1) Find

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

a) $-4 \sin(4x)$

b) 0

c) $-4 \cos(4x)$

d) $4 \cos(4x)$

e) $4 \sin(4x)$

2) The function g is defined by the formula

$$g(x) = \int_0^x e^{3t} \, dt$$

Find the slope of the tangent line at $x = 1$.

a) e^3

b) $3e^3$

c) $\frac{1}{3} e^3$

d) $\frac{1}{3} (e^3 - 1)$

e) $e^3 - 1$

3) Find

$$\lim_{x \to \infty} \left(\frac{3x - 1}{\sqrt{x^2 + 9}} \right)$$

a) 3

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

c) 1

d) $-\frac{1}{9}$

e) The limit does not exist.

4) The given function f has a removable discontinuity at $x = -5$. Find A.

$$f(x) = \begin{cases} 5x^2 + 8 & x < -5 \\ 8x & x = -5 \\ Ax + 8 & -5 < x \end{cases}$$

a) -4

b) 5

c) -15

d) -25

e) -5

5) If $f'(x) = -5(x-4)^2(x-8)$ which of the following is true about $y = f(x)$?

a) f has a local minimum at $x = 4$ and a point of inflection at $x = 8$.

b) f has a local minimum at $x = 4$ and a local maximum at $x = 8$.

c) f has a point of inflection at $x = 4$ and a local minimum at $x = 8$.

d) f has a point of inflection at $x = 4$ and a local maximum at $x = 8$.

e) f has a local maximum at $x = 4$ and a local minimum at $x = 8$.

6) Find $f'(9)$, given that

$$f(x) = 2x^2 + 5\sqrt{x}$$

a) 177

b) 207

c) $\frac{221}{6}$

d) 51

e) $\frac{113}{3}$

7) Find the average value of the given function *f* over the interval [0, 3].

$$f(x) = e^{7x}$$

a) $\frac{1}{7}\left(e^{21} - 1\right)$

b) $\frac{1}{21}\left(e^{21} - 1\right)$

c) $\frac{1}{21}e^{21}$

d) $\frac{1}{3}\left(e^{21} - 1\right)$

e) $\frac{1}{7}e^{21}$

8) Find $f'(0)$, given that

$$f(x) = 2^x \ln\left(5\,e^x\right)$$

a) $\ln(5) + 1$

b) 1

c) $\ln(2)\ln(5) + 1$

d) $\ln(2)\ln(5) + 2$

e) $\ln(10) + 1$

9) Find $f'(1)$, given that

$$f(x) = \frac{x^2 + 7}{(8x)}$$

a) $\frac{15}{64}$

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

c) $\frac{1}{64}$

d) $\frac{15}{8}$

e) $\frac{7}{4}$

10) Find

$$\lim_{x \to 0}\left(\frac{\sin(8x)\cos(x) - \sin(8x)}{x^2}\right)$$

a) 1

b) 8

c) -8

d) The limit does not exist.

e) 0

11) Given the following curve, find $\frac{d^2y}{dx^2}$.

$$7x + y^2 = 15$$

a) $-\frac{7}{2y^2}$
b) $\frac{7}{2y^2}$
c) $-\frac{49}{4y^3}$
d) $\frac{49}{4y^3}$
e) $\frac{49}{2y^3}$

12) Given that $f(x) = 6\sin^2(3x)$, find $f''\left(\frac{1}{18}\pi\right)$.

a) $18\sqrt{2}$
b) 0
c) 54
d) 18
e) $18\sqrt{3}$

13) Find the midpoint rectangular approximation for $\int_0^3 2x^3\,dx$ using 3 subintervals of equal length.

a) $\frac{153}{4}$
b) 72
c) $\frac{153}{2}$
d) 144
e) $\frac{25}{4}$

14) Find the derivative of the function $y = \cos^{-1}(5x)$.

a) $\frac{5}{\sqrt{1+25x^2}}$
b) $-\frac{5}{\sqrt{1-25x^2}}$
c) $-5\sin(5x)$
d) $5\sin(5x)$
e) $-5\sin^{-1}(5x)$

15) Find

$$\frac{\partial}{\partial x}\left(\int_2^x \ln(4+t)\,dt\right)$$

a) $-\ln(4+x)$
b) $\ln(4+x)$

c) $2\ln(4+x)$

d) $\dfrac{1}{4+x}$

e) $\dfrac{2}{4+x}$

16) Find the equation of the tangent line to the given curve at the point (0, 7).

$$y = 5x^2 + 10x + 7$$

a) $y = 10x + 7$

b) $y = 10x - 7$

c) $y = 7x + 5$

d) $y = -5x + 7$

e) $y = 20x$

17) If $g(f(x)) = x$, $g(4) = 2$ and $g'(4) = 12$, then $f'(2)$ is

a) $-\dfrac{1}{4}$

b) $-\dfrac{1}{12}$

c) $\dfrac{1}{4}$

d) $\dfrac{1}{3}$

e) $\dfrac{1}{12}$

18) Given that $\int_0^{36} e^x \, dx = m$

find $\int_0^6 x\, e^{x^2} \, dx$

a) m^2

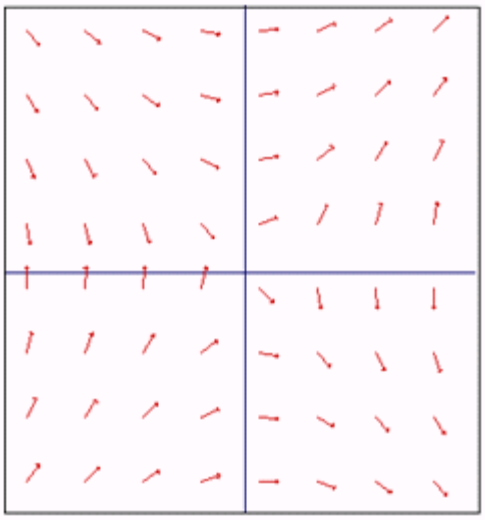
b) m

c) $2m$

d) $\dfrac{1}{2}m^2$

e) $\dfrac{1}{2}m$

19) Which of the following differential equations corresponds to the slope field shown in the figure below?



a) $\frac{dy}{dx} = -\frac{y}{x}$

b) $\frac{dy}{dx} = \frac{1}{5} x y$

c) $\frac{dy}{dx} = \frac{1}{10} x y$

d) $\frac{dy}{dx} = \frac{y}{x}$

e) $\frac{dy}{dx} = \frac{x}{y}$

20) Given the following function, with $x > 0$, on which interval is the function decreasing?

$$f(x) = \frac{x}{\ln(7x)}$$

a) $\left(1, \frac{1}{7} e\right)$

b) $\left(0, \frac{1}{7}\right)$

c) $(1, 7)$

d) $\left(0, \frac{1}{7} e\right)$

e) $(1, 7e)$

21) Find the area of the region enclosed by the graphs of

$$y = 3x^2$$
and
$$y = 2x$$

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

b) $\frac{2}{27}$

c) $\frac{9}{8}$

d) $\frac{4}{27}$

e) $\frac{8}{27}$

22) Find

$$\int_1^4 \frac{5}{\sqrt{x}}\,dx$$

a) 39
b) 5
c) 10
d) 20
e) 40

23) The region bounded by the following graph

$$y = 2\sin(x)$$

and the x-axis, for $0 \le x \le \frac{1}{2}\pi$, is rotated about the line $y = -3$. The volume of this solid can be represented by:

a) $2\pi \int_0^{\frac{1}{2}\pi} (4\sin(x)^2 + 3)\,dx$

b) $\pi \int_0^{\frac{1}{2}\pi} ((2\sin(x) + 3)^2 - 9)\,dx$

c) $\pi \int_0^{\frac{1}{2}\pi} (4\sin(x)^2 - 9)\,dx$

d) $2\pi \int_0^{\frac{1}{2}\pi} 4\sin(3 + x)^2\,dx$

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

24) The side of a cube is expanding at a constant rate of 5 inches per second. What is the rate of change of the volume, in in^3 per second, when the total surface area of the cube is 54 in^2?
a) 90
b) 45
c) 135
d) 15
e) 270

25) The solution to the differential equation

$$\frac{dy}{dx} = 4xy$$

with the initial condition $y(0) = 6$ is
a) $6\ln(2x^2)$
b) $e^{2x^2} + 5$
c) $\ln(2x^2 + 6)$

d) $6\,e^{2x^2}$

e) $e^{2x^2} + 6$

26) $\int \sec^2(6x)\,dx =$

a) $\frac{1}{6}\tan^2(6x) + C$

b) $-6\tan(6x) + C$

c) $6\tan^2(6x) + C$

d) $\frac{1}{6}\tan(6x) + C$

e) $6\tan(6x) + C$

27) The position of a particle moving along a horizontal line is given by

$$x(t) = 2(t-4)^3$$

What is the maximum speed of the particle for $0 \leq t \leq 10$?

a) 384

b) 72

c) 96

d) 32

e) 216

28) Using the information below, find $\frac{dz}{dt}$ when $t = 0$.

$$z = \ln(y)$$
$$y = 4x^2 + 4$$
$$x = 2t + 1$$

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

b) 8

c) 16

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

e) 2

29) If f is a differentiable function and $f(0) = -3$ and $f(5) = 6$, then which of the following must be true?

I. There exists a c in [0,5] where $f(c) = 0$.
II. There exists a c in [0,5] where $f'(c) = 0$.
III. There exists a c in [0,5] where $f'(c) = 9/5$.

a) I, II and III
b) II only
c) II and III only
d) I and III only
e) I only

30) Which of the following function(s) is continuous and differentiable?

I. $f(x) = \frac{8}{\sqrt{x}}$

II. $g(x) = x\,|x|$

III. $h(x) = \begin{cases} 6x + 1 & x \leq 0 \\ x^2 + 1 & 0 < x \end{cases}$

a) I only
b) II only
c) III only
d) I and II only
e) I and III only

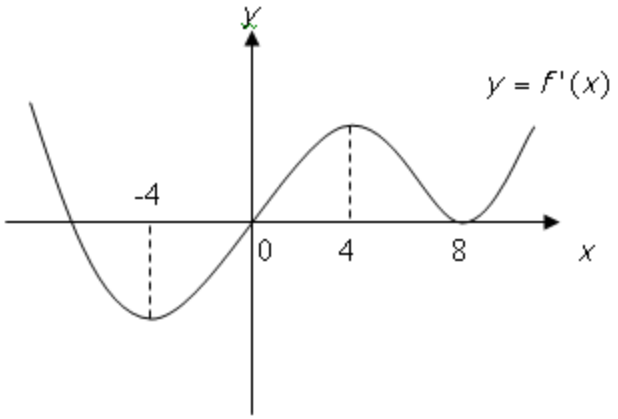
31) The area of the region in the first quadrant bounded by the graphs of $y = 3\cos(x)$, $y = 3\sin(x)$, and the y-axis is

a) $3\left(\sqrt{2} - 1\right)$
b) $\frac{3}{2}\sqrt{2}$
c) 6
d) $3\sqrt{2} + 1$
e) $3\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 9cm^3 per second. At what rate is the radius of the sphere changing when its volume is $36\pi\ \text{cm}^3$?

a) $\frac{1}{8\pi}$ cm/sec
b) $\frac{3}{8\pi}$ cm/sec
c) $\frac{1}{\pi}$ cm/sec
d) $\frac{1}{4\pi}$ cm/sec
e) $\frac{3}{\pi}$ cm/sec

33) The graph of the derivative of f is shown below. Which of the following must be true?



a) f has a local minimum at $x = -4$.
b) f has a local maximum at $x = 0$.
c) f is concave down on [0, 8].
d) f has a point of inflection at $x = 8$.
e) f is increasing on [-4, 4].

34) A particle is moving along the x-axis and its position at time $t \geq 0$ is given by

$$S(t) = (t-3)^2\,(t-6)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 3$ and $x = 6$.
II. The particle is slowing down on [0, 3].
III. The particle is speeding up on [3, 6].
a) II and III only
b) I only
c) II only
d) I and III only
e) I, II and III

35) The region enclosed by the graphs of

$$y = 5\,e^x$$

and the line

$$y = 5$$

for $0 \leq x \leq 1$, is revolved about the y-axis. Which of the following integrals gives the volume generated?

a) $\pi \int_0^1 \left(5\,e^x - 5\right)^2 dx$

b) $\pi \int_5^{5e} \left(1 - \left(\ln\left(\frac{1}{5}y\right)\right)^2\right) dy$

c) $\pi \int_5^{5e} \left(5 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

d) $\pi \int_0^5 \left(1 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

e) $\pi \int_5^{5e} \left(1 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

36) If

$$4x^2 + xy - \cos(y) = 10$$

then $\frac{dy}{dx}$ is

a) $-\frac{8x}{x + \sin(y)}$

b) $\frac{y - 8x}{x - \sin(y)}$

c) $-\frac{(y + 8x)}{x + \sin(y)}$

d) $\frac{y + x}{x - \sin(y)}$

e) $-\frac{(x + \sin(y))}{y + 8x}$

37) The sum of two positive integers *x* and *y* is 60. Find the value of *x* that minimizes

$$P = x^3 - 60xy$$

a) $x = 30$

b) $x = 20$

c) $x = 10$

d) $x = 50$

e) $x = 40$

38) A particle moves along a straight line, and its velocity at time *t* is given by

$$v(t) = 4 - \ln(t)$$

What is the total distance the particle travels from $t = 1$ to $t = e$?

a) $4e + 4$

b) $4e - 1$

c) $4e + 1$

d) $e - 5$

e) $4e - 5$

39) The function *f* is defined as

$$f(x) = \frac{(x-5)^2}{x-6}$$

$$x \neq 6$$

Which of the following is **false**?

a) *f* is decreasing on [5, 6].

b) *f* has a vertical asymptote at $x = 6$.

c) *f* has a horizontal asymptote at $y = 1$.

d) *f* has a local maximum at $x = 5$.

e) *f* is concave up for $x > 6$.

40) The base of a solid is the region bounded by

$$y = 5\sqrt{x}$$

the *x*-axis, and

the line $x = 5$

Each cross-section of the solid perpendicular to the *x*-axis is a square, with one side on the *xy*-plane. Which of the following expressions represents the volume of the solid?

a) $\int_0^5 5x\ dx$

b) $\int_0^5 5\sqrt{x}\ dx$

c) $\int_0^5 25x\ dx$

d) $\int_0^1 25x\ dx$

e) $\int_0^1 5\sqrt{x}\ dx$

41) The rate at which a bacteria population grows is proportional to the number of bacteria present. Initially, there were 1000 bacteria present and the population doubled in 4 hours. Roughly how many hours does it take for the population to reach 10000?

a) 13.2

b) 16.4

c) 20.8

d) 8.8

e) 11.6

42) Given that $F'(x) = f(x)$, find

$$\int_0^6 x f(x^2)\ dx$$

a) $6F(36)$

b) $\frac{F(36)-F(0)}{(2)}$

c) $2F(\sqrt{6})-2F(0)$

d) $\frac{36F(36)}{(2)}$

e) $2F(36)-2F(0)$

43) The line normal to

$$5x^2+4y+y^2=3$$

at x = m is parallel to the *y*-axis. What is *m*?

a) -2

b) 0

c) 5

d) -5

e) 2

44) *f* and *g* are two differentiable functions such that

$$f(1) = g(1) = 4$$
$$f'(1) = g'(1) = 6$$

$f'(4) = 4$
$g'(4) = 6$

If $h(x) = (f \circ g)(x)$, then $h'(1)$ is

a) 24
b) 6
c) 16
d) 36
e) 1

45) If $\frac{dy}{dx} = ye^x$ and $y(0) = 6$, then $y\ln(2)$ =

a) $6\,e^{-2}$
b) $6\,e^{2}$
c) $6\,e^{3}$
d) $6\,e^{-1}$
e) $6\,e$

1) Find

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

a) $-4 \sin(4x)$

b) 0

c) $-4 \cos(4x)$

*d) $4 \cos(4x)$

e) $4 \sin(4x)$

2) The function *g* is defined by the formula

$$g(x) = \int_0^x e^{3t} \, dt$$

Find the slope of the tangent line at $x = 1$.

*a) e^3

b) $3e^3$

c) $\frac{1}{3} e^3$

d) $\frac{1}{3}(e^3 - 1)$

e) $e^3 - 1$

3) Find

$$\lim_{x \to \infty} \left(\frac{3x - 1}{\sqrt{x^2 + 9}} \right)$$

*a) 3

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

c) 1

d) $-\frac{1}{9}$

e) The limit does not exist.

4) The given function *f* has a removable discontinuity at $x = -5$. Find *A*.

$$f(x) = \begin{cases} 5x^2 + 8 & x < -5 \\ 8x & x = -5 \\ Ax + 8 & -5 < x \end{cases}$$

a) -4

b) 5

c) -15

*d) -25

e) -5

5) If $f'(x) = -5(x-4)^2(x-8)$ which of the following is true about $y = f(x)$?

a) *f* has a local minimum at $x = 4$ and a point of inflection at $x = 8$.

b) *f* has a local minimum at $x = 4$ and a local maximum at $x = 8$.

c) *f* has a point of inflection at $x = 4$ and a local minimum at $x = 8$.

*d) *f* has a point of inflection at $x = 4$ and a local maximum at $x = 8$.

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$$f(x) = 2x^2 + 5\sqrt{x}$$

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7) Find the average value of the given function *f* over the interval [0, 3].

$$f(x) = e^{7x}$$

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*b) $\frac{1}{21}\left(e^{21} - 1\right)$

c) $\frac{1}{21}e^{21}$

d) $\frac{1}{3}\left(e^{21} - 1\right)$

e) $\frac{1}{7}e^{21}$

8) Find *f* ' (0), given that

$$f(x) = 2^x \ln\left(5\,e^x\right)$$

a) $\ln(5) + 1$

b) 1

*c) $\ln(2)\ln(5) + 1$

d) $\ln(2)\ln(5) + 2$

e) $\ln(10) + 1$

9) Find *f* ' (1), given that

$$f(x) = \frac{x^2 + 7}{(8x)}$$

a) $\frac{15}{64}$

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

c) $\frac{1}{64}$

d) $\frac{15}{8}$

e) $\frac{7}{4}$

10) Find

$$\lim_{x \to 0}\left(\frac{\sin(8x)\cos(x) - \sin(8x)}{x^2}\right)$$

a) 1

b) 8

c) -8

d) The limit does not exist.

*e) 0

11) Given the following curve, find $\frac{d^2y}{dx^2}$.

$$7x + y^2 = 15$$

a) $-\frac{7}{2y^2}$

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d) $\frac{49}{4y^3}$

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c) $-5\sin(5x)$

d) $5\sin(5x)$

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15) Find

$$\frac{\partial}{\partial x}\left(\int_2^x \ln(4+t)\,dt\right)$$

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*b) $\ln(4+x)$

c) $2\ln(4+x)$

d) $\frac{1}{4+x}$

e) $\frac{2}{4+x}$

16) Find the equation of the tangent line to the given curve at the point (0, 7).

$$y = 5x^2 + 10x + 7$$

*a) $y = 10x + 7$

b) $y = 10x - 7$

c) $y = 7x + 5$

d) $y = -5x + 7$

e) $y = 20x$

17) If $g(f(x)) = x$, $g(4) = 2$ and $g'(4) = 12$, then $f'(2)$ is

a) $-\frac{1}{4}$

b) $-\frac{1}{12}$

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

d) $\frac{1}{3}$

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find $\int_0^6 x\, e^{x^2} \, dx$

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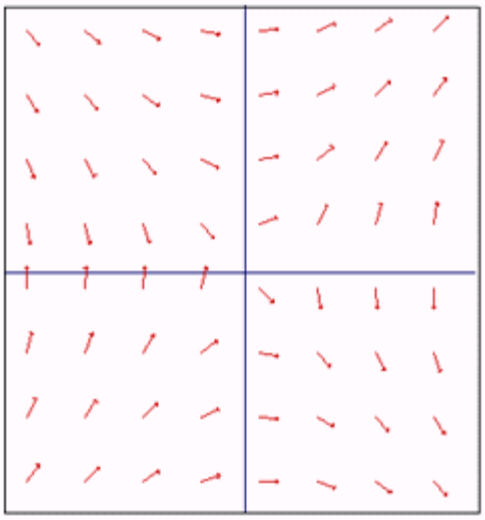

a) $\frac{dy}{dx} = -\frac{y}{x}$

b) $\frac{dy}{dx} = \frac{1}{5} x y$

c) $\frac{dy}{dx} = \frac{1}{10} x y$

d) $\frac{dy}{dx} = \frac{y}{x}$

*e) $\frac{dy}{dx} = \frac{x}{y}$

20) Given the following function, with $x > 0$, on which interval is the function decreasing?

$$f(x) = \frac{x}{\ln(7x)}$$

a) $\left(1, \frac{1}{7} e\right)$

b) $\left(0, \frac{1}{7}\right)$

c) $(1, 7)$

*d) $\left(0, \frac{1}{7} e\right)$

e) $(1, 7e)$

21) Find the area of the region enclosed by the graphs of

$$y = 3x^2$$
and
$$y = 2x$$

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

b) $\frac{2}{27}$

c) $\frac{9}{8}$

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22) Find

$$\int_1^4 \frac{5}{\sqrt{x}}\,dx$$

a) 39
b) 5
*c) 10
d) 20
e) 40

23) The region bounded by the following graph

$$y = 2\sin(x)$$

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c) $\pi\int_0^{\frac{1}{2}\pi} (4\sin(x)^2 - 9)\,dx$

d) $2\pi\int_0^{\frac{1}{2}\pi} 4\sin(3 + x)^2\,dx$

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$$\frac{dy}{dx} = 4xy$$

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a) $6\ln(2x^2)$
b) $e^{2x^2} + 5$
c) $\ln(2x^2 + 6)$

*d) $6\,e^{2x^2}$

e) $e^{2x^2} + 6$

26) $\int \sec^2(6x)\,dx =$

a) $\frac{1}{6}\tan^2(6x) + C$

b) $-6\tan(6x) + C$

c) $6\tan^2(6x) + C$

*d) $\frac{1}{6}\tan(6x) + C$

e) $6\tan(6x) + C$

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What is the maximum speed of the particle for $0 \leq t \leq 10$?

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$$z = \ln(y)$$
$$y = 4x^2 + 4$$
$$x = 2t + 1$$

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

b) 8

c) 16

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

*e) 2

29) If f is a differentiable function and $f(0) = -3$ and $f(5) = 6$, then which of the following must be true?

I. There exists a c in [0,5] where $f(c) = 0$.
II. There exists a c in [0,5] where $f'(c) = 0$.
III. There exists a c in [0,5] where $f'(c) = 9/5$.

a) I, II and III
b) II only
c) II and III only
*d) I and III only
e) I only

30) Which of the following function(s) is continuous and differentiable?

I. $f(x) = \frac{8}{\sqrt{x}}$

II. $g(x) = x\,|x|$

III. $h(x) = \begin{cases} 6x + 1 & x \le 0 \\ x^2 + 1 & 0 < x \end{cases}$

a) I only
b) II only
c) III only
*d) I and II only
e) I and III only

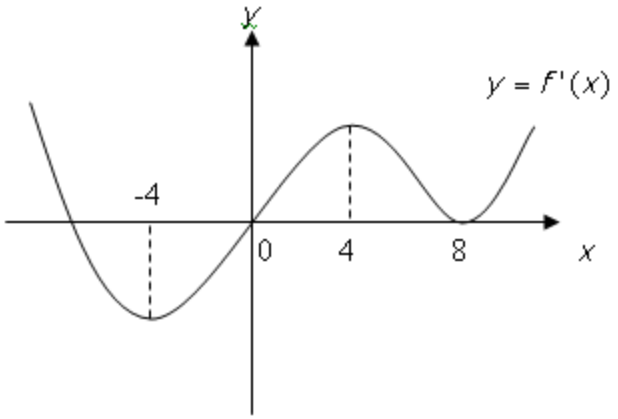
31) The area of the region in the first quadrant bounded by the graphs of $y = 3\cos(x)$, $y = 3\sin(x)$, and the y-axis is

*a) $3\left(\sqrt{2} - 1\right)$
b) $\frac{3}{2}\sqrt{2}$
c) 6
d) $3\sqrt{2} + 1$
e) $3\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 9cm^3 per second. At what rate is the radius of the sphere changing when its volume is $36\pi\ \text{cm}^3$?

a) $\frac{1}{8\pi}$ cm/sec
b) $\frac{3}{8\pi}$ cm/sec
c) $\frac{1}{\pi}$ cm/sec
*d) $\frac{1}{4\pi}$ cm/sec
e) $\frac{3}{\pi}$ cm/sec

33) The graph of the derivative of f is shown below. Which of the following must be true?



a) f has a local minimum at $x = -4$.
b) f has a local maximum at $x = 0$.
c) f is concave down on [0, 8].
*d) f has a point of inflection at $x = 8$.
e) f is increasing on [-4, 4].

34) A particle is moving along the x-axis and its position at time $t \geq 0$ is given by

$$S(t) = (t-3)^2\,(t-6)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 3$ and $x = 6$.
II. The particle is slowing down on [0, 3].
III. The particle is speeding up on [3, 6].
a) II and III only
b) I only
*c) II only
d) I and III only
e) I, II and III

35) The region enclosed by the graphs of

$$y = 5\,e^x$$

and the line

$$y = 5$$

for $0 \leq x \leq 1$, is revolved about the y-axis. Which of the following integrals gives the volume generated?

a) $\pi \int_0^1 (5\,e^x - 5)^2\,dx$

*b) $\pi \int_5^{5e} \left(1 - \left(\ln\left(\frac{1}{5}y\right)\right)^2\right) dy$

c) $\pi \int_5^{5e} \left(5 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

d) $\pi \int_0^5 \left(1 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

e) $\pi \int_5^{5e} \left(1 - \ln\left(\frac{1}{5}y\right)\right)^2 dy$

36) If

$$4x^2 + xy - \cos(y) = 10$$

then $\frac{dy}{dx}$ is

a) $-\frac{8x}{x + \sin(y)}$

b) $\frac{y - 8x}{x - \sin(y)}$

*c) $-\frac{(y + 8x)}{x + \sin(y)}$

d) $\frac{y + x}{x - \sin(y)}$

e) $-\frac{(x + \sin(y))}{y + 8x}$

37) The sum of two positive integers *x* and *y* is 60. Find the value of *x* that minimizes

$$P = x^3 - 60xy$$

a) $x = 30$

*b) $x = 20$

c) $x = 10$

d) $x = 50$

e) $x = 40$

38) A particle moves along a straight line, and its velocity at time *t* is given by

$$v(t) = 4 - \ln(t)$$

What is the total distance the particle travels from *t* = 1 to *t* = e?

a) $4e + 4$

b) $4e - 1$

c) $4e + 1$

d) $e - 5$

*e) $4e - 5$

39) The function *f* is defined as

$$f(x) = \frac{(x-5)^2}{x-6}$$

$x \neq 6$

Which of the following is **false**?

a) *f* is decreasing on [5, 6].

b) *f* has a vertical asymptote at *x* = 6.

*c) *f* has a horizontal asymptote at *y* = 1.

d) *f* has a local maximum at *x* = 5.

e) *f* is concave up for *x* > 6.

40) The base of a solid is the region bounded by

$$y = 5\sqrt{x}$$

the *x*-axis, and

the line *x* = 5

Each cross-section of the solid perpendicular to the *x*-axis is a square, with one side on the *xy*-plane. Which of the following expressions represents the volume of the solid?

a) $\int_0^5 5x\,dx$

b) $\int_0^5 5\sqrt{x}\,dx$

*c) $\int_0^5 25x\,dx$

d) $\int_0^1 25x\,dx$

e) $\int_0^1 5\sqrt{x}\,dx$

41) The rate at which a bacteria population grows is proportional to the number of bacteria present. Initially, there were 1000 bacteria present and the population doubled in 4 hours. Roughly how many hours does it take for the population to reach 10000?

*a) 13.2

b) 16.4

c) 20.8

d) 8.8

e) 11.6

42) Given that $F'(x) = f(x)$, find

$$\int_0^6 x f(x^2)\,dx$$

a) $6F(36)$

*b) $\frac{F(36)-F(0)}{(2)}$

c) $2F(\sqrt{6})-2F(0)$

d) $\frac{36F(36)}{(2)}$

e) $2F(36)-2F(0)$

43) The line normal to

$$5x^2+4y+y^2=3$$

at x = m is parallel to the *y*-axis. What is *m*?

a) -2

*b) 0

c) 5

d) -5

e) 2

44) *f* and *g* are two differentiable functions such that

$$f(1) = g(1) = 4$$
$$f'(1) = g'(1) = 6$$

$f'(4) = 4$
$g'(4) = 6$

If $h(x) = (f \circ g)(x)$, then $h'(1)$ is

*a) 24

b) 6

c) 16

d) 36

e) 1

45) If $\frac{dy}{dx} = ye^x$ and $y(0) = 6$, then $y\ln(2) =$

a) $6\,e^{-2}$

b) $6\,e^{2}$

c) $6\,e^{3}$

d) $6\,e^{-1}$

*e) $6\,e$