1) Find

$$\lim_{h \to 0} \left(\frac{\sin(5x + 5h) - \sin(5x)}{h} \right)$$

a) 0
b) $5 \sin(5x)$
c) $5 \cos(5x)$
d) $-5 \cos(5x)$
e) $-5 \sin(5x)$

2) The function g is defined by the formula

$$g(x) = \int_0^x e^{4t} \, dt$$

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

a) $\frac{1}{4} e^4$
b) $4 e^4$
c) e^4
d) $\frac{1}{4} (e^4 - 1)$
e) $e^4 - 1$

3) Find

$$\lim_{x \to \infty} \left(\frac{5x - 2}{\sqrt{x^2 + 8}} \right)$$

a) The limit does not exist.
b) 1
c) $-\frac{1}{4}$
d) 5
e) $\frac{5}{8}$

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

$$f(x) = \begin{cases} 5x^2 + 9 & x < -5 \\ 9x & x = -5 \\ Ax + 9 & -5 < x \end{cases}$$

a) -4
b) 5
c) -15
d) -25
e) -5

5) If $f'(x) = -4 (x-6)^2 (x-9)$ which of the following is true about $y = f(x)$?

a) f has a local minimum at $x = 6$ and a local maximum at $x = 9$.
b) f has a local maximum at $x = 6$ and a local minimum at $x = 9$.
c) f has a point of inflection at $x = 6$ and a local maximum at $x = 9$.
d) f has a point of inflection at $x = 6$ and a local minimum at $x = 9$.
e) f has a local minimum at $x = 6$ and a point of inflection at $x = 9$.

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

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

a) 450

b) $\frac{545}{6}$

c) 420

d) 105

e) $\frac{275}{3}$

7) Find the average value of the given function *f* over the interval [0, 4].

$$f(x) = e^{6x}$$

a) $\frac{1}{24}\left(e^{24} - 1\right)$

b) $\frac{1}{6}\left(e^{24} - 1\right)$

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

d) $\frac{1}{4}\left(e^{24} - 1\right)$

e) $\frac{1}{6}e^{24}$

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

$$f(x) = 7^x \ln\left(3e^x\right)$$

a) 1

b) $\ln(7)\ln(3) + 1$

c) $\ln(3) + 1$

d) $\ln(7)\ln(3) + 7$

e) $\ln(21) + 1$

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

$$f(x) = \frac{x^2 + 5}{(8x)}$$

a) $\frac{13}{64}$

b) $-\frac{1}{2}$

c) $\frac{3}{64}$

d) $\frac{13}{8}$

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

10) Find

$$\lim_{x \to 0}\left(\frac{\sin(3x)\cos(x) - \sin(3x)}{x^2}\right)$$

a) -3

b) 3

c) 0

d) 1

e) The limit does not exist.

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

$$5x + y^2 = 15$$

a) $-\frac{25}{4y^3}$

b) $\frac{5}{2y^2}$

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

d) $\frac{25}{4y^3}$

e) $\frac{25}{2y^3}$

12) Given that $f(x) = 7\sin^2(2x)$, find $f''\left(\frac{1}{12}\pi\right)$.

a) $14\sqrt{2}$

b) 0

c) 28

d) 14

e) $14\sqrt{3}$

13) Find the midpoint rectangular approximation for $\int_0^3 4x^3\,dx$ using 3 subintervals of equal length.

a) $\frac{153}{2}$

b) 144

c) 153

d) 288

e) $\frac{25}{2}$

14) Find the derivative of the function $y = \cos^{-1}(6x)$.

a) $6\sin(6x)$

b) $\frac{6}{\sqrt{1+36x^2}}$

c) $-6\sin(6x)$

d) $-6\sin^{-1}(6x)$

e) $-\frac{6}{\sqrt{1-36x^2}}$

15) Find

$$\frac{\partial}{\partial x}\left(\int_5^x \ln(3+t)\,dt\right)$$

a) $\frac{5}{3+x}$

b) $5\ln(3+x)$

c) $\frac{1}{3+x}$

d) $\ln(3+x)$

e) $-\ln(3+x)$

16) Find the equation of the tangent line to the given curve at the point (0, 8).

$$y = 5x^2 + 10x + 8$$

a) $y = 8x + 5$

b) $y = 10x - 8$

c) $y = 10x + 8$

d) $y = -5x + 8$

e) $y = 20x$

17) If $g(f(x)) = x$, $g(4) = 2$ and $g'(4) = 13$, then $f'(2)$ is

a) $\frac{1}{13}$

b) $-\frac{1}{13}$

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

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

e) $\frac{4}{13}$

18) Given that $\int_0^{64} e^x \, dx = m$

find $\int_0^8 x\, e^{x^2} \, dx$

a) m^2

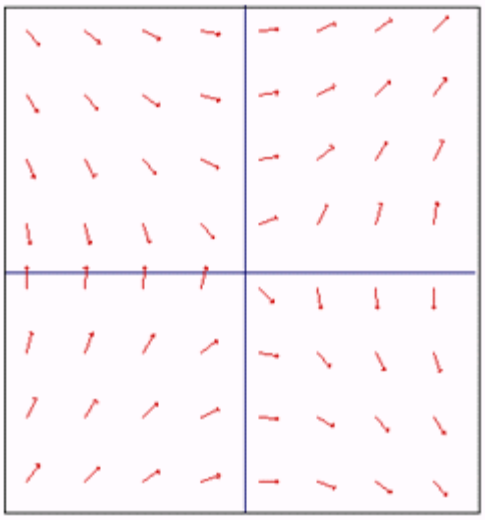
b) m

c) $2m$

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

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

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



a) $\frac{dy}{dx} = \frac{1}{3} x y$

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

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

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

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

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

$$f(x) = \frac{x}{\ln(3x)}$$

a) $(1, 3)$

b) $(1, 3e)$

c) $\left(0, \frac{1}{3}\right)$

d) $\left(1, \frac{1}{3}e\right)$

e) $\left(0, \frac{1}{3}e\right)$

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

$$y = 3x^2$$
and
$$y = 4x$$

a) $\frac{32}{27}$

b) $\frac{64}{27}$

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

d) $\frac{9}{32}$

e) $\frac{9}{16}$

22) Find

$$\int_1^9 \frac{2}{\sqrt{x}}\,dx$$

a) 8
b) 4
c) 35
d) 12
e) 36

23) The region bounded by the following graph

$$y = 4\sin(x)$$

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

a) $2\pi \int_0^{\frac{1}{2}\pi} (16\sin(x)^2 + 2)\,dx$
b) $\pi \int_0^{\frac{1}{2}\pi} ((4\sin(x) + 2)^2 - 4)\,dx$
c) $\pi \int_0^{\frac{1}{2}\pi} (16\sin(x)^2 - 4)\,dx$
d) $2\pi \int_0^{\frac{1}{2}\pi} 16\sin(x + 2)^2\,dx$
e) $2\pi \int_0^{\frac{1}{2}\pi} (4\sin(x) + 2)^2\,dx$

24) The side of a cube is expanding at a constant rate of 2 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) 6
b) 18
c) 36
d) 108
e) 54

25) The solution to the differential equation

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

with the initial condition $y(0) = 4$ is
a) $4\ln(5x^2)$
b) $e^{5x^2} + 3$
c) $\ln(5x^2 + 4)$

d) $4\, e^{5x^2}$

e) $e^{5x^2} + 4$

26) $\int \sec^2(3x)\, dx =$

a) $\frac{1}{3}\tan^2(3x) + C$

b) $-3\tan(3x) + C$

c) $3\tan^2(3x) + C$

d) $\frac{1}{3}\tan(3x) + C$

e) $3\tan(3x) + C$

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

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

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

a) 16

b) 48

c) 96

d) 768

e) 256

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

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

a) 60

b) 30

c) 6

d) $\frac{3}{5}$

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

29) If f is a differentiable function and $f(0) = -3$ and $f(2) = 6$, then which of the following must be true?

I. There exists a c in [0,2] where $f(c) = 0$.
II. There exists a c in [0,2] where $f'(c) = 0$.
III. There exists a c in [0,2] where $f'(c) = 9/2$.

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. $f(x) = \frac{7}{\sqrt{x}}$

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

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

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

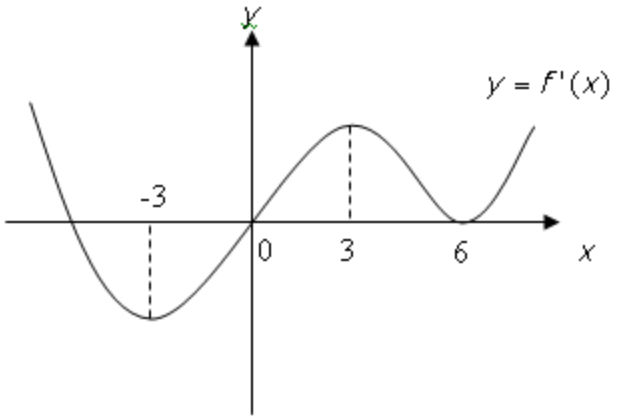
31) The area of the region in the first quadrant bounded by the graphs of $y = 4\cos(x)$, $y = 4\sin(x)$, and the y-axis is

a) $4\sqrt{2}$
b) 8
c) $4\sqrt{2} + 1$
d) $4\left(\sqrt{2} - 1\right)$
e) $2\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 10cm^3 per second. At what rate is the radius of the sphere changing when its volume is $36\pi\ \text{cm}^3$?

a) $\frac{5}{36\pi}$ cm/sec
b) $\frac{5}{12\pi}$ cm/sec
c) $\frac{10}{9\pi}$ cm/sec
d) $\frac{5}{18\pi}$ cm/sec
e) $\frac{10}{3\pi}$ 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 maximum at $x = 0$.
b) f is increasing on [-3, 3].
c) f has a point of inflection at $x = 6$.
d) f is concave down on [0, 6].
e) f has a local minimum at $x = -3$.

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

$$S(t) = (t-4)^2\,(t-5)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 4$ and $x = 5$.
II. The particle is slowing down on [0, 4].
III. The particle is speeding up on [4, 5].
a) I only
b) II only
c) II and III only
d) I and III only
e) I, II and III

35) The region enclosed by the graphs of

$$y = 7\,e^x$$

and the line

$$y = 7$$

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

a) $\pi \int_{7}^{7e} \left(1 - \left(\ln\left(\frac{1}{7}y\right)\right)^2\right) dy$

b) $\pi \int_{0}^{1} \left(7\,e^x - 7\right)^2 dx$

c) $\pi \int_{7}^{7e} \left(7 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

d) $\pi \int_{0}^{7} \left(1 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

e) $\pi \int_{7}^{7e} \left(1 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

36) If

$$5x^2 + xy - \cos(y) = 10$$

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

a) $\frac{y - 10x}{x - \sin(y)}$

b) $-\frac{(y + 10x)}{x + \sin(y)}$

c) $-\frac{10x}{x + \sin(y)}$

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

e) $-\frac{(x + \sin(y))}{y + 10x}$

37) The sum of two positive integers *x* and *y* is 120. Find the value of *x* that minimizes

$$P = x^3 - 120xy$$

a) $x = 60$

b) $x = 40$

c) $x = 20$

d) $x = 100$

e) $x = 80$

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

$$v(t) = 5 - \ln(t)$$

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

a) $5e + 1$

b) $5e - 1$

c) $5e - 6$

d) $5e + 5$

e) $e-6$

39) The function *f* is defined as

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

$$x \neq 7$$

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 [2, 7].

d) *f* has a local maximum at $x = 2$.

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

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

$$y = 8\sqrt{x}$$

the *x*-axis, and

the line $x = 8$

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) $\int_0^8 8x\,dx$

b) $\int_0^8 8\sqrt{x}\,dx$

c) $\int_0^8 64x\,dx$

d) $\int_0^1 64x\,dx$

e) $\int_0^1 8\sqrt{x}\,dx$

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

a) 16.5

b) 20.5

c) 26.0

d) 11.0

e) 14.5

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

$$\int_0^4 x f(x^2)\,dx$$

a) $\frac{16F(16)}{(2)}$

b) $4F(16)$

c) $2F(2) - 2F(0)$

d) $2F(16) - 2F(0)$

e) $\frac{F(16) - F(0)}{(2)}$

43) The line normal to

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

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

a) 1

b) 2

c) –2

d) 0

e) –1

44) f and g are two differentiable functions such that

$$f(1) = g(1) = 4$$
$$f'(1) = g'(1) = 8$$

$f'(4) = 4$
$g'(4) = 8$

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

a) 16
b) 8
c) 32
d) 64
e) 1

45) If $\frac{dy}{dx} = ye^x$ and $y(0) = 5$, then $y\ln(2) =$

a) $5\,e$
b) $5\,e^2$
c) $5\,e^3$
d) $5\,e^{-2}$
e) $5\,e^{-1}$

1) Find

$$\lim_{h \to 0} \left(\frac{\sin(5x + 5h) - \sin(5x)}{h} \right)$$

a) 0

b) $5 \sin(5x)$

*c) $5 \cos(5x)$

d) $-5 \cos(5x)$

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

2) The function g is defined by the formula

$$g(x) = \int_0^x e^{4t} \, dt$$

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

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

b) $4 e^4$

*c) e^4

d) $\frac{1}{4} (e^4 - 1)$

e) $e^4 - 1$

3) Find

$$\lim_{x \to \infty} \left(\frac{5x - 2}{\sqrt{x^2 + 8}} \right)$$

a) The limit does not exist.

b) 1

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

*d) 5

e) $\frac{5}{8}$

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

$$f(x) = \begin{cases} 5x^2 + 9 & x < -5 \\ 9x & x = -5 \\ Ax + 9 & -5 < x \end{cases}$$

a) -4

b) 5

c) -15

*d) -25

e) -5

5) If $f'(x) = -4 (x-6)^2 (x-9)$ which of the following is true about $y = f(x)$?

a) f has a local minimum at $x = 6$ and a local maximum at $x = 9$.

b) f has a local maximum at $x = 6$ and a local minimum at $x = 9$.

*c) f has a point of inflection at $x = 6$ and a local maximum at $x = 9$.

d) f has a point of inflection at $x = 6$ and a local minimum at $x = 9$.

e) f has a local minimum at $x = 6$ and a point of inflection at $x = 9$.

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

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

a) 450

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7) Find the average value of the given function *f* over the interval [0, 4].

$$f(x) = e^{6x}$$

*a) $\frac{1}{24}\left(e^{24} - 1\right)$

b) $\frac{1}{6}\left(e^{24} - 1\right)$

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

d) $\frac{1}{4}\left(e^{24} - 1\right)$

e) $\frac{1}{6}e^{24}$

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

$$f(x) = 7^x \ln\left(3e^x\right)$$

a) 1

*b) $\ln(7)\ln(3) + 1$

c) $\ln(3) + 1$

d) $\ln(7)\ln(3) + 7$

e) $\ln(21) + 1$

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

$$f(x) = \frac{x^2 + 5}{(8x)}$$

a) $\frac{13}{64}$

*b) $-\frac{1}{2}$

c) $\frac{3}{64}$

d) $\frac{13}{8}$

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

10) Find

$$\lim_{x \to 0}\left(\frac{\sin(3x)\cos(x) - \sin(3x)}{x^2}\right)$$

a) -3

b) 3

*c) 0

d) 1

e) The limit does not exist.

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

$$5x + y^2 = 15$$

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d) $-6\sin^{-1}(6x)$

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15) Find

$$\frac{\partial}{\partial x}\left(\int_5^x \ln(3+t)\,dt\right)$$

a) $\frac{5}{3+x}$

b) $5\ln(3+x)$

c) $\frac{1}{3+x}$

*d) $\ln(3+x)$

e) $-\ln(3+x)$

16) Find the equation of the tangent line to the given curve at the point (0, 8).

$$y = 5x^2 + 10x + 8$$

a) $y = 8x + 5$

b) $y = 10x - 8$

*c) $y = 10x + 8$

d) $y = -5x + 8$

e) $y = 20x$

17) If $g(f(x)) = x$, $g(4) = 2$ and $g'(4) = 13$, then $f'(2)$ is

*a) $\frac{1}{13}$

b) $-\frac{1}{13}$

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

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

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18) Given that $\int_0^{64} e^x \, dx = m$

find $\int_0^8 x\, e^{x^2} \, dx$

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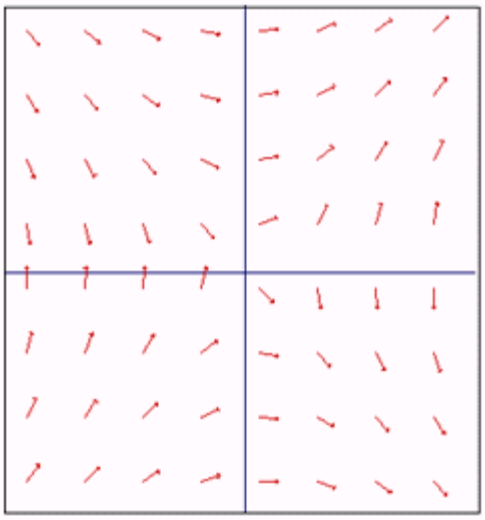

a) $\frac{dy}{dx} = \frac{1}{3} x y$

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

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

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

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

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

$$f(x) = \frac{x}{\ln(3x)}$$

a) $(1, 3)$

b) $(1, 3e)$

c) $\left(0, \frac{1}{3}\right)$

d) $\left(1, \frac{1}{3}e\right)$

*e) $\left(0, \frac{1}{3}e\right)$

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and
$$y = 4x$$

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d) $\frac{9}{32}$

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22) Find

$$\int_1^9 \frac{2}{\sqrt{x}}\,dx$$

*a) 8
b) 4
c) 35
d) 12
e) 36

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a) $2\pi \int_0^{\frac{1}{2}\pi} (16\sin(x)^2 + 2)\,dx$

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c) $\pi \int_0^{\frac{1}{2}\pi} (16\sin(x)^2 - 4)\,dx$

d) $2\pi \int_0^{\frac{1}{2}\pi} 16\sin(x + 2)^2\,dx$

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

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a) 6
b) 18
c) 36
d) 108
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25) The solution to the differential equation

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

with the initial condition $y(0) = 4$ is

a) $4\ln(5x^2)$
b) $e^{5x^2} + 3$
c) $\ln(5x^2 + 4)$

*d) $4\,e^{5x^2}$

e) $e^{5x^2} + 4$

26) $\int \sec^2(3x)\,dx =$

a) $\frac{1}{3}\tan^2(3x) + C$

b) $-3\tan(3x) + C$

c) $3\tan^2(3x) + C$

*d) $\frac{1}{3}\tan(3x) + C$

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

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

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*d) 768

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

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$$x = 6t + 1$$

a) 60

b) 30

*c) 6

d) $\frac{3}{5}$

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

29) If f is a differentiable function and $f(0) = -3$ and $f(2) = 6$, then which of the following must be true?

I. There exists a c in [0,2] where $f(c) = 0$.
II. There exists a c in [0,2] where $f'(c) = 0$.
III. There exists a c in [0,2] where $f'(c) = 9/2$.

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. $f(x) = \frac{7}{\sqrt{x}}$

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

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

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

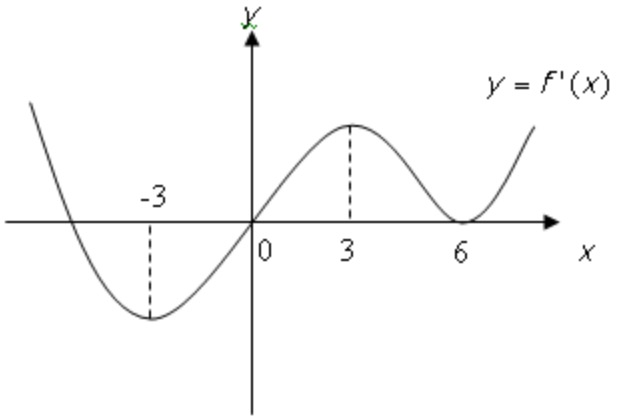
31) The area of the region in the first quadrant bounded by the graphs of $y = 4\cos(x)$, $y = 4\sin(x)$, and the y-axis is

a) $4\sqrt{2}$
b) 8
c) $4\sqrt{2} + 1$
*d) $4\left(\sqrt{2} - 1\right)$
e) $2\sqrt{2}$

32) Air is pumped into a spherical balloon at a rate of 10cm^3 per second. At what rate is the radius of the sphere changing when its volume is $36\pi\ \text{cm}^3$?

a) $\frac{5}{36\pi}$ cm/sec
b) $\frac{5}{12\pi}$ cm/sec
c) $\frac{10}{9\pi}$ cm/sec
*d) $\frac{5}{18\pi}$ cm/sec
e) $\frac{10}{3\pi}$ 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 maximum at $x = 0$.
b) f is increasing on [-3, 3].
*c) f has a point of inflection at $x = 6$.
d) f is concave down on [0, 6].
e) f has a local minimum at $x = -3$.

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

$$S(t) = (t-4)^2\,(t-5)$$

Which of the following is (are) true?
I. The particle changes direction at $x = 4$ and $x = 5$.
II. The particle is slowing down on [0, 4].
III. The particle is speeding up on [4, 5].
a) I only
*b) II only
c) II and III only
d) I and III only
e) I, II and III

35) The region enclosed by the graphs of

$$y = 7\,e^x$$

and the line

$$y = 7$$

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

*a) $\pi \int_{7}^{7e} \left(1 - \left(\ln\left(\frac{1}{7}y\right)\right)^2\right) dy$

b) $\pi \int_{0}^{1} \left(7\,e^x - 7\right)^2 dx$

c) $\pi \int_{7}^{7e} \left(7 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

d) $\pi \int_{0}^{7} \left(1 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

e) $\pi \int_{7}^{7e} \left(1 - \ln\left(\frac{1}{7}y\right)\right)^2 dy$

36) If

$$5x^2 + xy - \cos(y) = 10$$

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

a) $\frac{y - 10x}{x - \sin(y)}$

*b) $-\frac{(y + 10x)}{x + \sin(y)}$

c) $-\frac{10x}{x + \sin(y)}$

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

e) $-\frac{(x + \sin(y))}{y + 10x}$

37) The sum of two positive integers *x* and *y* is 120. Find the value of *x* that minimizes

$$P = x^3 - 120xy$$

a) $x = 60$

*b) $x = 40$

c) $x = 20$

d) $x = 100$

e) $x = 80$

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

$$v(t) = 5 - \ln(t)$$

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

a) $5e + 1$

b) $5e - 1$

*c) $5e - 6$

d) $5e + 5$

e) $e-6$

39) The function *f* is defined as

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

$$x \neq 7$$

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 [2, 7].

d) *f* has a local maximum at *x* = 2.

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

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

$$y = 8\sqrt{x}$$

the *x*-axis, and

the line *x* = 8

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) $\int_0^8 8x\,dx$

b) $\int_0^8 8\sqrt{x}\,dx$

*c) $\int_0^8 64x\,dx$

d) $\int_0^1 64x\,dx$

e) $\int_0^1 8\sqrt{x}\,dx$

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

*a) 16.5

b) 20.5

c) 26.0

d) 11.0

e) 14.5

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

$$\int_0^4 x f(x^2)\,dx$$

a) $\frac{16F(16)}{(2)}$

b) $4F(16)$

c) $2F(2) - 2F(0)$

d) $2F(16) - 2F(0)$

*e) $\frac{F(16) - F(0)}{(2)}$

43) The line normal to

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

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

a) 1

b) 2

c) –2

*d) 0

e) –1

44) f and g are two differentiable functions such that

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

$f'(1) = g'(1) = 8$

$f'(4) = 4$
$g'(4) = 8$

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

a) 16
b) 8
*c) 32
d) 64
e) 1

45) If $\frac{dy}{dx} = ye^x$ and $y(0) = 5$, then $y\ln(2) =$

*a) $5\,e$
b) $5\,e^2$
c) $5\,e^3$
d) $5\,e^{-2}$
e) $5\,e^{-1}$