AP CALCULUS AB/BC MULTIPLE CHOICE QUESTIONS

1.

If $f(x)=\dfrac{x^2-9}{x+3}$ is continuous at $x=-3$, then $f(-3)=$

A. –3
B. 3
C. 0
D. 6
E. –6

2.

If $f(x)=2+|x-4|$, then $f'(4)=$

A. 2
B. 1
C. –1
D. 4
E. Nonexistent

3.

For what values of x is the graph of $f(x)=\dfrac{3}{2-x}$ concave downward?

A. No values of x.
B. $x<2$
C. $x>2$
D. $x<-2$
E. $x>-2$

4.

The shortest distance from the curve $y = \frac{4}{x}$ to the origin is :

A. 2
B. 4
C. $\sqrt{2}$
D. $2\sqrt{2}$
E. $\sqrt{2}/2$

5.

If $f(x) = (1+2x)^5$, then the fourth derivative of $f(x)$ is:

A. $5*2^5$
B. 0
C. $5!*2^4(1+2x)$
D. $5!(2)$
E. $5!(1+2x)$

6.

If $x + y = xy$, then $\frac{dy}{dx} =$

A. $\frac{1}{x-1}$
B. $\frac{1-y}{x-1}$
C. $\frac{2-x}{y}$
D. $x+y-1$
E. $\frac{y-1}{x-1}$

7.

The average value of $f(x) = \cos x$ on $[0, \frac{\pi}{2}]$ is:

A. $\dfrac{\pi}{4}$

B. $\dfrac{\pi}{2}$

C. 1

D. $\dfrac{3\pi}{2}$

E. $\dfrac{2}{\pi}$

8.

What is the 50$^{\text{th}}$ derivative of $\cos x$?

A. $-\cos x$

B. $\cos x$

C. $\sin x$

D. $-\sin x$

E. 0

9.

$\lim\limits_{h \to 0} \dfrac{(x+h)^4 - x^4}{h}$ at the point $x = 2$ is:

A. 64

B. 32

C. 16

D. 4

E. 0

10.

What is the domain of $f(x) = \ln\sqrt{\dfrac{x+3}{x-5}}$?

A. $x < -3$
B. $x \neq 4$
C. $x > 5$
D. $-3 < x < 5$
E. $x < -3$ or $x > 5$

11.

$\lim\limits_{x \to 3} \dfrac{x-3}{3-x}$ is:

A. –1
B. 0
C. 1
D. 3
E. Nonexistent

12.

A function whose derivative is a constant multiple of itself must be:

A. Quadratic
B. Linear
C. Logarithmic
D. Exponential
E. Periodic

13.

If $f'(x) > 0$ and $f''(x) > 0$ for all x, which statement is true about g, the inverse function of f?

A. g is not a function

B. g is increasing and concave up everywhere

C. g is decreasing and concave down everywhere

D. g is increasing and concave down everywhere

E. g is decreasing and concave up everywhere

14.

If $x + 7y = 29$ is the equation of the line normal to the graph of f at the point $(1, 4)$, then $f'(1) =$

A. 7

B. $\frac{1}{7}$

C. $\frac{-1}{7}$

D. $\frac{-7}{29}$

E. -7

15.

A particle travels in a straight line with a constant acceleration of $3\,m/s^2$. If the velocity of the particle is 10 m/s at time 2 seconds, how far does the particle travel during the time interval when its velocity increases from 4 m/s to 10 m/s?

A. 20 m

B. 14 m

C. 7 m

D. 6 m

E. 3 m

16.

A polynomial $p(x)$ has a relative maximum at (–2, 4), a relative minimum at (1, 1), a relative maximum at (5, 7), and no other critical points. How many real zeros does $p(x)$ have?

A. 1
B. 2
C. 3
D. 4
E. 5

17.

The average value of $\frac{1}{x}$ on $[1,3]$ is:

A. $\frac{1}{2}$
B. $\frac{2}{3}$
C. $\frac{\ln 2}{2}$
D. $\frac{\ln 3}{2}$
E. $\ln 3$

18.

If c is the number that satisfies the Mean Value Theorem for $f(x) = x^3 - 2x^2$ on [0, 2], then $c =$

A. 0
B. $\frac{1}{2}$
C. 1
D. $\frac{4}{3}$
E. 2

19.

The base of a solid is the region in the first quadrant enclosed by the parabola $y = 4x^2$, the line $x = 1$, and the $x-$axis. Each plane section of the solid perpendicular to the $x-$axis is a square. The volume of the solid is:

A. $\frac{4\pi}{3}$
B. $\frac{16\pi}{5}$
C. $\frac{4}{3}$
D. $\frac{16}{5}$
E. $\frac{64}{5}$

20.

If the graph of $y = x^3 + ax^2 + bx - 4$ has a point of inflection at $(1, -6)$, what is the value of b?

A. -3
B. 0
C. 1
D. 3
E. It cannot be determined.

21.

The region R in the first quadrant is enclosed by the lines $x=0$, $y=5$, and the graph of $y=x^2+1$. The volume of the solid generated when R is revolved about the $y-$axis is:

A. 6π
B. 8π
C. $\frac{32\pi}{3}$
D. 16π
E. $\frac{544\pi}{15}$

22.

If $f(x)=e^x$, then $\ln[f'(2)]=$

A. 2
B. 0
C. $\frac{1}{e^2}$
D. $2e$
E. e^2

23.

If $y^2-2xy=16$, then $\frac{dy}{dx}=$

A. $\frac{x}{y-x}$
B. $\frac{y}{x-y}$
C. $\frac{y}{y-x}$
D. $\frac{y}{2y-x}$
E. $\frac{2y}{x-y}$

24.

$$\lim_{h\to 0}\frac{\sin(x+h)-\sin x}{h}=$$

A. 1

B. $\sin x$

C. $\cos x$

D. 0

E. Nonexistent

25.

Bacteria in a certain culture increase at a rate proportional to the number present. If the number of bacteria doubles in three hours, in how many hours will the number of bacteria triple?

A. $\dfrac{3\ln 3}{\ln 2}$

B. $\dfrac{2\ln 3}{\ln 2}$

C. $\dfrac{\ln 3}{\ln 2}$

D. $\ln\left(\dfrac{27}{2}\right)$

E. $\ln\left(\dfrac{9}{2}\right)$

26.

The area of the region in the first quadrant enclosed by the graph of $y = x(1-x)$ and the $x-$axis is:

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{1}{6}$

D. $\frac{5}{6}$

E. 1

27.

A person 2 meters tall walks directly away from a streetlight that is 8 meters above the ground. If the person is walking at a constant rate and the person's shadow is lengthening at a rate of $\frac{4}{9}$ meters per second, at what rate, in meters per second, is the person walking?

A. $\frac{4}{27}$

B. $\frac{4}{9}$

C. $\frac{3}{4}$

D. $\frac{4}{3}$

E. $\frac{16}{9}$

28.

If $\frac{dy}{dx} = y\sec^2 x$ and $y = 5$ when $x = 0$, then $y =$

A. $e^{\tan x} + 4$
B. $e^{\tan x} + 5$
C. $\tan x + 5$
D. $\tan x + 5e^x$
E. $5e^{\tan x}$

29.

Let f and g be differentiable functions. If g is the inverse function of f, and if $g(-2) = 5$ and $f'(5) = -\frac{1}{2}$, then $g'(-2) =$

A. 2
B. $\frac{1}{2}$
C. $\frac{1}{5}$
D. $-\frac{1}{5}$
E. –2

30.

If $\int_1^4 f(x)\,dx = 6$, then $\int_1^4 f(5-x)\,dx =$

A. 6
B. 3
C. 0
D. –1
E. –6

31.

$$\int_0^1 x(x^2+2)^2\,dx =$$

A. $\frac{19}{2}$

B. $\frac{19}{3}$

C. $\frac{9}{2}$

D. $\frac{19}{6}$

E. $\frac{1}{6}$

32.

If $F(x)=\int_1^{x^2}\sqrt{1+t^3}\,dt$, then $F'(x)=$

A. $2x\sqrt{1+x^3}$

B. $2x\sqrt{1+x^6}$

C. $\sqrt{1+x^6}$

D. $\sqrt{1+x^3}$

E. $\int_1^{x^2}\frac{3t^2}{2\sqrt{1+t^3}}\,dt$

33.

If $f(x)=\ln\left(\sqrt{x}\right)$, then $f''(x)=$

A. $-\frac{2}{x^2}$

B. $-\frac{1}{2x^2}$

C. $-\frac{1}{2x}$

D. $-\frac{1}{2x^{3/2}}$

E. $\frac{2}{x^2}$

34.

Let $f(x)=\begin{cases}\sin x & x<0\\ x^2 & 0\le x<1\\ 2-x & 1\le x<2\\ x-3 & 2\le x\end{cases}$.

For what values of x is $f(x)$ discontinuous?

A. 0 only
B. 1 only
C. 2 only
D. 0 and 2 only
E. 0, 1, and 2

35.

$$\frac{d}{dx}\ln\left|\cos\left(\frac{\pi}{x}\right)\right|=$$

A. $\dfrac{-\pi}{x^2\cos\left(\dfrac{\pi}{x}\right)}$

B. $-\tan\left(\dfrac{\pi}{x}\right)$

C. $\dfrac{\pi}{x}\tan\left(\dfrac{\pi}{x}\right)$

D. $\dfrac{\pi}{x^2}\tan\left(\dfrac{\pi}{x}\right)$

E. $\dfrac{1}{\cos\left(\dfrac{\pi}{x}\right)}$

36.

Let R be the region between the graphs of $y=1$ and $y=\sin x$ from $x=0$ to $x=\frac{\pi}{2}$. The volume of the solid obtained by revolving R about the $x-$axis is given by:

A. $2\pi\int_0^{\frac{\pi}{2}} x\sin x\,dx$

B. $2\pi\int_0^{\frac{\pi}{2}} x\cos x\,dx$

C. $\pi\int_0^{\frac{\pi}{2}} (1-\sin x)^2\,dx$

D. $\pi\int_0^{\frac{\pi}{2}} \sin^2 x\,dx$

E. $\pi\int_0^{\frac{\pi}{2}} \left(1-\sin^2 x\right)dx$

37.

What is the 30th derivative of $y=\cos(3x)$?

A. $-3^{30}\cos(3x)$

B. $3^{30}\cos(3x)$

C. $-3^{29}\sin(3x)$

D. $2^{30}\sin(3x)$

E. $2^{31}\sin(3x)$

38.

If $y=\left(3x^3+2\right)^4$, then $\frac{dy}{dx}=$

A. $81x^4$

B. $4\left(3x^3+2\right)^3$

C. $4x^2\left(3x^3+2\right)^3$

D. $36x\left(3x^3+2\right)^3$

E. $36x^2\left(3x^3+2\right)^3$

39.

If $f'(x)=(x-1)(x+2)(3-x)$, which of the following is **not** true about $f(x)$?

A. $f(x)$ has a horizontal tangent at $x=1$

B. $f(x)$ is a polynomial of degree 4

C. $f(x)$ has a relative maximum at $x=3$

D. $f(x)$ is decreasing on the interval $(-2,1)$

E. $f(x)$ is concave up on the interval $(-2,1)$

40.

At the point of intersection of $y=\sin\left(x+\frac{\pi}{2}\right)$ and $y=1-\frac{x^2}{2}$, the tangent lines are:

A. Identical

B. Parallel

C. Perpendicular

D. Intersecting, but not perpendicular

E. None of the above.

41.

The graph of an even function passing through $(3,-2)$ must also contain:

A. $(-3,-2)$
B. $(-3,2)$
C. $(3,2)$
D. $(2,3)$
E. $(0,0)$

42.

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

A. 1
B. -2
C. -1
D. 0
E. 2

43.

$$\int 5^{2x}\,dx=$$

A. $\dfrac{5^{2x}}{\ln 5}+C$
B. $\dfrac{5^{2x}}{2\ln 5}+C$
C. $\dfrac{5^{2x+1}}{2x+1}+C$
D. $\dfrac{5^{2x}}{2}+C$
E. $(\ln 5)5^{2x}+C$

44.

Let $f(x)=\begin{cases}\dfrac{25-x^2}{5-x} & x\neq 5\\ 5 & x=5\end{cases}$. Which of the following is correct?

A. $f(x)$ is continuous at 5, since $f(x)$ is defined at $x=5$

B. $f(x)$ is continuous at 5, since $\lim_{x\to 5} f(x)$ exists

C. $f(x)$ is discontinuous at 5, since $f(5)$ does not exist

D. $f(x)$ is discontinuous at 5, since $\lim_{x\to 5} f(x)$ does not exist

E. $f(x)$ is discontinuous at 5, since $\lim_{x\to 5} f(x)\neq f(5)$

45.

If $y=\ln(2x+3)$, then $\dfrac{d^2y}{dx^2}=$

A. $\dfrac{2}{2x+3}$

B. $\dfrac{2}{(2x+3)^2}$

C. $\dfrac{4}{(2x+3)^2}$

D. $\dfrac{-4}{(2x+3)^2}$

E. $\dfrac{-2}{(2x+3)^2}$

46.

$\lim_{h\to 0}\dfrac{5^{2+h}-25}{h}=$

A. 0

B. 1

C. 25

D. $25\ln 5$

E. $25e^5$

47.

Which of the following is symmetric with respect to the origin?

A. $f(x) = \cos x$

B. $f(x) = \sin x$

C. $f(x) = x^3 - 2$

D. $f(x) = |x|$

E. $f(x) = 2^x$

48.

If $f(x) = \dfrac{\cos^2 x}{1 - \sin x}$, then $f'(x) =$

A. $\cos x$

B. $\sin x$

C. $-\sin x$

D. $2\sin x$

E. $-\cos x$

49.

If f is continuous on $[a,b]$, which of the following is **not** necessarily true?

I. f has a maximum on $[a,b]$

II. f has a minimum on $[a,b]$

III. $f'(c) = 0$ for some c between a and b

A. I only

B. II only

C. III only

D. I and II only

E. I, II, and III

50.

If $f(x)=10^{2x}$ and $g(x)$ is the inverse function of f, then $f\left(g\left(\log 2\right)\right)=$

A. $0.5\log 2$

B. $\log 2$

C. 2

D. 4

E. 0.25

51.

The slope of the tangent to the curve $y^3x+y^2x^2=6$ at (2, 1) is:

A. $\frac{-3}{2}$

B. -1

C. $\frac{-5}{14}$

D. $\frac{-3}{14}$

E. 0

52.

If $f(x)=\sin^2\left(3-x\right)$, then $f'(0)=$

A. $-2\cos 3$

B. $-2\sin 3\cos 3$

C. $6\cos 3$

D. $2\sin 3\cos 3$

E. $6\sin 3\cos 3$

53.

The solution to the differential equation $\dfrac{dy}{dx} = \dfrac{x^3}{y^2}$, where $y(2) = 3$, is:

A. $y = \sqrt[3]{\frac{3}{4}x^4}$

B. $y = \sqrt[3]{\frac{3}{4}x^4} + \sqrt[3]{15}$

C. $y = \sqrt[3]{\frac{3}{4}x^4} + 15$

D. $y = \sqrt[3]{\frac{3}{4}x^4 + 5}$

E. $y = \sqrt[3]{\frac{3}{4}x^4 + 15}$

54.

$\int (x-1)\sqrt{x}\, dx =$

A. $\frac{3}{2}\sqrt{x} - \frac{1}{\sqrt{x}} + C$

B. $\frac{2}{3}x^{\frac{3}{2}} + \frac{1}{2}x^{\frac{1}{2}} + C$

C. $\frac{2}{5}x^{\frac{5}{2}} - \frac{2}{3}x^{\frac{3}{2}} + C$

D. $\frac{1}{2}x^2 + 2x^{\frac{3}{2}} - x + C$

E. $\frac{1}{2}x^2 - x + C$

55.

What is $\lim_{x\to\infty}\dfrac{x^2-4}{2+x-4x^2}$?

A. –2
B. –0.25
C. 0.5
D. 1
E. DNE (Does Not Exist)

56.

If r is positive and increasing, for what value of r is the rate of increase of r^3 twelve times that of r?

A. $\sqrt[3]{4}$
B. 2
C. 6
D. $2\sqrt{3}$
E. $\sqrt[3]{12}$

57.

The average value of the function $f(x)=e^{-x^2}$ on the interval $[-1,1]$ is:

A. 0
B. 0.368
C. 0.747
D. 1
E. 1.494

58.

The area of the region in the first quadrant between the graph of $y = x\sqrt{4-x^2}$ and the $x-$axis is:

A. $\frac{2}{3}\sqrt{2}$

B. $\frac{8}{3}$

C. $2\sqrt{2}$

D. $2\sqrt{3}$

E. $\frac{16}{3}$

59.

If $\frac{dy}{dx} = y\cos x$ and $y = 3$ when $x = 0$, then $y =$

A. $e^{\sin x} + 2$

B. $e^{\sin x} + 3$

C. $3e^{\sin x}$

D. $\sin x + 3$

E. $\sin x + 3e^{x}$

60.

The third-degree Taylor polynomial about $x = 0$ of $\ln(1-x)$ is:

A. $-x - \frac{x^2}{2} - \frac{x^3}{3}$

B. $1 - x + \frac{x^2}{2}$

C. $x - \frac{x^2}{2} + \frac{x^3}{3}$

D. $-1 + x - \frac{x^2}{2}$

E. $-x + \frac{x^2}{2} - \frac{x^3}{3}$

61.

The line perpendicular to the tangent of the curve represented by the equation $y = x^2 + 6x + 4$ at the point $(-2,-4)$ also intersects the curve at $x =$

A. -6

B. $\frac{-9}{2}$

C. $\frac{-7}{2}$

D. -3

E. $\frac{-1}{2}$

62.

If $y = x + \sin(xy)$, then $\frac{dy}{dx} =$

A. $1+\cos(xy)$

B. $1+y\cos(xy)$

C. $\frac{1}{1-\cos(xy)}$

D. $\frac{1}{1-x\cos(xy)}$

E. $\frac{1+y\cos(xy)}{1-x\cos(xy)}$

63.

$$\lim_{h\to 0}\frac{\cos\left(\frac{\pi}{2}+h\right)-\cos\left(\frac{\pi}{2}\right)}{h} =$$

A. -1

B. 0

C. 1

D. DNE

E. $\frac{-\sqrt{2}}{2}$

64.

Which of the following is true about $f(x) = x^4 - 2x^3$?

A. No relative extrema
B. 1 point of inflection, 2 relative extrema
C. 2 points of inflection, 1 relative extremum
D. 2 points of inflection, 2 relative extrema
E. 2 points of inflection, 3 relative extrema

65.

Which of the following are anti-derivatives of $\frac{\ln^2 x}{x}$?

I. $\frac{\ln^3 x}{3}$

II. $\frac{\ln^3 x}{3} + 6$

III. $\frac{2\ln x - \ln^2 x}{x^2}$

A. I only
B. III only
C. I and II only
D. I and III only
E. II, and III

66.

A particle moves along the $x-$axis so that at any time t, its velocity is given by $v(t) = \ln(t+1) - 2t + 1$. The total distance traveled by the particle from $t = 0$ to $t = 2$ is:

A. 0.6667
B. 0.704
C. 1.540
D. 2.667
E. 2.901

67.

If f is differentiable at $x = a$, which of the following could be false?

A. f is continuous at $x = a$

B. $\lim_{x \to a} f(x)$ DNE

C. $\lim_{x \to a} \dfrac{f(x) - f(a)}{x - a}$ exists

D. $f'(a)$ is defined

E. $f''(a)$ is defined

68.

If f is defined by $f(x) = \sqrt{x^3 + 2}$ and g is an anti-derivative of f such that $g(3) = 5$, then $g(1) =$

A. –3.268

B. –1.585

C. 1.732

D. 6.585

E. 11.585

69.

Let $g(t) = 100 + 20\sin\left(\dfrac{\pi t}{2}\right) + 10\cos\left(\dfrac{\pi t}{6}\right)$. For $0 \le t \le 8$, g is decreasing most rapidly at:

A. 0.949

B. 2.017

C. 3.103

D. 5.965

E. 8.000

70.

$\int_{0}^{\infty} e^{-2t}\,dt$ is:

A. –1
B. –0.5
C. 0.5
D. 1
E. Divergent

71.

If F' is continuous for all x, then $\lim_{h\to 0}\frac{1}{h}\int_{a}^{a+h} F'(x)\,dx =$

A. 0
B. $F(0)$
C. $F(a)$
D. $F'(0)$
E. $F'(a)$

72.

The closed area bounded by the curve $y = e^{2x}$ and the lines $x = 1$ and $y = 1$ is:

A. $\frac{2-e^2}{2}$
B. $\frac{e^2-3}{2}$
C. $\frac{3-e^2}{2}$
D. $\frac{e^2-2}{2}$
E. $\frac{e^2-1}{2}$

73.

If $\frac{d}{dx} f(x) = g(x)$ and if $h(x) = x^2$, then $\frac{d}{dx} f\left(h(x)\right) =$

A. $g\left(x^2\right)$

B. $2xg(x)$

C. $g'(x)$

D. $2xg\left(x^2\right)$

E. $x^2 g\left(x^2\right)$

74.

Which integral gives the length of the graph of $y = \sqrt{x}$ between $x = a$ and $x = b$, where $a \le x \le b$?

A. $\int_a^b \sqrt{x^2 + x}\, dx$

B. $\int_a^b \sqrt{x + \sqrt{x}}\, dx$

C. $\int_a^b \sqrt{x + \frac{1}{2\sqrt{x}}}\, dx$

D. $\int_a^b \sqrt{1 + \frac{1}{4x}}\, dx$

E. $\int_a^b \sqrt{1 + \frac{1}{2\sqrt{x}}}\, dx$

75.

Which of the following are true about $g(x)=\int_1^x 100\left(t^2-3t+2\right)e^{-t^2}\,dt$?

I. g is increasing on (1, 2)

II. g is decreasing on (2, 3)

III. $g(3)<0$

A. I only
B. II only
C. III only
D. II and III only
E. I, II, and III

76.

The area of one loop of the graph of the polar equation $r=2\sin(3\theta)$ is given by which of the following?

A. $4\int_0^{\frac{\pi}{3}}\sin^2(3\theta)\,d\theta$

B. $2\int_0^{\frac{\pi}{3}}\sin(3\theta)\,d\theta$

C. $2\int_0^{\frac{\pi}{3}}\sin^2(3\theta)\,d\theta$

D. $2\int_0^{\frac{2\pi}{3}}\sin^2(3\theta)\,d\theta$

E. $2\int_0^{\frac{2\pi}{3}}\sin(3\theta)\,d\theta$

77.

A point (x, y) is moving along a curve $y = f(x)$. At the instant when the slope of the curve is $\frac{-1}{3}$, the $x-$coordinate of the point is increasing at the rate of 5 units per second. The rate of change, in units per second, of the $y-$coordinate of the point is:

A. $-\frac{5}{4}$

B. $-\frac{1}{3}$

C. $\frac{1}{3}$

D. $\frac{3}{5}$

E. $\frac{-5}{3}$

78.

Which of the following series converges to 2?

I. $\sum_{n=1}^{\infty} \frac{2n}{n+1}$

II. $\sum_{n=1}^{\infty} \frac{-8}{(-3)^n}$

III. $\sum_{n=0}^{\infty} \frac{1}{2^n}$

A. I only
B. II only
C. III only
D. I and III only
E. II and III only

79.

What are the values of x for which the series $\sum_{n=1}^{\infty} \frac{n3^n}{x^n}$ converges?

A. All x except $x = 0$
B. $|x| = 3$
C. $-3 \le x \le 3$
D. $|x| > 3$
E. The series diverges for all x.

80.

Let $y = f(x)$ be the solution to the differential equation $\frac{dy}{dx} = \arcsin(xy)$ with the initial condition $f(0) = 2$. What is the approximation for $f(1)$ if Euler's method is used, starting at $x = 0$ with a step size of 0.5?

A. 2
B. $2 + \frac{\pi}{6}$
C. $2 + \frac{\pi}{4}$
D. $2 + \frac{\pi}{2}$
E. 3

81.

If the function g is defined by $g(x) = \int_0^x \sin(t^2)\,dt$ on the closed interval $[-1, 3]$, then g has a local minimum at $x =$

A. 0
B. 1.084
C. 1.772
D. 2.171
E. 2.507

82.

The volume generated by revolving about the $x-$axis the region enclosed by the graphs of $y=2x$ and $y=2x^2$, for $0 \le x \le 1$, is:

A. $\pi\int_0^1 \left(2x-x^2\right)^2 dx$

B. $\pi\int_0^1 \left(4x^2-4x^4\right) dx$

C. $2\pi\int_0^1 x\left(2x-x^2\right) dx$

D. $\pi\int_0^2 \left(\sqrt{\frac{y}{2}}-\frac{y}{2}\right)^2 dy$

E. $\pi\int_0^2 \left(\frac{y}{2}-\frac{y^2}{2}\right)^2 dy$

83.

Two particles start at the origin and move along the $x-$axis. For $0 \le t \le 10$, their respective position functions are given by $x_1 = \sin t$ and $x_2 = e^{-2t} - 1$. For how many values of t do the particles have the same velocity?

A. None
B. One
C. Two
D. Three
E. Four

84.

Find the absolute extrema of $f(x) = 8x^3 + 21x^2 - 12x + 18$ on $[-3,1]$.

A. Absolute max at $x = \frac{1}{4}$; Absolute min at $x = -2$

B. Absolute max at $x = -2$; Absolute min at $x = \frac{1}{4}$

C. Absolute min at $x = \frac{-7}{8}$; No absolute max

D. Absolute max at $x = \frac{-7}{8}$; No absolute min

E. Absolute max at $x = \frac{1}{4}$; Absolute min at $x = \frac{-7}{8}$

85.

$\ln(x-5) < 0$ if and only if:

A. $x > 6$

B. $x < 6$

C. $0 < x < 6$

D. $5 < x < 6$

E. $x > 5$

86.

If the function f is defined by $f(x) = x^7 - 2$, then f^{-1}, the inverse of f, is:

A. $\frac{1}{\sqrt[7]{x} + 2}$

B. $\frac{1}{\sqrt[7]{x+2}}$

C. $\sqrt[7]{x-2}$

D. $\sqrt[7]{x} - 2$

E. $\sqrt[7]{x+2}$

87.

$$\lim_{x \to 0} \frac{e^{3x} - 1}{\tan x} =$$

A. -1
B. 0
C. 1
D. 3
E. It does not exist

88.

A tank is being filled with water at the rate of $300\sqrt{t}$ gallons per hour with $t > 0$, measured in hours. If the tank is originally empty, how many gallons of water are in the tank after 4 hours?

A. 600
B. 900
C. 1200
D. 1600
E. 2400

89.

The region in the first quadrant enclosed by the graphs of $y = x$ and $y = 2\sin x$ is revolved about the $y-$axis. The volume of the solid generated is:

A. 1.895
B. 2.126
C. 5.245
D. 6.678
E. 13.355

90.

If $f(x) = x\sqrt[3]{x}$, then $f'(x) =$

A. $4x^3$

B. $\frac{3}{7}x^{\frac{7}{3}}$

C. $\frac{4}{3}x^{\frac{1}{3}}$

D. $\frac{1}{3}x^{\frac{1}{3}}$

E. $\frac{1}{3}x^{\frac{-2}{3}}$

91.

If $k > 0$ and $\int_k^6 \frac{1}{x+2}\,dx = \ln k$, then $k =$

A. 1
B. 2
C. 3
D. 4
E. 5

92.

The region enclosed by the line $x + y = 1$ and the coordinate axes is rotated about the line $y = -1$. The volume of the solid is:

A. $\frac{17\pi}{2}$

B. 3π

C. $\frac{2\pi}{3}$

D. $\frac{3\pi}{4}$

E. $\frac{4\pi}{3}$

93.

$y = \sin x + \cos x$ is a solution of:

I. $y + \frac{dy}{dx} = 2\sin x$

II. $y + \frac{dy}{dx} = 2\cos x$

III. $\frac{dy}{dx} - y = -2\sin x$

A. I only
B. II only
C. III only
D. I and III
E. II and III

94.

If $f(x) = \begin{cases} n + e^{2x} & x \ge 0 \\ 4 + mx & x < 0 \end{cases}$ is differentiable at $x = 0$, then $f(n-m) =$

A. $2 + e$
B. $3 + e^2$
C. e^2
D. $2e$
E. e^3

95.

If $\frac{dy}{dx} = \sin x^3$, then $\frac{d^2y}{dx^2} =$

A. $3x^2 \cos x^3$
B. $-3x^2 \cos\left(x^3\right)$
C. $x^2 \cos\left(3^2\right)$
D. $-x^2 \cos\left(3^2\right)$
E. $\cos\left(x^3\right)$

96.

$$\lim_{x\to-\infty}\frac{\sqrt{1+x^2}}{3x-2}=$$

A. -1

B. $\frac{1}{5}$

C. 1

D. $\frac{-1}{3}$

E. $\frac{1}{3}$

97.

Find the value of a if $\int_0^{\frac{\pi}{2}}\frac{\cos(ax)}{2+\sin(ax)}dx=\ln\left(\frac{3}{2}\right)$

A. π

B. 1

C. $1+\pi$

D. $\sqrt{2}$

E. $1+e$

98.

What is the anti-derivative of 3^x ?

A. $\dfrac{3^x}{\ln 3}+\ln 3$

B. $\dfrac{3^{3x}}{\ln 3}+\ln 3$

C. $\dfrac{x^3}{\ln 3}+\dfrac{1}{\ln 3}$

D. $x+3\ln 3$

E. $3^x+\ln 3$

99.

The base of a solid is the region in the first and second quadrants bounded by the graph of $y=1-x^2$ and the $x-$axis. If the cross-sections of the solid perpendicular to the $x-$axis are squares, what is the volume of the solid?

A. 1.333

B. 1.269

C. 1.066

D. 0.933

E. 1.121

100.

At what value of x are the tangent lines to the graphs of $f(x)=\ln x$ and $g(x)=6^x$ parallel?

A. -1

B. 0.5

C. 1.2

D. 0.32

E. 0.43

101.

The average value of $f(x) = \sin^2(3x) + x$ on $[0, \pi]$ is:

A. 2.07
B. 1.05
C. 3.3
D. 1.23
E. 1.9

102.

The base of a solid is the region in the first quadrant bounded by the graph of $y = -x^2 + 5x - 4$ and the $x-$axis. If cross-sections perpendicular to the $x-$axis are equilateral triangles, what is the volume of the solid?

A. 1.871
B. 2.320
C. 1.555
D. 3.507
E. 2.000

103.

A speedboat travels on a river. Its speed v, in miles per hour, is given below. Using a left Riemann sum, approximate the total distance traveled by the speedboat from $t = 0.5$ to $t = 3$.

t	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**
v	32	30	16	22	20	24	26

A. 85
B. 56
C. 86
D. 78
E. 66

104.

$\lim\limits_{x\to\infty} \dfrac{3x^4+5x-3}{-3x^5-x-1} =$

A. 1

B. ∞

C. -1

D. 0

E. $\dfrac{-4}{5}$

105.

$\displaystyle\int_0^{0.25} \frac{32}{1+16x^2}\,dx =$

A. 0

B. 2π

C. -2π

D. 6π

E. 4π

106.

The derivative of $2\csc x - 5\sec x$ is:

A. $-5\csc x - 2\sec x$

B. $-5\sec x\tan x - 2\csc x\cot x$

C. $-5(\sec x)^2 - 2(\csc x)^2$

D. $-5\sec x\tan x + 2\csc x\cot x$

E. $-5(\tan x)^2 - 3(\cot x)^2$

107.

The derivative of $\frac{x^3-1}{x^3+1}$ is:

A. $\frac{3x^2}{4\left(x^3+1\right)^2}$

B. $\frac{12x^2-1}{8\left(x^3+1\right)^2}$

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

D. $\frac{6x^2}{\left(1+x^3\right)^2}$

E. $\frac{24x^2-1}{8\left(x^3+1\right)^2}$

108.

$\lim_{x\to 3}\frac{x-3}{x^2-2x-3}=$

A. 0

B. 1

C. $\frac{1}{4}$

D. ∞

E. None of the above.

109.

$\lim_{x\to 0}\frac{|x|}{x}$ is:

A. 0

B. Nonexistent

C. 1

D. –1

E. None of the above.

110.

$\lim_{x \to 7} \frac{x-7}{\sqrt{x}-7}$ is

A. $2\sqrt{7}$

B. $\sqrt{7}$

C. 0

D. $-2\sqrt{7}$

E. Nonexistent.

111.

$\lim_{x \to 1} \frac{x}{\ln x}$ is:

A. 0

B. $\frac{1}{e}$

C. 1

D. e

E. Does not exist.

112.

If $a \neq 0$, then $\lim_{x \to a} \frac{x^2 - a^2}{x^4 - a^4}$ is:

A. $\frac{1}{a^2}$

B. $\frac{1}{2a^2}$

C. $\frac{1}{6a^2}$

D. 0

E. Does not exist.

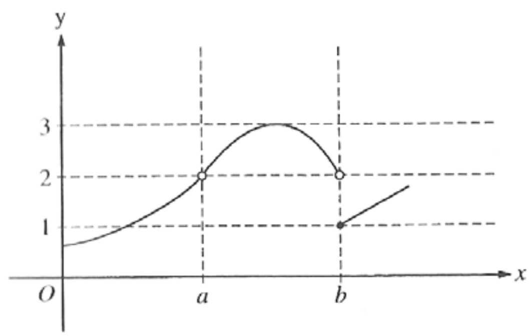
113.

$$\lim_{x\to\infty}\frac{x^3-2x^2+3x-4}{4x^3-3x^2+2x-1}=$$

A. 4
B. 1
C. 0.25
D. 0
E. –1

114.

Which of the following statements about f, shown in the graph below, is true?



A. $\lim_{x\to a} f(x)=\lim_{x\to b} f(x)$
B. $\lim_{x\to a} f(x)=2$
C. $\lim_{x\to b} f(x)=2$
D. $\lim_{x\to b} f(x)=1$
E. $\lim_{x\to a} f(x)$ does not exist.

115.

Let $f(x)=4-3x$. Which of the following is equal to $f'(-1)$?

A. –7
B. 7
C. –3
D. 3
E. Does not exist.

116.

Which of the following is true about $f(x) = x^{\frac{4}{5}}$ at $x = 0$?

A. It has a corner

B. It has a cusp

C. It has a vertical tangent

D. It is discontinuous

E. $f(0)$ does not exist

117.

Which of the following is true about $f(x) = |x|$?

I. f is continuous at $x = 0$

II. f is differentiable at $x = 0$

III. f has an absolute minimum at $x = 0$.

A. I only

B. II only

C. III only

D. I and III only

E. II and III only

118.

If the normal line to f at (1, 2) passes through (–1, 1), then $f'(1) =$

A. –2

B. 2

C. –0.5

D. 0.5

E. 3

119.

Find $\frac{dy}{dx}$ if $y = \frac{4x-3}{2x+1}$

A. $\frac{10}{(4x-3)^2}$

B. $-\frac{10}{(4x-3)^2}$

C. $\frac{10}{(2x+1)^2}$

D. $-\frac{10}{(2x+1)^2}$

E. 2

120.

Let $f(x) = 1 - 3x^2$. Which of the following equals $f'(1)$?

A. –6

B. –5

C. 5

D. 6

E. Does not exist.

121.

The 7th derivative of $y = -\sin x$ is:

A. y

B. $\frac{dy}{dx}$

C. $\frac{d^2y}{dx^2}$

D. $\frac{d^3y}{dx^3}$

E. None of the above.

122.

Find $\frac{dy}{dx}$ if $y = \frac{4}{x^3}$.

A. $-4x^2$

B. $\frac{-12}{x^2}$

C. $\frac{12}{x^2}$

D. $\frac{12}{x^4}$

E. $\frac{-12}{x^4}$

123.

Find $(fg)'$ at $x = 3$ if

	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
$x=1$	4	2	5	0.5
$x=3$	7	–4	1.5	–1

A. $\frac{5}{2}$

B. $\frac{-3}{2}$

C. -13

D. 12

E. $\frac{21}{2}$

124.

$\lim_{x\to 1}\frac{\ln(x+1)-\ln 2}{x-1}=$

A. 0

B. $\frac{d}{dx}\left[\ln(x+1)\right]$

C. $f\,'(1)$ if $f(x)=\ln(x+1)$

D. 1

E. The limit does not exist.

125.

Find $\frac{d^2y}{dx^2}$ if $f(x)=(2x+3)^4$

A. $4(2x+3)^3$

B. $8(2x+3)^3$

C. $12(2x+3)^3$

D. $24(2x+3)^2$

E. $48(2x+3)^2$

126.

Find $\frac{dy}{dx}$ if $y=4\sin^2(3x)$

A. $8\sin(3x)$

B. $24\sin(3x)$

C. $8\sin(3x)\cos(3x)$

D. $12\sin(3x)\cos(3x)$

E. $24\sin(3x)\cos(3x)$

127.

If $x^2 + y^2 = 25$, what is the value of $\frac{d^2y}{dx^2}$ at (4, 3)?

A. $-\frac{25}{27}$

B. $-\frac{7}{27}$

C. $\frac{7}{27}$

D. $\frac{3}{4}$

E.

c

128.

The instantaneous rate of change of $f(x) = \frac{x^2 - 2}{x - 1}$ at $x = 2$ is:

A. –2

B. $\frac{1}{6}$

C. $\frac{1}{2}$

D. 2

E. 6

129.

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

A. $\frac{4 - 3y}{2y - 3x}$

B. $\frac{3x - 4}{2x}$

C. $\frac{3y - x}{2}$

D. $\frac{3y - 4}{2y - 3x}$

E. $\frac{4 + 3y}{2y + 3x}$

130.

Suppose $f(x)$ is continuous on $[0,2]$ and $f(0)=1$, $f(1)=k$, $f(2)=2$. The equation $f(x)=\frac{1}{2}$ has at least two solutions in $(0,2)$ if $k=$

A. 0
B. 0.5
C. 1
D. 2
E. 3

ANSWER KEY – last updated 03-20-2011

ID		ID		ID		ID		ID		ID	
001	E	026	C	051	C	076	C	101	A	126	E
002	E	027	D	052	B	077	E	102	D	127	A
003	C	028	E	053	E	078	C	103	B	128	D
004	D	029	E	054	C	079	D	104	D	129	D
005	C	030	A	055	B	080	C	105	B	130	A
006	B	031	D	056	B	081	E	106	B		
007	E	032	B	057	C	082	B	107	D		
008	A	033	B	058	B	083	D	108	C		
009	B	034	C	059	C	084	B	109	B		
010	E	035	D	060	A	085	D	110	C		
011	A	036	E	061	B	086	E	111	E		
012	D	037	A	062	E	087	D	112	B		
013	D	038	E	063	A	088	D	113	C		
014	A	039	E	064	C	089	C	114	B		
015	B	040	A	065	C	090	C	115	C		
016	B	041	A	066	C	091	B	116	B		
017	D	042	B	067	E	092	E	117	D		
018	D	043	B	068	B	093	E	118	A		
019	D	044	E	069	B	094	B	119	C		
020	B	045	E	070	C	095	A	120	A		
021	C	046	D	071	E	096	D	121	D		
022	A	047	B	072	B	097	B	122	E		
023	C	048	A	073	D	098	A	123	C		
024	C	049	C	074	D	099	C	124	C		
025	A	050	B	075	C	100	D	125	E		