1) Find

$$\lim_{h \to 0} \left(\frac{\sin(8x + 8h) - \sin(8x)}{h} \right)$$

a) 0
b) $8\sin(8x)$
c) $8\cos(8x)$
d) $-8\cos(8x)$
e) $-8\sin(8x)$

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

$$g(x) = \int_0^x e^{2t}\, dt$$

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

a) e^2
b) $2e^2$
c) $\frac{1}{2}e^2$
d) $\frac{1}{2}(e^2 - 1)$
e) $e^2 - 1$

3) Find

$$\lim_{x \to \infty} \left(\frac{5x - 4}{\sqrt{x^2 + 10}} \right)$$

a) $\frac{1}{2}$
b) 5
c) 1
d) $-\frac{2}{5}$
e) The limit does not exist.

4) The given function *f* has a removable discontinuity at *x* = -2. Find *A*.

$$f(x) = \begin{cases} 5x^2 + 10 & x < -2 \\ 10x & x = -2 \\ Ax + 10 & -2 < x \end{cases}$$

a) -10
b) -2
c) 2
d) -6
e) -1

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

a) *f* has a local maximum at *x* = 5 and a local minimum at *x* = 8.
b) *f* has a point of inflection at *x* = 5 and a local maximum at *x* = 8.
c) *f* has a local minimum at *x* = 5 and a local maximum at *x* = 8.
d) *f* has a point of inflection at *x* = 5 and a local minimum at *x* = 8.
e) *f* has a local minimum at *x* = 5 and a point of inflection at *x* = 8.

6) Find *f* ' (4), given that

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

a) $\frac{99}{4}$

b) 60

c) 54

d) 30

e) $\frac{51}{2}$

7) Find the average value of the given function *f* over the interval [0, 2].

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

a) $\frac{1}{14} e^{14}$

b) $\frac{1}{7}\left(e^{14} - 1\right)$

c) $\frac{1}{14}\left(e^{14} - 1\right)$

d) $\frac{1}{2}\left(e^{14} - 1\right)$

e) $\frac{1}{7} e^{14}$

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

$$f(x) = 3^x \ln\left(11\, e^x\right)$$

a) $\ln(3)\ln(11) + 3$

b) 1

c) $\ln(11) + 1$

d) $\ln(33) + 1$

e) $\ln(3)\ln(11) + 1$

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

$$f(x) = \frac{x^2 + 6}{(7x)}$$

a) $\frac{13}{7}$

b) $\frac{13}{49}$

c) $\frac{1}{49}$

d) $\frac{12}{7}$

e) $-\frac{5}{7}$

10) Find

$$\lim_{x \to 0} \left(\frac{\sin(5x)\cos(x) - \sin(5x)}{x^2} \right)$$

a) 5
b) 0
c) -5
d) 1
e) The limit does not exist.

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

$$7x + y^2 = 20$$

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

12) Given that $f(x) = 8\sin^2(5x)$, find $f''\left(\frac{1}{30}\pi\right)$.

a) $40\sqrt{3}$
b) $40\sqrt{2}$
c) 40
d) 200
e) 0

13) Find the midpoint rectangular approximation for $\int_0^3 8x^3\,dx$ using 3 subintervals of equal length.

a) 288
b) 153
c) 306
d) 576
e) 25

14) Find the derivative of the function $y = \cos^{-1}(2x)$.

a) $-2\sin^{-1}(2x)$
b) $-2\sin(2x)$
c) $2\sin(2x)$
d) $-\frac{2}{\sqrt{1-4x^2}}$
e) $\frac{2}{\sqrt{1+4x^2}}$

15) Find

$$\frac{\partial}{\partial x}\left(\int_5^x \ln(10+t)\,dt\right)$$

a) $\frac{1}{10+x}$
b) $-\ln(10+x)$
c) $5\ln(10+x)$

d) $\dfrac{5}{10+x}$

e) $\ln(10+x)$

16) Find the equation of the tangent line to the given curve at the point (0, 9).

$$y=4x^2+8x+9$$

a) $y=-4x+9$

b) $y=8x-9$

c) $y=9x+4$

d) $y=16x$

e) $y=8x+9$

17) If $g(f(x)) = x$, $g(5) = 2$ and $g'(5) = 14$, then $f'(2)$ is

a) $\dfrac{5}{14}$

b) $\dfrac{1}{5}$

c) $-\dfrac{1}{5}$

d) $\dfrac{1}{14}$

e) $-\dfrac{1}{14}$

18) Given that $\displaystyle\int_0^{25} e^x \, dx = m$

find $\displaystyle\int_0^{5} x\, e^{x^2} \, dx$

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

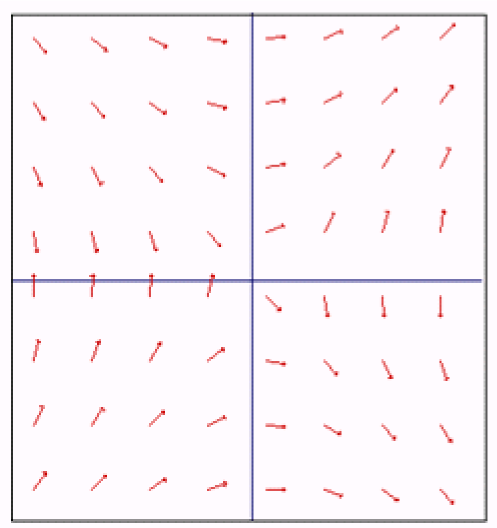
b) $2m$

c) m^2

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

e) 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) $\frac{dy}{dx} = \frac{1}{6} x y$

c) $\frac{dy}{dx} = \frac{1}{12} x y$

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?

$$f(x) = \frac{x}{\ln(11 x)}$$

a) $\left(0, \frac{1}{11}\right)$

b) $(1, 11 e)$

c) $\left(0, \frac{1}{11} e\right)$

d) $(1, 11)$

e) $\left(1, \frac{1}{11} e\right)$

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

$$y = 4 x^2$$

and

$$y = 2 x$$

a) $\frac{1}{6}$

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

c) $\frac{1}{24}$

d) $\frac{8}{3}$

e) $\frac{16}{3}$

22) Find

$$\int_{1}^{9} \frac{5}{\sqrt{x}}\, dx$$

a) 90
b) 89
c) 30
d) 20
e) 10

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 = -4. The volume of this solid can be represented by:

a) $2\pi \int_{0}^{\frac{1}{2}\pi} (2\sin(x) + 4)^2\, dx$
b) $\pi \int_{0}^{\frac{1}{2}\pi} \left(4\sin(x)^2 - 16\right) dx$
c) $2\pi \int_{0}^{\frac{1}{2}\pi} 4\sin(4 + x)^2\, dx$
d) $\pi \int_{0}^{\frac{1}{2}\pi} \left((2\sin(x) + 4)^2 - 16\right) dx$
e) $2\pi \int_{0}^{\frac{1}{2}\pi} \left(4\sin(x)^2 + 4\right) dx$

24) The side of a cube is expanding at a constant rate of 6 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) 324
b) 108
c) 18
d) 162
e) 54

25) The solution to the differential equation

$$\frac{dy}{dx} = 10\, x\, y$$

with the initial condition $y(0) = 2$ is
a) $\ln(5x^2 + 2)$
b) $e^{5x^2} + 2$
c) $e^{5x^2} + 1$

d) $2\ln(5x^2)$

e) $2e^{5x^2}$

26) $\int \sec^2(8x)\,dx =$

a) $8\tan(8x) + C$

b) $\frac{1}{8}\tan(8x) + C$

c) $-8\tan(8x) + C$

d) $8\tan^2(8x) + C$

e) $\frac{1}{8}\tan^2(8x) + C$

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

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

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

a) 768

b) 144

c) 192

d) 64

e) 432

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

$$z = \ln(y)$$
$$y = 6x^2 + 6$$
$$x = 5t + 1$$

a) 5

b) 30

c) 60

d) $\frac{5}{12}$

e) $\frac{5}{6}$

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

I. There exists a c in [0,6] where $f(c) = 0$.
II. There exists a c in [0,6] where $f\,'(c) = 0$.
III. There exists a c in [0,6] where $f\,'(c) = 3/2$.

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

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

I. $f(x) = \dfrac{5}{\sqrt{x}}$

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

III. $h(x) = \begin{cases} 7x + 1 & x \le 0 \\ x^2 + 1 & 0 < x \end{cases}$

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

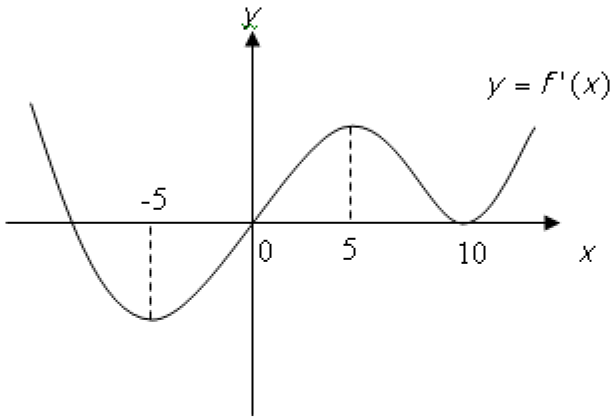
31) The area of the region in the first quadrant bounded by the graphs of $y = 2\cos(x)$, $y = 2\sin(x)$, and the y-axis is

a) $\sqrt{2}$
b) $2\left(\sqrt{2} - 1\right)$
c) 4
d) $2\sqrt{2} + 1$
e) $2\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 8cm^3 per second. At what rate is the radius of the sphere changing when its volume is 36π cm^3?

a) $\dfrac{2}{9\pi}$ cm/sec
b) $\dfrac{8}{3\pi}$ cm/sec
c) $\dfrac{1}{3\pi}$ cm/sec
d) $\dfrac{8}{9\pi}$ cm/sec
e) $\dfrac{1}{9\pi}$ cm/sec

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



a) *f* is increasing on [-5, 5].
b) *f* has a point of inflection at $x = 10$.
c) *f* has a local maximum at $x = 0$.
d) *f* is concave down on [0, 10].
e) *f* has a local minimum at $x = -5$.
34) A particle is moving along the *x*-axis and its position at time $t \geq 0$ is given by

$$S(t) = (t-2)^2\,(t-5)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 2$ and $x = 5$.
II. The particle is slowing down on [0, 2].
III. The particle is speeding up on [2, 5].
a) II only
b) I only
c) II and III only
d) I and III only
e) I, II and III
35) The region enclosed by the graphs of

$$y = 4\,e^x$$

and the line

$$y = 4$$

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

a) $\pi \int_4^{4e} \left(4 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

b) $\pi \int_0^1 (4\,e^x - 4)^2\, dx$

c) $\pi \int_4^{4e} \left(1 - \left(\ln\left(\frac{1}{4}y\right)\right)^2\right) dy$

d) $\pi \int_0^4 \left(1 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

e) $\pi \int_4^{4e} \left(1 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

36) If

$$6x^2 + xy - \cos(y) = 10$$

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

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

b) $\dfrac{y-12x}{x-\sin(y)}$

c) $-\dfrac{12x}{x+\sin(y)}$

d) $-\dfrac{(x+\sin(y))}{y+12x}$

e) $-\dfrac{(y+12x)}{x+\sin(y)}$

37) The sum of two positive integers *x* and *y* is 90. Find the value of *x* that minimizes

$$P = x^3 - 90xy$$

a) $x = 75$

b) $x = 45$

c) $x = 15$

d) $x = 60$

e) $x = 30$

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

$$v(t) = 3 - \ln(t)$$

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

a) $3e - 1$

b) $3e - 4$

c) $3e + 1$

d) $3e + 3$

e) $e - 4$

39) The function *f* is defined as

$$f(x) = \frac{(x-3)^2}{x-7}$$

$$x \neq 7$$

Which of the following is **false**?

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

b) *f* has a vertical asymptote at *x* = 7.

c) *f* is decreasing on [3, 7].

d) *f* has a local maximum at *x* = 3.

e) *f* is concave up for *x* > 7.

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

$$y = 7\sqrt{x}$$

the *x*-axis, and

the line *x* = 7

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) $\int_0^1 7\sqrt{x}\, dx$

b) $\int_0^7 7x\, dx$

c) $\int_0^1 49x\, dx$

d) $\int_0^7 49x\, dx$

e) $\int_0^7 7\sqrt{x}\, dx$

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 2 hours. Roughly how many hours does it take for the population to reach 10000?

a) 8.2
b) 6.6
c) 10.4
d) 4.4
e) 5.8

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

$$\int_{-2}^{6} x f(x^2)\, dx$$

a) $2F(36) - 2F(4)$

b) $2F(\sqrt{6}) - 2F(\mathrm{I}\sqrt{2})$

c) $\frac{36F(36) - 4F(4)}{(2)}$

d) $\frac{F(36) - F(4)}{(2)}$

e) $6F(36) + 2F(4)$

43) The line normal to

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

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

a) -3
b) -1
c) 3
d) 1
e) 0

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

$$f(1) = g(1) = 4$$
$$f'(1) = g'(1) = 7$$

$f'(4) = 4$
$g'(4) = 7$

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

a) 49
b) 7
c) 16
d) 1
e) 28

45) If $\frac{dy}{dx} = ye^{x}$ and $y(0) = 7$, then $y\ln(2) =$

a) $7\,e^{-1}$
b) $7\,e^{3}$
c) $7\,e^{-2}$
d) $7\,e$
e) $7\,e^{2}$

1) Find

$$\lim_{h \to 0} \left(\frac{\sin(8x + 8h) - \sin(8x)}{h} \right)$$

a) 0
b) $8 \sin(8x)$
*c) $8 \cos(8x)$
d) $-8 \cos(8x)$
e) $-8 \sin(8x)$
2) The function *g* is defined by the formula

$$g(x) = \int_0^x e^{2t}\, dt$$

Find the slope of the tangent line at *x* = 1.
*a) e^2
b) $2 e^2$
c) $\frac{1}{2} e^2$
d) $\frac{1}{2} (e^2 - 1)$
e) $e^2 - 1$
3) Find

$$\lim_{x \to \infty} \left(\frac{5x - 4}{\sqrt{x^2 + 10}} \right)$$

a) $\frac{1}{2}$
*b) 5
c) 1
d) $-\frac{2}{5}$
e) The limit does not exist.
4) The given function *f* has a removable discontinuity at *x* = -2. Find *A*.

$$f(x) = \begin{cases} 5x^2 + 10 & x < -2 \\ 10x & x = -2 \\ Ax + 10 & -2 < x \end{cases}$$

*a) -10
b) -2
c) 2
d) -6
e) -1
5) If *f* ' (*x*) = $-5(x-5)^2(x-8)$ which of the following is true about *y* = *f* (*x*)?
a) *f* has a local maximum at *x* = 5 and a local minimum at *x* = 8.
*b) *f* has a point of inflection at *x* = 5 and a local maximum at *x* = 8.
c) *f* has a local minimum at *x* = 5 and a local maximum at *x* = 8.
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$$f(x) = 3x^2 + 3\sqrt{x}$$

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7) Find the average value of the given function *f* over the interval [0, 2].

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

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*c) $\frac{1}{14} (e^{14} - 1)$

d) $\frac{1}{2} (e^{14} - 1)$

e) $\frac{1}{7} e^{14}$

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

$$f(x) = 3^x \ln(11 e^x)$$

a) $\ln(3)\ln(11) + 3$

b) 1

c) $\ln(11) + 1$

d) $\ln(33) + 1$

*e) $\ln(3)\ln(11) + 1$

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

$$f(x) = \frac{x^2 + 6}{(7x)}$$

a) $\frac{13}{7}$

b) $\frac{13}{49}$

c) $\frac{1}{49}$

d) $\frac{12}{7}$

*e) $-\frac{5}{7}$

10) Find

$$\lim_{x \to 0} \left(\frac{\sin(5x)\cos(x) - \sin(5x)}{x^2} \right)$$

a) 5

*b) 0

c) -5

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e) The limit does not exist.

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

$$7x + y^2 = 20$$

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c) $2\sin(2x)$

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15) Find

$$\frac{\partial}{\partial x}\left(\int_5^x \ln(10+t)\,dt\right)$$

a) $\frac{1}{10+x}$

b) $-\ln(10+x)$

c) $5\ln(10+x)$

d) $\frac{5}{10+x}$

*e) $\ln(10+x)$

16) Find the equation of the tangent line to the given curve at the point (0, 9).

$$y = 4x^2 + 8x + 9$$

a) $y = -4x + 9$

b) $y = 8x - 9$

c) $y = 9x + 4$

d) $y = 16x$

*e) $y = 8x + 9$

17) If $g(f(x)) = x$, $g(5) = 2$ and $g'(5) = 14$, then $f'(2)$ is

a) $\frac{5}{14}$

b) $\frac{1}{5}$

c) $-\frac{1}{5}$

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18) Given that $\int_0^{25} e^x \, dx = m$

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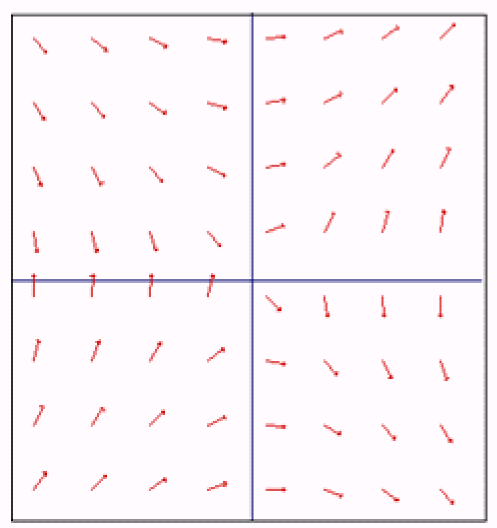

a) $\frac{dy}{dx} = -\frac{y}{x}$

b) $\frac{dy}{dx} = \frac{1}{6} x y$

c) $\frac{dy}{dx} = \frac{1}{12} x y$

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?

$$f(x) = \frac{x}{\ln(11 x)}$$

a) $\left(0, \frac{1}{11}\right)$

b) $(1, 11 e)$

*c) $\left(0, \frac{1}{11} e\right)$

d) $(1, 11)$

e) $\left(1, \frac{1}{11} e\right)$

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

$$y = 4 x^2$$
and
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a) $\frac{1}{6}$

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and the *x*-axis, for $0 \le x \le \frac{1}{2}\pi$, is rotated about the line *y* = -4. The volume of this solid can be represented by:

a) $2\pi \int_{0}^{\frac{1}{2}\pi} (2\sin(x) + 4)^2\, dx$

b) $\pi \int_{0}^{\frac{1}{2}\pi} \left(4\sin(x)^2 - 16\right) dx$

c) $2\pi \int_{0}^{\frac{1}{2}\pi} 4\sin(4 + x)^2\, dx$

*d) $\pi \int_{0}^{\frac{1}{2}\pi} \left((2\sin(x) + 4)^2 - 16\right) dx$

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$$\frac{dy}{dx} = 10\, x\, y$$

with the initial condition *y*(0) = 2 is
a) $\ln(5x^2 + 2)$
b) $e^{5x^2} + 2$
c) $e^{5x^2} + 1$

d) $2\ln(5x^2)$
*e) $2e^{5x^2}$
26) $\int \sec^2(8x)\,dx =$
a) $8\tan(8x)+C$
*b) $\frac{1}{8}\tan(8x)+C$
c) $-8\tan(8x)+C$
d) $8\tan^2(8x)+C$
e) $\frac{1}{8}\tan^2(8x)+C$
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$$x(t)=4(t-4)^3$$

What is the maximum speed of the particle for $0 \leq t \leq 10$?
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$$z=\ln(y)$$
$$y=6x^2+6$$
$$x=5t+1$$

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b) 30
c) 60
d) $\frac{5}{12}$
e) $\frac{5}{6}$

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

I. There exists a c in [0,6] where $f(c) = 0$.
II. There exists a c in [0,6] where $f\,'(c) = 0$.
III. There exists a c in [0,6] where $f\,'(c) = 3/2$.

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

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

I. $f(x) = \dfrac{5}{\sqrt{x}}$

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

III. $h(x) = \begin{cases} 7x + 1 & x \le 0 \\ x^2 + 1 & 0 < x \end{cases}$

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

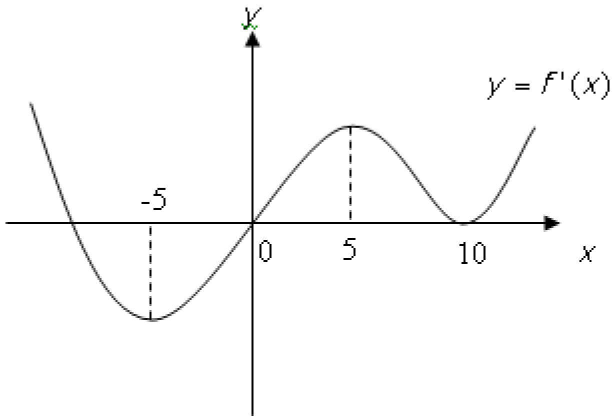
31) The area of the region in the first quadrant bounded by the graphs of $y = 2\cos(x)$, $y = 2\sin(x)$, and the y-axis is

a) $\sqrt{2}$
*b) $2\left(\sqrt{2} - 1\right)$
c) 4
d) $2\sqrt{2} + 1$
e) $2\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 8cm^3 per second. At what rate is the radius of the sphere changing when its volume is 36π cm^3?

*a) $\dfrac{2}{9\pi}$ cm/sec
b) $\dfrac{8}{3\pi}$ cm/sec
c) $\dfrac{1}{3\pi}$ cm/sec
d) $\dfrac{8}{9\pi}$ cm/sec
e) $\dfrac{1}{9\pi}$ cm/sec

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



a) f is increasing on [-5, 5].
*b) f has a point of inflection at $x = 10$.
c) f has a local maximum at $x = 0$.
d) f is concave down on [0, 10].
e) f has a local minimum at $x = -5$.
34) A particle is moving along the x-axis and its position at time $t \geq 0$ is given by

$$S(t) = (t-2)^2\ (t-5)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 2$ and $x = 5$.
II. The particle is slowing down on [0, 2].
III. The particle is speeding up on [2, 5].
*a) II only
b) I only
c) II and III only
d) I and III only
e) I, II and III
35) The region enclosed by the graphs of

$$y = 4\,e^x$$

and the line

$$y = 4$$

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

a) $\pi \int_{4}^{4e} \left(4 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

b) $\pi \int_{0}^{1} (4\,e^x - 4)^2\, dx$

*c) $\pi \int_{4}^{4e} \left(1 - \left(\ln\left(\frac{1}{4}y\right)\right)^2\right) dy$

d) $\pi \int_{0}^{4} \left(1 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

e) $\pi \int_{4}^{4e} \left(1 - \ln\left(\frac{1}{4}y\right)\right)^2 dy$

36) If

$$6x^2 + xy - \cos(y) = 10$$

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

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

b) $\frac{y-12x}{x-\sin(y)}$

c) $-\frac{12x}{x+\sin(y)}$

d) $-\frac{(x+\sin(y))}{y+12x}$

*e) $-\frac{(y+12x)}{x+\sin(y)}$

37) The sum of two positive integers *x* and *y* is 90. Find the value of *x* that minimizes

$$P = x^3 - 90xy$$

a) $x = 75$

b) $x = 45$

c) $x = 15$

d) $x = 60$

*e) $x = 30$

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

$$v(t) = 3 - \ln(t)$$

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

a) $3e - 1$

*b) $3e - 4$

c) $3e + 1$

d) $3e + 3$

e) $e - 4$

39) The function *f* is defined as

$$f(x) = \frac{(x-3)^2}{x-7}$$

$$x \neq 7$$

Which of the following is **false**?

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

b) *f* has a vertical asymptote at $x = 7$.

c) *f* is decreasing on [3, 7].

d) *f* has a local maximum at $x = 3$.

e) *f* is concave up for $x > 7$.

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

$$y = 7\sqrt{x}$$

the *x*-axis, and

the line $x = 7$

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) $\int_0^1 7\sqrt{x}\, dx$

b) $\int_0^7 7x\, dx$

c) $\int_0^1 49x\, dx$

*d) $\int_0^7 49x\, dx$

e) $\int_0^7 7\sqrt{x}\, dx$

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 2 hours. Roughly how many hours does it take for the population to reach 10000?

a) 8.2
*b) 6.6
c) 10.4
d) 4.4
e) 5.8

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

$$\int_{-2}^{6} x f(x^2)\, dx$$

a) $2F(36) - 2F(4)$

b) $2F(\sqrt{6}) - 2F(I\sqrt{2})$

c) $\frac{36F(36) - 4F(4)}{(2)}$

*d) $\frac{F(36) - F(4)}{(2)}$

e) $6F(36) + 2F(4)$

43) The line normal to

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

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

a) -3
b) -1
c) 3
d) 1
*e) 0

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

$$f(1) = g(1) = 4$$
$$f'(1) = g'(1) = 7$$

$f'(4) = 4$
$g'(4) = 7$

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

a) 49
b) 7
c) 16
d) 1
*e) 28

45) If $\frac{dy}{dx} = ye^x$ and $y(0) = 7$, then $y\ln(2) =$

a) $7\,e^{-1}$
b) $7\,e^{3}$
c) $7\,e^{-2}$
*d) $7\,e$
e) $7\,e^{2}$