \frac{2}{5}x^5 + C$

e) $\frac{5^x}{\ln(5)} + \frac{1}{3}x^6 + C$

15) What is the average value of the function

$$g(x) = (2x + 3)^2$$

on the interval from $x = -3$ to $x = -1$?

a) $\frac{7}{3}$

b) -4

c) 5

d) $\frac{14}{3}$

e) 3

16) Compute

$$\lim_{t \to 0} \left(\frac{\tan\left(\frac{1}{4}\pi + t\right) - \tan\left(\frac{1}{4}\pi\right)}{t} \right)$$

a) 1

b) $\frac{1}{4}\pi$

c) π

d) 2

e) -1

17) Find the instantaneous rate of change of

$$f(t) = \left(2t^3 - 3t + 4\right)\sqrt{t^2 + 3t + 4}$$

at $t = 0$.

a) -3

b) $\frac{-3}{4}$

c) 0

d) -4

e) $\frac{-5}{4}$

18) Compute

$$\frac{d}{dx} 2^{\cos(x)}$$

a) $\sin(x)\, 2^{\cos(x)} \ln(2)$

b) $-\sin(x)\, 2^{\cos(x)} \ln(2)$

c) $-\sin(x)\, 2^{\cos(x)}$

d) $-\dfrac{\sin(x)\, 2^{\cos(x)}}{\ln(2)}$

e) $\dfrac{\sin(x)\, 2^{\cos(x)}}{\ln(2)}$

19) A solid is generated by rotating the region enclosed by the graph of

$$y = \sqrt{x}$$

the lines $x = 1$, $x = 2$, and $y = 1$, about the x-axis. Which of the following integrals gives the volume of the solid?

a) $\displaystyle\int_1^2 \pi\, (x - 1)\, dx$

b) $\displaystyle\int_1^2 \pi\, (x - 1)^2\, dx$

c) $\displaystyle\int_1^2 \pi\, \left(\sqrt{x} - 1\right)^2 dx$

d) $\displaystyle\int_1^2 \pi\, (2 - x)^2\, dx$

e) $\displaystyle\int_1^2 \pi\, \left(2 - \sqrt{x}\right)^2 dx$

20) Compute

$$\lim_{x \to 0} \left(-\frac{4x}{\sin(2x)} + \frac{x}{\cos(2x)} \right)$$

a) ∞

b) 0

c) $\frac{-5}{2}$

d) -2

e) *undefined*

21) Given $y > 0$ and

$$\frac{dy}{dx} = \frac{3x^2 + 4x}{y}$$

If the point

$$\left(1, \sqrt{10}\right)$$

is on the graph relating x and y, then what is y when $x = 0$?

a) 3

b) 2

c) 1

d) 6

e) 10

22) Determine

$$\int_1^2 \frac{1}{\sqrt{4 - t^2}}\, dt$$

a) $\frac{1}{2}\pi$

b) $\frac{1}{3}\pi$

c) π

d) $\frac{1}{6}\pi$

e) $\frac{1}{4}\pi$

23) Determine

$$\int e^{(2x)} \sqrt{e^x + 1}\, dx$$

a) $\frac{2}{5}\left(e^x + 1\right)^{(5/2)} - \frac{2}{3}\left(e^x + 1\right)^{(3/2)} + C$

b) $e^{(2x)}\left(e^x + 1\right)^{(3/2)} + C$

c) $\frac{2}{5} e^{\left(\frac{5}{2}x\right)} - 5\, e^{\left(\frac{3}{2}x\right)} + C$

d) $\frac{2}{5}\left(e^x + 1\right)^{(5/2)} - 3\left(e^x + 1\right)^{(3/2)} + C$

e) $\frac{2}{5}\left(e^x + 1\right)^{(5/2)} + 3\left(e^x + 1\right)^{(3/2)} + C$

24) A particle's acceleration for $t \geq 0$ is given by

$$a(t) = 12t + 4$$

The particle's initial position is 2 and its velocity at $t = 1$ is 5. What is the position of the particle at $t = 2$?

a) 10

b) 12

c) 16

d) 4

e) 20

25) Determine

$$\int_0^{\frac{1}{2}\pi} \sin(3x)\, dx + \int_0^{\frac{1}{6}\pi} \cos(3x)\, dx$$

a) -1

b) 1

c) 0

d) $\frac{2}{3}$

e) $\frac{-2}{3}$

26) Determine the derivative of

$$f(x) = (\cos(2x - 4))^3$$

at $x = \pi/2$.

a) $-6\ (\cos(\pi - 4))^2$

b) $-6\cos(\pi - 4)^2 \sin(\pi - 4)$

c) $-6\ (\cos(\pi - 4))^2 \sin(\pi - 4)$

d) $18\ (\cos(\pi - 4))^2 \sin(\pi - 4)$

e) $18\ (\cos(\pi - 4))^2$

27) Compute the derivative of

$$f(x) = \int_0^{x^2} \ln\left(t^2 + 1\right)\, dt$$

a) $\ln\left(x^4 + 1\right)$

b) $2x \ln\left(x^4 + 1\right)$

c) $\frac{2x}{x^4 + 1}$

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

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

28) Determine

$$\frac{d}{dx}\ln(\ln(2-\cos(x)))$$

a) $\dfrac{\cos(x)}{(2-\cos(x))\ln(2-\cos(x))}$

b) $\dfrac{\sin(x)}{\ln(2-\cos(x))}$

c) $\dfrac{\sin(x)}{(2-\cos(x))\ln(2-\cos(x))}$

d) $\dfrac{\sin(x)\ (2-\cos(x))}{\ln(2-\cos(x))}$

e) $-\dfrac{\cos(x)}{\ln(2-\cos(x))}$

Calculators ARE Permitted On This Portion Of The Exam
17 Questions - 50 Minutes

1) Give a value of c that satisfies the conclusion of the Mean Value Theorem for Derivatives for the function

$$f(x) = -2x^2 - x + 2$$

on the interval [1,3].

a) $\frac{9}{4}$

b) $\frac{3}{2}$

c) $\frac{1}{2}$

d) 2

e) $\frac{5}{4}$

2) The function

$$f(x) = 3x^3 + 2e^{(2x)}$$

is invertible. Give the derivative of f^{-1} at $x = 2$.

a) $9 + 4e^2$

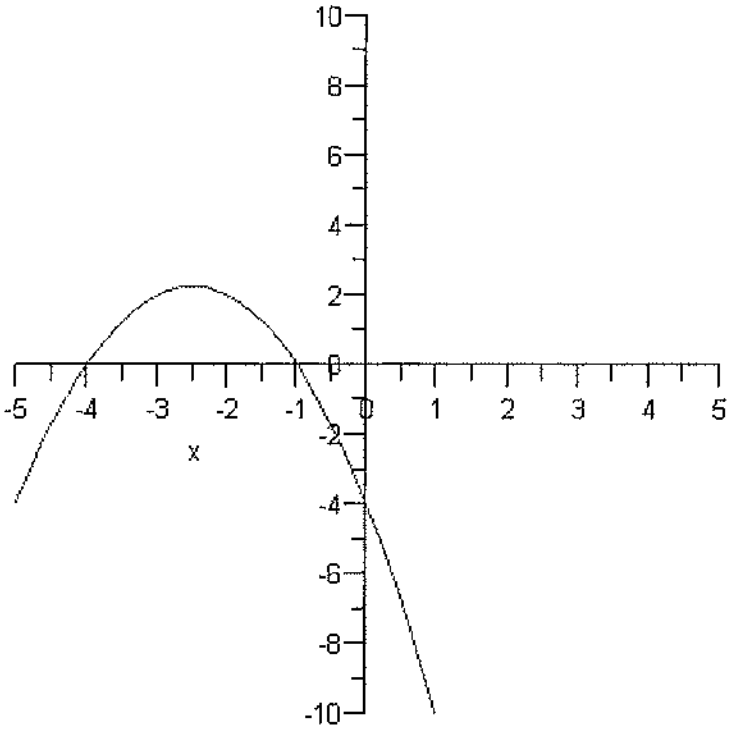
b) 4

c) $\frac{1}{9 + 4e^2}$

d) 1

e) $\frac{1}{4}$

3) The **derivative** of f is graphed below.



Give a value of x where f has a local maximum.

a) -4

b) -1

c) $\frac{-5}{2}$

d) *There is no such value of x.*

e) 1

4) Let

$$f(x) = \begin{cases} -x + 5 & x < -2 \\ x^2 + 1 & -2 \leq x \text{ and } x \leq 1 \\ 2x^3 - 1 & 1 \leq x \end{cases}$$

Which of the following is (are) true?

1) f is continuous at $x = -2$.
2) f is differentiable at $x = 1$.
3) f has a local minimum at $x = 0$.
4) f has an absolute maximum at $x = -2$.

a) 2 and 4
b) 3 only
c) 2 only
d) 1 and 3
e) 1 and 4

5) Given

$$\left[\int_0^{50} 3\,f(x)\,dx = 3,\ \int_2^{50} f(x)\,dx = -4\right]$$

Determine

$$\int_0^2 f(x)\,dx$$

a) 10

b) -3

c) *There is not enough information.*

d) -6

e) 5

6) Give the approximate location of a local maximum for the function

$$f(x) = 3x^3 + 5x^2 - 3x$$

a) $(-1.357, 5.779)$

b) $(0.2457, -.3908)$

c) $(-1.357, 5.713)$

d) $(0.2457, -.3216)$

e) $(-1.357, -.3908)$

7) Give the approximate average value of the function

$$f(x) = 4x\ln(2x)$$

over the interval [1,4].

a) 19.71

b) 12.54

c) 16.71

d) 18.02182670

e) 18.71

8) The region enclosed by the graphs of

$$[y = x^3 - 1,\ y = x - 1]$$

is rotated around the y-axis to generate a solid. What is the volume of the solid?

a) 0.8380

b) 0.7855

c) 1.676

d) 1.047

e) 2.356

9) What is the approximate instantaneous rate of change of the function

$$f(t) = \int_0^{3t} \cos(x)\, dx$$

at $t = \pi/7$?

a) $-.9009$

b) -7.207

c) 3.473

d) 0.4341

e) -1.030

10) What is the error when the integral

$$\int_0^1 \sin(\pi x)\, dx$$

is approximated by the Trapezoidal rule with $n = 3$?

a) 0.011

b) 0.032

c) 0.109

d) 0.059

e) 0.051

11) The amount of money in a bank account is increasing at the rate of

$$R(t) = 10000\, e^{(0.06t)}$$

dollars per year, where t is measured in years. If $t = 0$ corresponds to the year 2005, then what is the approximate total amount of increase from 2005 to 2007.

a) \$18,350
b) \$4,500
c) \$21,250
d) \$32,560
e) \$16,250

12) A particle moves with acceleration

$$a(t) = 3t^2 - 2t$$

and its initial velocity is 0. For how many values of t does the particle change direction?

a) 3

b) 2

c) 1

d) 0

e) 4

13) At what approximate rate (in cubic meters per minute) is the volume of a sphere changing at the instant when the surface area is 5 square meters and the radius is increasing at the rate of 1/3 meters per minute?
a) 5.271

b) 1.700

c) 1.667

d) 1.080

e) 2.714

14) A rectangle has one side on the x-axis and the upper two vertices on the graph of

$$y = e^{(-2x^2)}$$

Give a decimal approximation to the maximum possible area for this rectangle.
a) 1.649

b) 1.

c) -1.

d) 0.5458

e) 0.6065

15) A rough approximation for ln(5) is 1.609. Use this approximation and differentials to approximate ln (128/25).
a) 1.633

b) 1.621

c) 1.632

d) 1.585

e) 1.597

16) The function

$$f(x) = \begin{cases} n x^3 - x & x \leq 1 \\ m x^2 + 5 & 1 < x \end{cases}$$

is differentiable everywhere. What is n?
a) -9

b) 13

c) -17

d) -11

e) -14

17) Which of the following functions has a vertical asymptote at x = -1 and a horizontal asymptote at y =

2?

a) $f(x) = \dfrac{2x^2 + 1}{x^2 - 1}$

b) $f(x) = \ln(2x + 2)$

c) $f(x) = e^{(x-1)} + 2$

d) $f(x) = \arctan(x - 1) + 2 - \dfrac{1}{2}\pi$

e) $f(x) = \dfrac{x - 1}{2x + 2}$