Calculus AB:

Multiple Choice Questions

$$f(c) = \frac{1}{b-a}\int_{a}^{b} f(x)\,dx$$

Topics include differentiation, integrals, mean value theorem, graphs, extrema, differential equations, inverses, logarithms, and more.

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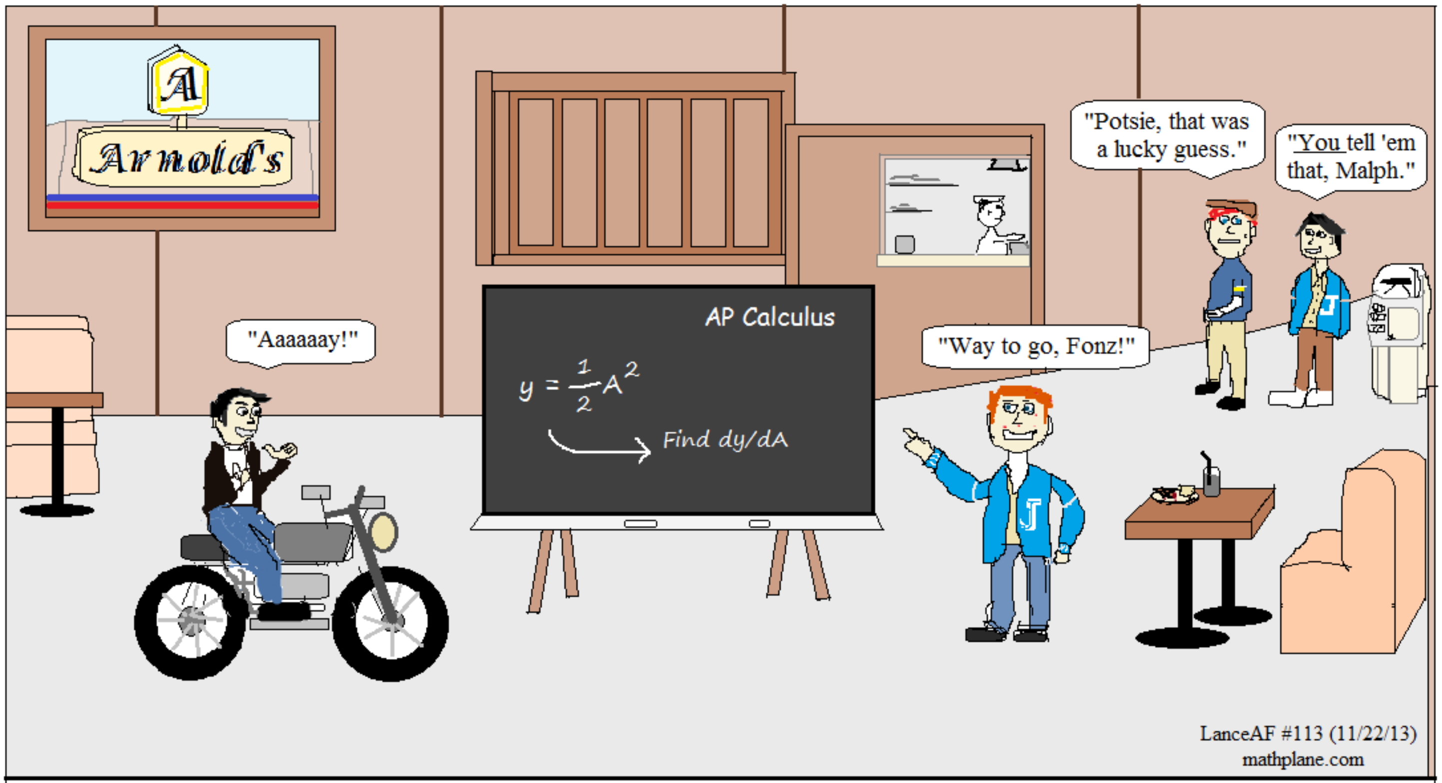

LanceAF #113 (11/22/13)
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Happy Days

Despite Richie's help, Fonzie dropped out of Calculus.
(... although he did have some success with velocity and acceleration!)

Multiple Choice Questions -→

1) What is the slope of the curve $x^3 + y^2 = 1$ @ $x = 1$?

a) 1

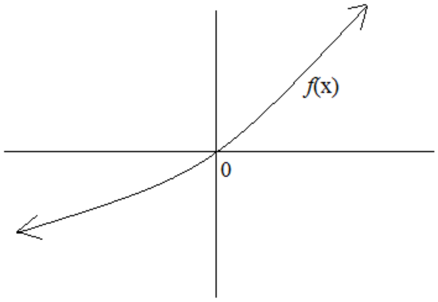
b) -3/2

c) 0

d) undefined

e) 1/2

2) Which is the smallest value?



a) $f(0)$

b) $f'(0)$

c) $f''(0)$

d) $f(3)$

e) $f'(3)$

3) $\int_0^8 x^{1/3} =$

a) 2

b) 6

c) 8

d) 12

e) none of the above

4) $h(x) = 5\cos^2(\pi - x)$ $\qquad h'(\frac{\pi}{2}) =$

a) 0

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

c) 5

d) 10

e) -10

5) $f(x) = \left| x^3 \right|$ $\qquad$ What is $\lim_{x \to -1} f'(x)$?

a) -3

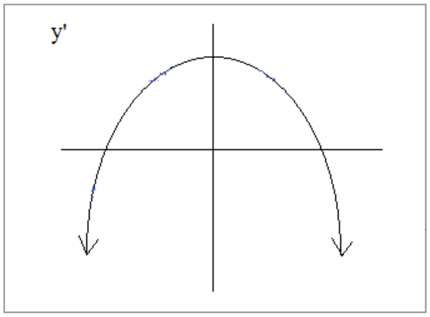
b) 0

c) 1

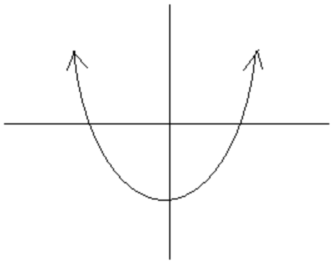
d) 3

e) Does not exist

6) Below is a graph of y'.
Which graph is possibly y?



a)



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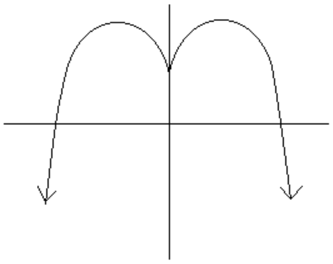

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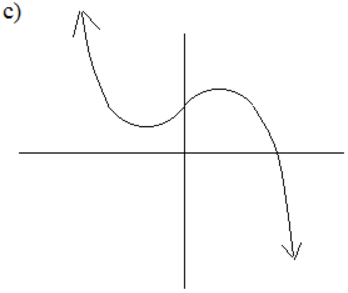

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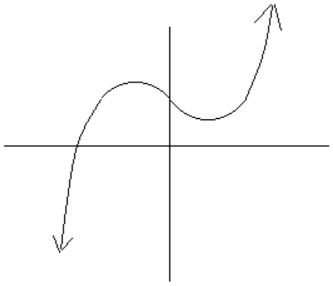

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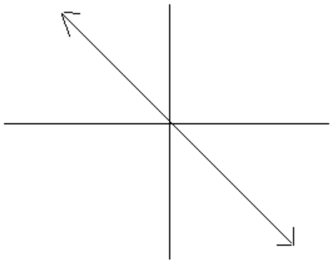


7) Find the instant rate of change with respect to r of

$$V = \frac{1}{6}\pi r^2 (5 - r)$$

@ r = 5

a) 0

b) $\frac{25\pi}{3}$

c) $\frac{-25\pi}{6}$

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

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

8) The velocity of a particle is modeled by $v(t) = t^2 - 3t - 10$
When is the particle *speeding up?*

a) $0 < t < 3/2$

b) $t > 3/2$

c) $t > 5$

d) $-2 < t < 3/2$ and $t > 5$

e) $3/2 < t < 5$

9) If $f'(x) = x^2\sqrt{x^3+1}$, and $f(2) = 0$,

then $f(0) =$

a) 2/9

b) 2/3

c) -52/3

d) -52/9

e) 0

10) $\displaystyle\int_{\frac{\pi}{2}}^{x} 2\cos t\, dt =$

a) 2sinx

b) $\frac{\sin x}{2}$

c) $2\sin x - 1$

d) $2(1 - \sin x)$

e) $2\sin x - 2$

11) Determine the equation of the line tangent to the curve

$x^2 - 3xy = 7$ @ (-1, 2)

a) $8x + 3y = -2$

b) $8x - 3y = -14$

c) $4x - 5y = -14$

d) $4x + 5y = 6$

e) $3x - 2y = -7$

12)

$f(3)$	$g(3)$	$f'(3)$	$g'(3)$
-1	2	4	-2

$h(x) = \frac{f(x)}{g(x)}$ $h'(3) =$

a) -2

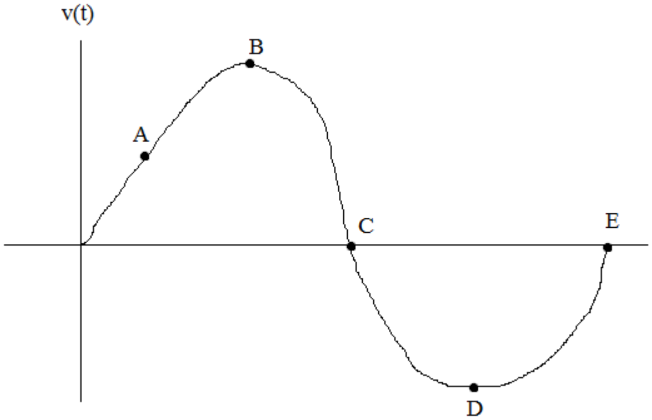
b) $\frac{3}{2}$

c) 3

d) 5

e) -3

13) The graph shows the velocity of an object (moving right and left) along the x-axis as a function of time. Which point corresponds to the position farthest to the right?



a) A

b) B

c) C

d) D

e) E

14) $$\int_{2}^{4} \frac{dx}{5-3x}$$

a) 8

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

c) $-3(\ln 7)$

d) $(\ln 7)^3$

e) Does not exist

15) What is the *absolute minimum* on the interval [-2, 1] for

$$f(x) = 6x^3 + 6x^2 - 6x + 14 \ ?$$

a) -6

b) -1

c) 1/3

d) 2

e) 12 8/9

16) $f(x) = 2x + e^x$

$g(x) = f^{-1}(x)$ for all x

Since $f(0) = 1$, what is $g'(1)$?

a) -3

b) -1/3

c) 0

d) 1/3

e) 3

17) $\int_{0}^{4} g(x)\ dx = -10$ $\int_{0}^{10} g(x)\ dx = 4$ g(x) is an EVEN function

$\int_{-10}^{-4} g(x)\ dx =$

a) -14

b) -6

c) 0

d) 6

e) 14

18) If $\int_{0}^{7} f(x)\,dx = 20$ what is $\int_{0}^{7} 2f(x) + 4\ dx$?

a) 18

b) 42

c) 44

d) 48

e) 68

19) $f(x) = 3x^2 + 2x + 4$

What is the average value between x = 1 and x = 4?

a) 17

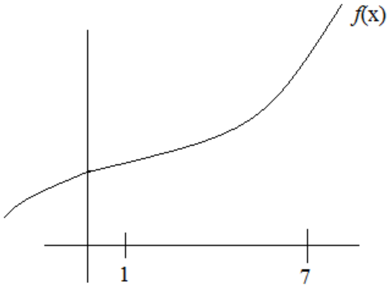
b) 23

c) 26

d) 30

e) 34.5

20) Which will give the highest value?



a) $\int_{1}^{7} f(x)$

b) Trapezoid Rule with 6 intervals

c) Left Riemann Sum using 3 subintervals between 1 and 7

d) Left Riemann Sum using 6 subintervals between 1 and 7

e) Right Riemann Sum using 6 subintervals between 1 and 7

21) For the function $f(x) = x^2 + 1$ on the interval [0, 2]

AP Calculus Questions

Find the value "c" guaranteed by the "integral mean value theorem"
(i.e. where the value $f(c)$ equals the average value on the interval [0, 2])

a) 1

b) 1.15

c) 1.75

d) 2

e) 3

22) For the function $h(x) = x^3 - 2$
on the interval [-1, 3]

I. determine the AROC (average rate of change)

a) -7

b) -1

c) 1

d) 7

e) 28

II. find the value "c" to verify the Mean Value Theorem

a) 1

b) 1.53

c) 2.57

d) 3

e) 6

23) Find the value of k so $g(x)$ is continuous:

$$g(x) = \begin{cases} k + x & \text{if} \quad x < 10 \\ xk & \text{if} \quad x \geq 10 \end{cases}$$

a) 9/10

b) 1

c) 10/9

d) 9

e) 10

24) For the equation $x = \sin t + 3$, $y = \cos t$ find $\frac{dy}{dx}$

a) $\tan t$

b) $-\tan t$

c) $\cot t$

d) $-\cot t$

e) $\frac{-\sin t(\sin t + 3) - \cos^2 t}{(\sin t + 3)^2}$

25) Find D_x of $g(f(x))$ when $x = 2$

x	1	2	3	4
$f(x)$	3	1	2	4
$f'(x)$	-7	-5	-4	-6
$g(x)$	4	3	1	2
$g'(x)$	1/3	1/9	7/9	2/9

a) 2/9

b) -4

c) 7/9

d) -5/3

e) -28/9

26) Find the equation of the line tangent to the graph $y = x^3 - 3x^2 + 5$ at the *point of inflection*.

a) $y = 6x + 6$

b) $y = x + 2$

c) $y = -3x + 6$

d) $y = -3x + 4$

e) $y = x + 8$

27) If the differential equation $\frac{dy}{dx} = \frac{-x}{4y}$ has a solution containing point (6, 1), then when x = 2,

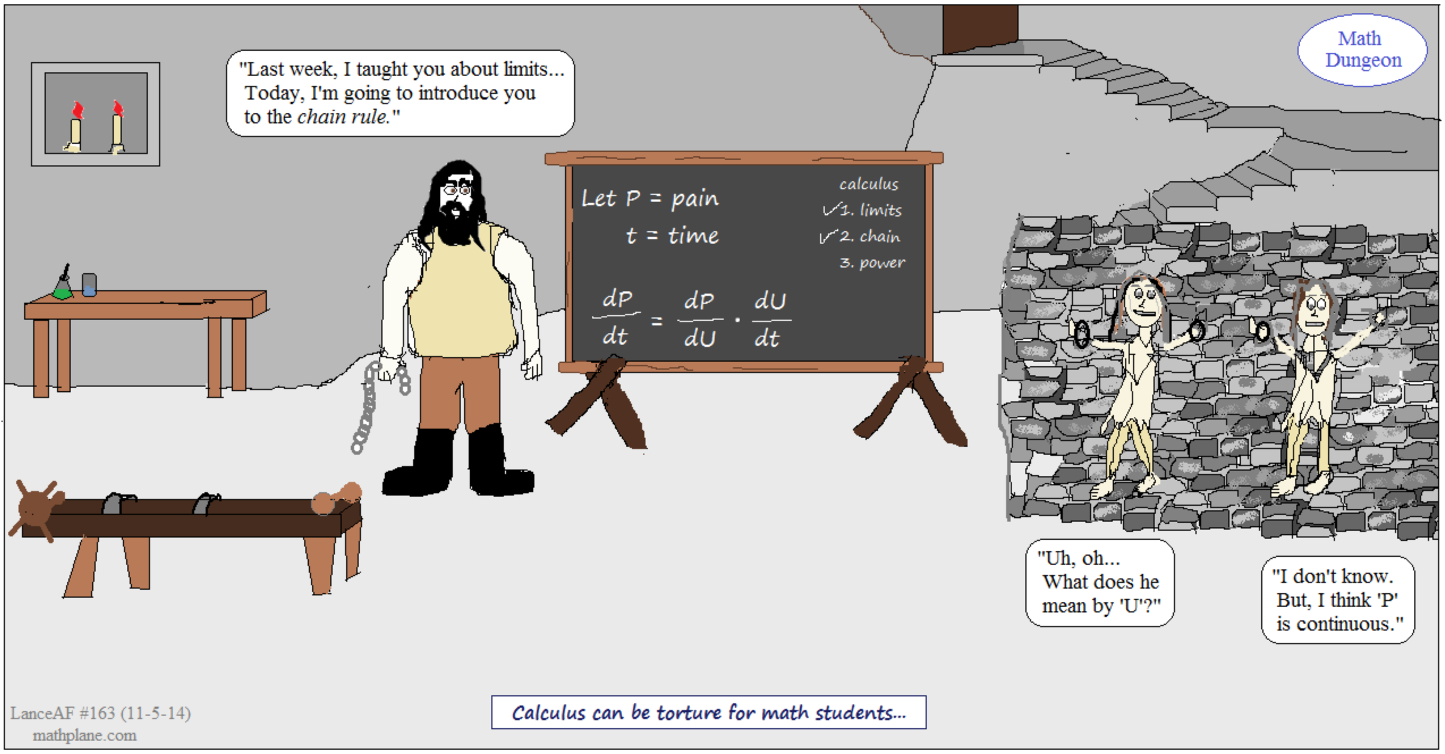
a) $y = 1$

b) $y = 2$

c) $y = 3$

d) $y = 4$

e) $y = 5$


Math Dungeon
"Last week, I taught you about limits... Today, I'm going to introduce you to the *chain rule*."
Let P = pain
t = time
calculus
✓1. limits
✓2. chain
3. power
$\frac{dP}{dt} = \frac{dP}{dU} \cdot \frac{dU}{dt}$
"Uh, oh... What does he mean by 'U'?"
"I don't know. But, I think 'P' is continuous."
Calculus can be torture for math students...
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SOLUTIONS-→

AP Calculus Questions

SOLUTIONS

1) What is the slope of the curve $x^3 + y^2 = 1$ @ $x = 1$?

a) 1

b) -3/2

c) 0

$\boxed{\text{d) undefined}}$

e) 1/2

Use implicit differentiation to find the instantaneous rate of change

$$3x^2 + 2y\frac{dy}{dx} = 0$$

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

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

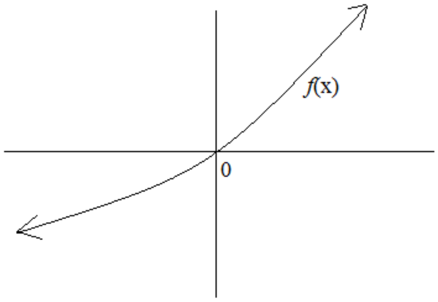
If $x = 1$, then $(1)^3 + y^2 = 1$

$y = 0$

substitute (1, 0) to find slope: $\frac{dy}{dx} = \frac{-3}{0}$

Undefined

2) Which is the smallest value?



$\boxed{\text{a) } f(0)}$

b) $f'(0)$

c) $f''(0)$

d) $f(3)$

e) $f'(3)$

Since the function is increasing,

$f'(x) > 0$

and, since the function is concave up,

$f''(x) > 0$...

Therefore, $\boxed{f(0) = 0 \text{ is the smallest..}}$

3) $$\int_0^8 x^{1/3} =$$

a) 2

b) 6

c) 8

$\boxed{\text{d) 12}}$

e) none of the above

$$\left.\frac{x^{4/3}}{4/3}\right|_0^8 = \left.\frac{3\,x^{4/3}}{4}\right|_0^8 = \frac{3(16)}{4} - 0 = \boxed{12}$$

4) $h(x) = 5\cos^2(\pi - x)$ $\quad h'(\frac{\pi}{2}) =$

$\boxed{\text{a) } 0}$

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

c) 5

d) 10

e) -10

$$h'(x) = 10\cos^1(\pi - x) \cdot \sin(\pi - x) \cdot (-1)$$

$$= -10\cos(\pi - x)\sin(\pi - x)$$

$$h'(\frac{\pi}{2}) = -10\cos(\frac{\pi}{2})\sin(\frac{\pi}{2})$$

$$= -10(0)(1) = \boxed{0}$$

5) $f(x) = |x^3|$ $\quad$ What is $\lim_{x \to -1} f'(x)$?

$\boxed{\text{a) -3}}$

b) 0

c) 1

d) 3

e) Does not exist

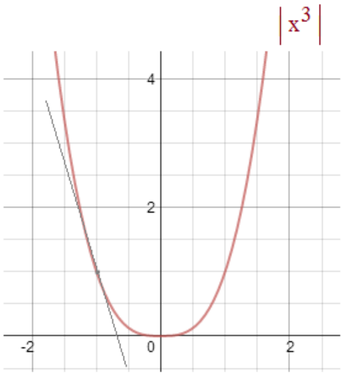
The derivative is the rate of change (slope) of the function.

$f'(x) = -3x^2$ for $x < 0$

$= 3x^2$ for $x > 0$

and, the derivative is continuous at -1...

$f'(-1) = -3(-1)^2 = \boxed{-3}$



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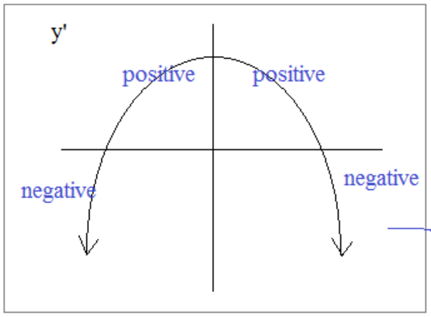
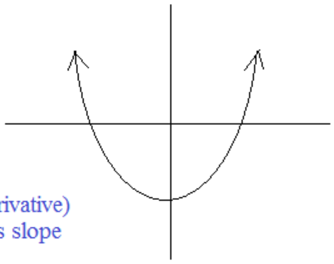
SOLUTIONS

6) Below is a graph of y'.
Which graph is possibly y?

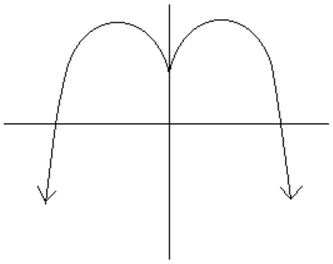


y' (the derivative) represents slope

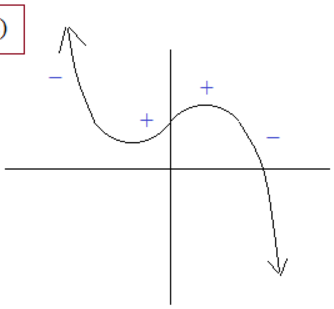
a)



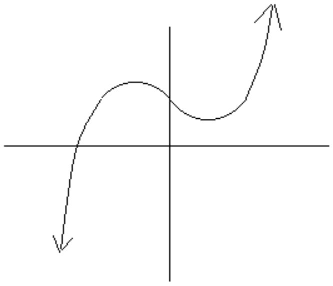
b)



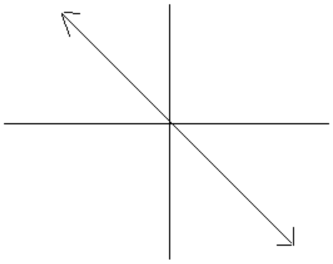
[✓ c)]



d)



e)



7) Find the instant rate of change with respect to r of

$$V = \frac{1}{6}\pi r^2 (5 - r)$$

@ r = 5

a) 0

b) $\frac{25\pi}{3}$

[✓ c) $\frac{-25\pi}{6}$]

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

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

$$V = \frac{1}{6}\pi(5r^2 - r^3)$$

$$\frac{dv}{dr} = \frac{\pi}{6}\left[10r - 3r^2\right]$$

Then, at r = 5: $\frac{\pi}{6}\left[10(5) - 3(5)^2\right] = \frac{\pi}{6}(-25)$

$$= \boxed{\frac{-25}{6}\pi}$$

8) The velocity of a particle is modeled by $v(t) = t^2 - 3t - 10$
When is the particle *speeding up?*

a) $0 < t < 3/2$

b) $t > 3/2$

c) $t > 5$

[✓ d) $-2 < t < 3/2$ and $t > 5$]

e) $3/2 < t < 5$

A particle is speeding up when the direction is increasing and accelerating OR, when the direction is decreasing and decelerating.

When is particle increasing? when $v(t) > 0$

$(t - 5)(t + 2) > 0$ on the interval $(-\infty, -2)$ and $(5, \infty)$

When is particle accelerating? when $a(t) > 0$ concave up

$a(t) = 2t - 3$ on the interval $(3/2, \infty)$

**particle is speeding up (in a positive direction) when $\boxed{t > 5}$

When is particle decreasing? when $v(t) < 0$ $(-2, 5)$

When is particle decelerating? when $a(t) < 0$ on the interval $(-\infty, 3/2)$

concave down

**particle is speeding up (in a negative direction) when $\boxed{-2 < t < 3/2}$

SOLUTIONS

9) If $f'(x) = x^2\sqrt{x^3 + 1}$, and $f(2) = 0$,

then $f(0) =$

a) 2/9

b) 2/3

c) -52/3

$\boxed{\text{d) } -52/9}$

e) 0

To find $f(x)$, take the antiderivative of $f'(x)$:

$$\int x^2 (x^3 + 1)^{\frac{1}{2}}\, dx$$

$$\frac{1}{3}\int \underset{U'}{3x^2}\, \underset{U}{(x^3 + 1)}^{\frac{1}{2}}\, dx$$

$$\frac{1}{3}\,\frac{(x^3+1)^{3/2}}{3/2} = \frac{2}{9}(x^3+1)^{3/2} + C$$

To find C, use a point on $f(x)$:

(2, 0): $\frac{2}{9}(2^3+1)^{3/2} + C = 0$

$6 + C = 0$

$f(x) = \frac{2}{9}(x^3+1)^{3/2} + (-6)$

Therefore, $f(0) = \frac{2}{9}(1) - 6 = \boxed{\frac{-52}{9}}$

10) $\int_{\frac{\pi}{2}}^{x} 2\cos t\; dt =$

a) $2\sin x$

b) $\frac{\sin x}{2}$

c) $2\sin x - 1$

d) $2(1 - \sin x)$

$\boxed{\text{e) } 2\sin x - 2}$

$$\int_{\frac{\pi}{2}}^{x} 2\cos t\; dt = 2\sin t\Big|_{\frac{\pi}{2}}^{x}$$

$$= 2\sin(x) - 2\sin(\frac{\pi}{2}) = \boxed{2\sin(x) - 2}$$

11) Determine the equation of the line tangent to the curve

$x^2 - 3xy = 7$ @ (-1, 2)

a) $8x + 3y = -2$

$\boxed{\text{b) } 8x - 3y = -14}$

c) $4x - 5y = -14$

d) $4x + 5y = 6$

e) $3x - 2y = -7$

To find equation of line, we need a point and the slope...
The point is (-1, 2), and to find the slope, use implicit differentiation:

$2x - 3(y + xy') = 0$

$2x = 3y + 3xy'$

$2x - 3y = 3xy'$

$y' = \frac{2x - 3y}{3x}$

@ (-1, 2) $y' = \frac{2(-1) - 3(2)}{3(-1)} = \frac{8}{3}$

$\boxed{y - 2 = \frac{8}{3}(x + 1)}$

$3y - 6 = 8x + 8$

$\boxed{y = \frac{8}{3}x + \frac{14}{3}}$

$\boxed{8x - 3y = -14}$

12)

$f(3)$	$g(3)$	$f'(3)$	$g'(3)$
-1	2	4	-2

$h(x) = \frac{f(x)}{g(x)}$ $h'(3) =$

a) -2

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

c) 3

d) 5

e) -3

Use quotient rule:

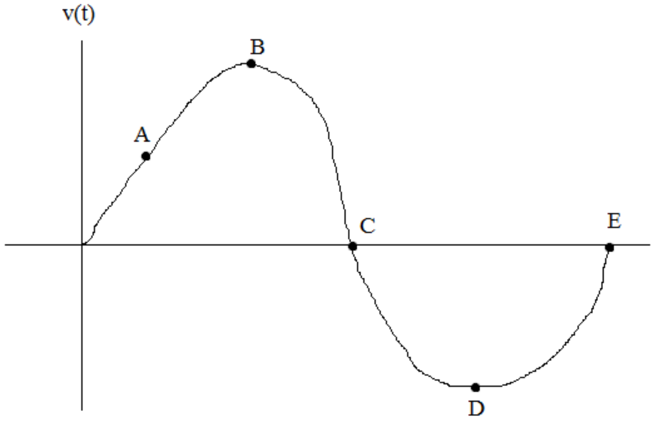
$$h'(x) = \frac{f'(x)g(x) - g'(x)f(x)}{g(x)^2}$$

$$h'(3) = \frac{f'(3)g(3) - g'(3)f(3)}{g(3)g(3)}$$

$$= \frac{4(2) - (-2)(-1)}{(2)(2)} = \boxed{\frac{3}{2}}$$

SOLUTIONS

13) The graph shows the velocity of an object (moving right and left) along the x-axis as a function of time. Which point corresponds to the position farthest to the right?



a) A

b) B

[✓ c) C]

d) D

e) E

The velocity graph shows the rate of change of the object.
so, if the graph is above the x-axis, the object is moving in a positive direction (i.e. to the right).
So, from t = 0 until point C, the particle is moving to the right...
After point C, the particle begins moving in a negative direction (i.e. to the left)...

14) $$\int_2^4 \frac{dx}{5-3x}$$

a) 8

[✓ b) $\frac{-\ln 7}{3}$]

c) -3(ln7)

d) $(\ln 7)^3$

e) Does not exist

"derivative of function"

$$-\frac{1}{3}\int_2^4 \frac{-3}{(5-3x)}\,dx$$

"function"

ln(function)

$$-\frac{1}{3}\ln\left|5-3x\right|\Big|_2^4$$

$$-\frac{1}{3}(\ln 7-\ln 1) = -\frac{1}{3}(\ln 7-0)$$

Using "U-substitution"

Let U = 5 - 3x

$$\frac{dU}{dx} = -3$$

$$dx = \frac{dU}{-3}$$

$$\int_2^4 \frac{1}{(5-3x)}\,dx$$

$$\int_2^4 \frac{1}{U}\,\frac{dU}{-3}$$

$$\frac{-1}{3}\ln U\Big|_2^4$$

15) What is the *absolute minimum* on the interval [-2, 1] for

$f(x) = 6x^3 + 6x^2 - 6x + 14$?

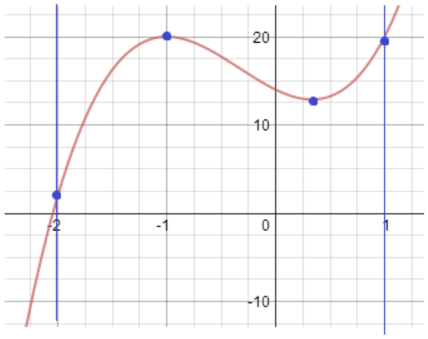
a) -6

b) -1

c) 1/3

[✓ d) 2]

e) 12 8/9



To find critical values and relative minimums, set derivative equal to zero...

$f'(x) = 18x^2 + 12x - 6$

$0 = 6(3x^2 + 2x - 1)$

$(3x - 1)(x + 1)$

$x = -1,\ 1/3$

$$\begin{array}{ccccc} + & -1 & - & 1/3 & + \end{array}$$

$f''(x) = 36x + 12$

$0 = 36x + 12$

$x = -1/3$ point of inflection

$x > -1/3$ (concave up)

$x < -1/3$ (concave down)

x = 1/3 is relative minimum

x = -1 is relative maximum

$f(1/3) = 6/27 + 2/3 - 2 + 14$
$= 12\ 8/9$

$\boxed{f(-2) = -48 + 24 + 12 + 14 = 2}$

$f(1) = 6 + 6 - 6 + 14 = 20$

endpoints of the interval

16) $f(x) = 2x + e^x$

$g(x) = f^{-1}(x)$ for all x

Since $f(0) = 1$, what is $g'(1)$?

a) -3

b) -1/3

c) 0

[✓ d) 1/3]

e) 3

Since inverses are reflections over y = x, it follows that their slopes are reciprocals...

$f'(x) = 2 + e^x$ at (0, 1), the slope is $2 + e^0 = 3$

therefore, the slope of $g(x)$ at (1, 0) should be 1/3

$\boxed{g'(1) = 1/3}$

SOLUTIONS

17) $\int_0^4 g(x)\,dx = -10$ $\int_0^{10} g(x)\,dx = 4$

g(x) is an EVEN function

$\int_{-10}^{-4} g(x)\,dx =$

a) -14

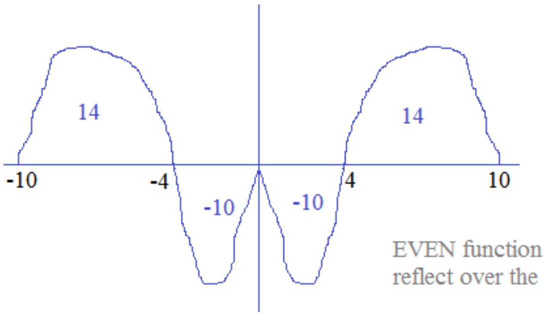
b) -6

c) 0

d) 6

[✓ e) 14]

possible sketch



EVEN functions
reflect over the y-axis

18) If $\int_0^7 f(x)\,dx = 20$ what is $\int_0^7 2f(x) + 4\,dx$?

a) 18

b) 42

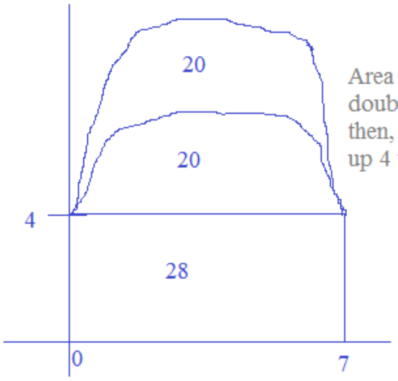
c) 44

d) 48

[✓ e) 68]

$$2\int_0^7 f(x)\,dx + \int_0^7 4\,dx$$

$$2\cdot(20) + 4x\Big|_0^7 = 68$$



Area is
doubled;
then, shifted
up 4 units...

19) $f(x) = 3x^2 + 2x + 4$

What is the average value between x = 1 and x = 4?

a) 17

b) 23

c) 26

[✓ d) 30]

e) 34.5

Area under curve between 1 and 4 $= \int_1^4 3x^2 + 2x + 4\,dx$

$$x^3 + x^2 + 4x\Big|_1^4 = 96 - 6 = 90$$

Therefore, the average value $= \frac{90}{(4-1)} = 30$

20) Which will give the highest value?

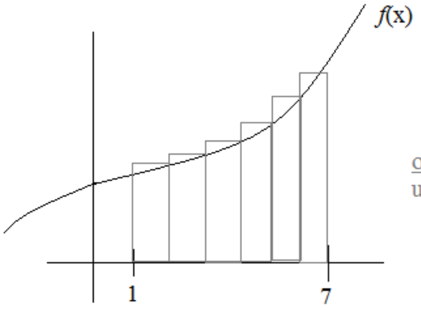
a) $\int_1^7 f(x)$

b) Trapezoid Rule with 6 intervals

c) Left Riemann Sum using 3 subintervals between 1 and 7

d) Left Riemann Sum using 6 subintervals between 1 and 7

[✓ e) Right Riemann Sum using 6 subintervals between 1 and 7]



overestimates the area
under the curve...

SOLUTIONS

21) For the function $f(x) = x^2 + 1$ on the interval [0, 2]

Find the value "c" guaranteed by the "integral mean value theorem"

(i.e. where the value $f(c)$ equals the average value on the interval [0, 2])

a) 1

$\boxed{\text{b) } 1.15}$

c) 1.75

d) 2

e) 3

First, find the average value on the interval:

$$\int_0^2 x^2 + 1 \; dx = \left.\frac{x^3}{3} + x\right|_0^2 = \frac{8}{3} + 2 - (0/3 + 0) = \frac{14}{3}$$

area under the curve
(i.e. total value on interval [0, 2])

average value: $\dfrac{\frac{14}{3}}{(2 - 0)} = \dfrac{7}{3}$ average value

Then,
since the function is continuous and closed on the interval,
there must be a value "c" such that $f(c)$ = average value

so, where does the function equal $\frac{7}{3}$? $\quad \frac{7}{3} = x^2 + 1$

$x = \dfrac{2\sqrt{3}}{3}$ approx. 1.15

$$f(c) = \frac{1}{b - a}\int_a^b f(x)\,dx$$

We don't include -1.15
(because it is not in the interval)

22) For the function $h(x) = x^3 - 2$
on the interval [-1, 3]

I. determine the AROC (average rate of change)

a) -7

b) -1

c) 1

$\boxed{\text{d) } 7}$

e) 28

Average
Rate
Of
Change

(slope) $\dfrac{25 - (-3)}{3 - (-1)} = 7$

II. find the value "c" to verify the Mean Value Theorem

a) 1

$\boxed{\text{b) } 1.53}$

c) 2.57

d) 3

e) 6

Instantaneous
Rate
Of
Change

$h'(x) = 3x^2 - 0$

at point "c" $\quad h'(c) = 7$

$3c^2 = 7$

$c = \cancel{-1.53}$ or 1.53

If function is continuous and differentiable...
there exists at least one point c where

$$f'(c) = \frac{f(b) - f(a)}{b - a} \qquad \text{interval } [a, b]$$

instantaneous
rate of change
at c

average rate
of change
between a and b

23) Find the value of k so $g(x)$ is continuous:

$$g(x) = \begin{cases} k + x & \text{if } x < 10 \\ xk & \text{if } x \geq 10 \end{cases}$$

a) 9/10

b) 1

$\boxed{\text{c) } 10/9}$

d) 9

e) 10

to be continuous, each part
of the piecewise function
must meet:

$k + x = xk$

at x = 10:

$10 + k = 10k$
$10 = 9k$
$k = 10/9$

(Note: although the function is continuous at x = 10, it is NOT differentiable because the slopes/ instanteous rates of change are different...)

24) For the equation
$x = \sin t + 3$
$y = \cos t$

find $\dfrac{dy}{dx}$

a) $\tan t$

$\boxed{\text{b) } -\tan t}$

c) $\cot t$

d) $-\cot t$

e) $\dfrac{-\sin t(\sin t + 3) - \cos^2 t}{(\sin t + 3)^2}$

We can find $\dfrac{dx}{dt} \longrightarrow \cos t + 0$

then, find $\dfrac{dy}{dt} \longrightarrow -\sin t$

$$\frac{dy}{dx} \leftarrow \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{-\sin t}{\cos t} = \boxed{-\tan t}$$

These show how x and y change *as t changes*

To find $\dfrac{dy}{dx}$, we combine the fractions (rates of change)

(chain rule)

$$\frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{dy}{dt} \cdot \frac{dt}{dx} = \frac{dy}{dx}$$

SOLUTIONS

25) Find D_x of $g(f(x))$ when x = 2

x	1	2	3	4
$f(x)$	3	1	2	4
$f'(x)$	-7	-5	-4	-6
$g(x)$	4	3	1	2
$g'(x)$	1/3	1/9	7/9	2/9

a) 2/9

b) -4

c) 7/9

$\boxed{\text{d) } -5/3}$

e) -28/9

Using the chain rule of compositions,
Derivative: $g(f(x))' = g'(f(x)) \cdot f'(x)$

$f(2) = 1$

$g'(1) = 1/3$ $\quad \boxed{-5/3}$

$f'(2) = -5$

26) Find the equation of the line tangent to the graph $y = x^3 - 3x^2 + 5$ at the *point of inflection*.

a) $y = 6x + 6$

b) $y = x + 2$

$\boxed{\text{c) } y = -3x + 6}$

d) $y = -3x + 4$

e) $y = x + 8$

For equation of line, we need a point and the slope...

The point will occur at the point of inflection...

$y' = 3x^2 - 6x$

$y'' = 6x - 6$

set $y'' = 0$: $\quad 6x - 6 = 0 \qquad x = 1$ (point of inflection)

plug x = 1 into the original equation,

$y = (1)^3 - 3(1)^2 + 5 = 3$

Then, the slope at (1, 3):

plug x = 1 into the derivative equation,

$y' = 3(1)^2 - 6(1) \qquad y' = -3$

Therefore, slope is -3...

$\boxed{y - 3 = -3(x - 1) \quad \text{or} \quad y = -3x + 6}$

27) If the differential equation $\frac{dy}{dx} = \frac{-x}{4y}$ has a solution containing point (6, 1), then when x = 2,

a) y = 1

b) y = 2

$\boxed{\text{c) } y = 3}$

d) y = 4

e) y = 5

Separable differential equations...

$4y\,dy = -x\,dx$ $\quad$ cross multiply / separate the variables...

$\int 4y\,dy = \int -x\,dx$ $\quad$ integrate

$2y^2 + C = \frac{-x^2}{2} + C$ $\quad$ combine

$\frac{x^2}{2} + 2y^2 = C$ $\quad$ find C

Since solution contains (6, 1)...

$\frac{6^2}{2} + 2(1)^2 = C \qquad C = 20$

$\frac{x^2}{2} + 2y^2 = 20$

finally, substitute x = 2

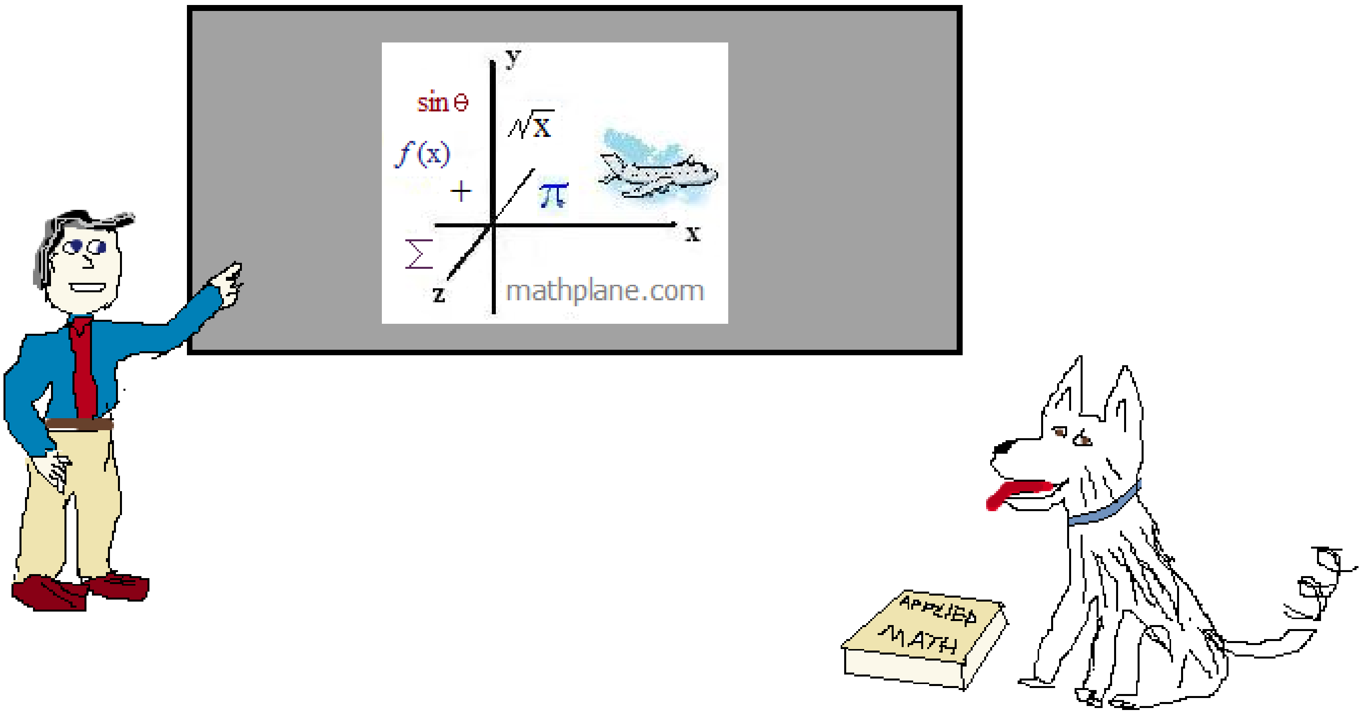
$\frac{2^2}{2} + 2y^2 = 20$

$\boxed{y = 3 \text{ or } -3}$

Thanks for visiting. (Hope it helps!)

If you have questions, suggestions, or requests, let us know.

Cheers.



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