

# Review Assignment #1

\* No Calculator

$$\textcircled{1} \int_1^2 (4x^3 - 6x) dx = [x^4 - 3x^2]_1^2 = [2^4 - 3(2)^2] - [1^4 - 3(1)^2] \\ = [16 - 12] - [1 - 3] \\ = 4 + 2 \\ = 6$$

$$\textcircled{2} f(x) = x\sqrt{2x-3} \quad \text{or} \quad x(2x-3)^{1/2}$$

$$u = x \quad u' = 1 \\ v = (2x-3)^{1/2} \quad v' = \frac{1}{2}(2x-3)^{-1/2} * 2$$

$$= \sqrt{2x-3} + \frac{x}{\sqrt{2x-3}} = \frac{2x-3+x}{\sqrt{2x-3}} = \frac{3x-3}{\sqrt{2x-3}}$$

$$\textcircled{3} Y = 3x^4 - 16x^3 + 24x^2 + 48$$

$$Y' = 12x^3 - 48x^2 + 48x$$

$$Y'' = 36x^2 - 96x + 48 = 0$$

$$12(3x^2 - 8x + 4) = 0$$

$$12(3x-2)(x-2) = 0$$

$$x = \frac{2}{3}, \quad x = 2$$

$$\begin{array}{r} 12 + + + \\ 3x-2 - + + \\ \hline x-2 - - + \\ \hline \end{array}$$

$$\frac{2}{3} < x < 2$$

$$\textcircled{4} \frac{1}{2} \int e^{\frac{t}{2}} dt$$

$$u = \frac{t}{2}$$

$$du = \frac{1}{2} dt$$

$$2 du = dt$$

$$2 + \frac{1}{2} \int e^u du$$

$$= e^u + C$$

$$= e^{\frac{t}{2}} + C$$

C

A

E

C

$$\textcircled{5} \quad \frac{d}{dx} (\cos(x^3))^2 = 2(\cos(x^3)) * -\sin(x^3) * 3x^2 = -6x^2 \cos(x^3) \sin(x^3)$$

double chainrule

D

$$\textcircled{6}$$

<u>Point</u> $x = \pi/4$ $y = \cos(\pi/2) = 0$ $\downarrow$ $(0, 0)$ $(\pi/4, 0)$	<u>Slope</u> $y = \cos(2x)$ $y' = -2\sin(2x) \Big _{x=\pi/4}$ $-2\sin(\pi/2)$ $y' = -2$
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$$y = -2(x - \pi/4)$$

\textcircled{7} tangent  $\parallel \rightarrow$  equal slopes

$$y = \frac{1}{2}x^2$$

$$y' = x$$

$$2x - 4y = 3$$

$$-4y = -2x + 3$$

$$y = \frac{1}{2}x - \frac{3}{4}$$

$$x = 1/2$$

$$\left(\frac{1}{2}, \frac{1}{8}\right)$$

$$y = \frac{1}{2}\left(\frac{1}{2}\right)^2 = \frac{1}{8}$$

\textcircled{8} A)

$\lim_{x \rightarrow a^-} f(x) = \lim_{x \rightarrow b^+} f(x)$ $y = 2$	$\lim_{x \rightarrow b^-} = 2$ $\lim_{x \rightarrow b^+} = 1$	$\lim_{x \rightarrow b} = \text{DNE}$
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B)

$\lim_{x \rightarrow a^+} = 2$ $\lim_{x \rightarrow a^-} = 2$	$\lim_{x \rightarrow a} = 2$
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\textcircled{9}  $x^2 + y^2 = 25$

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

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

$$U = -x \quad U' = -1 \quad V = y \quad V' = \frac{dy}{dx}$$

$$\frac{-x \frac{dy}{dx} - y}{y^2} = \frac{-x \left(-\frac{x}{y}\right) - y}{y^2} \Bigg|_{(4,3)} = \frac{-\frac{x^2}{y} - y}{y^2} = \frac{-\frac{16}{3} - 3}{9} = \frac{-25}{27}$$

A

D

$$f(x) = \ln|x^2 - 1| = \frac{2x}{x^2 - 1}$$

calculator open

$$\textcircled{D} f(x) = \frac{e^{2x}}{2x} \quad u = e^{2x} \quad u' = 2e^{2x}$$

$$v = 2x \quad v' = 2$$

$$f'(x) = \frac{4xe^{2x} - 2e^{2x}}{4x^2} = \frac{2e^{2x}(2x - 1)}{2^2 x^2} = \frac{e^{2x}(2x - 1)}{2x^2}$$

E

$$\textcircled{12} \lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} = 5$$

This means that  $f'(x) = 5$  at  $x=2$ .→  $f$  is differentiable.if a function is differentiable  
it has to be continuous.

C

$$\textcircled{13} f(x) = 2e^{4x^2}$$

$$f'(x) = 2e^{4x^2} + 8x \quad 16xe^{4x^2} = 3$$

$$= 16xe^{4x^2} \quad x = .168$$

$$\textcircled{14} f'(x) = e^x - 3x^2$$

$$e^x - 3x^2 = 0 \quad x = .910$$

max:  $f'(x) > 0 \rightarrow f'(x) < 0$   
above → below

⑯  $xy$

$$f'(x) = 4x - 8$$

$$4x - 8 = 0$$

$$x = 2$$

\*end points

$f'(x)=0$

$f'(x)=\text{DNC}$

none

$x=2$

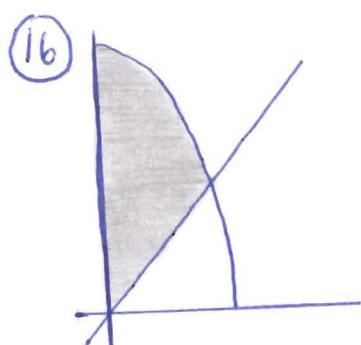
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$$\begin{array}{r} 4 \\ x-2 \end{array} \begin{array}{r} + \\ - \\ \hline \end{array} \begin{array}{r} + \\ + \\ \hline \end{array}$$

C

min @  $x=2 \rightarrow y = 2(2) - 8$

$y = -4$



.739

$$\int_0^2 (\cos x - x) dx = .400$$

C

⑰  $\lim_{x \rightarrow 2} \frac{x-2}{x-2}$

L'Hopital's Rule

$$\frac{f'(x)}{g'(x)} \rightarrow \text{deriv. of num.} \quad \lim_{x \rightarrow 2} \frac{1}{1} = 1$$

$f'(x) \rightarrow \text{deriv. of denom.}$

keep taking derivatives till you plug  
in the limit and dont get  $\frac{0}{0}$

⑱  $\lim_{x \rightarrow 0} \frac{\sin x}{x} \stackrel{\text{L'H}}{=} \frac{\cos x}{1} = \cos(0) = 1$

⑲  $\lim_{x \rightarrow 5} 2x^2 - 4x + 7$

\*cant simplify?  
↳ Plug in limit

$2(5)^2 - 4(5) + 7$   
 $50 - 20 + 7 = 37$

$$\textcircled{20} \quad \lim_{x \rightarrow \infty} \frac{x^2 + 4}{x - x^2} \rightarrow \frac{x^2}{-x^2} = -1$$

$\lim_{x \rightarrow \infty}$  → looking @ horizontal asymptotes

$$\frac{x^3}{x^2} \rightarrow \text{none}$$

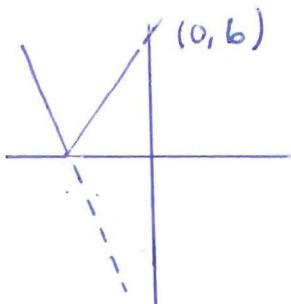
$$\frac{x^3}{x^3} \rightarrow \text{simplify}$$

$$\frac{x^3}{x^4} \rightarrow y=0$$

$$\textcircled{21} \quad \lim_{x \rightarrow -\infty} \frac{2x+3}{1-x^2} \rightarrow -\frac{2x}{x^2} \quad y=0$$

$$\textcircled{22} \quad \lim_{x \rightarrow -\infty} \frac{18x+6}{4x+2}$$

$$|18x+6| = \begin{cases} 8x+6 & x > -6 \\ -8x-48 & x < -6 \end{cases}$$



Use  $-8x-48$  (this is the piece of  $|1|$  that goes to  $-\infty$ .)

$$\lim_{x \rightarrow -\infty} \frac{-8x-48}{4x+2} = \frac{-8x}{4x} = -2$$

$$\textcircled{23} \quad t \geq 0 \quad v(t) = 3t^2 - 2t - 1 \quad \text{at } t=2 \quad x(t) = 5$$

$$\text{a) } \int 3t^2 - 2t - 1 dt = t^3 - t^2 - t + C$$

$$5 = 2^3 - (2)^2 - 2 + C$$

$$5 = 8 - 4 - 2 + C$$

$$5 = 2 + C$$

$$C = 3$$

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

instantaneous velocity  $\rightarrow 3t^2 - 2t - 1$

average velocity  $\rightarrow \frac{1}{3-0} \int_0^3 3t^2 - 2t - 1 dt = 5$

$$3t^2 - 2t - 1 = 5$$

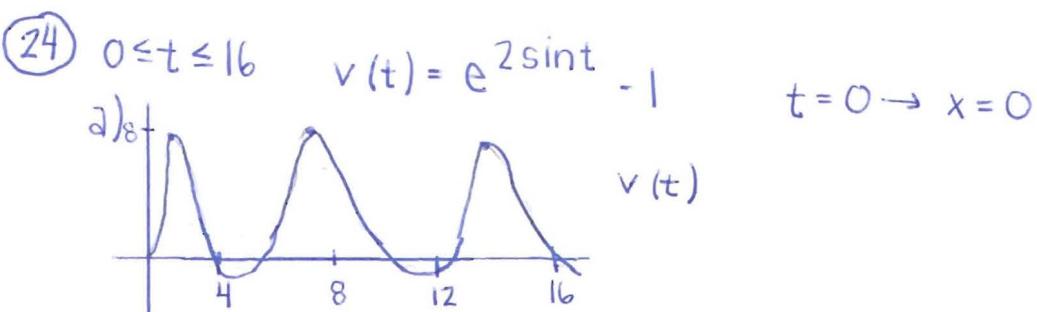
$$3t^2 - 2t - 6 = 0$$

$$t = \cancel{1.119} \quad t = 1.786$$

or

$$v(t) = \frac{x(3) - x(0)}{3 - 0} \rightarrow 3t^2 - 2t - 1 = 5 \quad t = 1.786$$

c)  $\int_0^3 |v(t)| dt = \int_0^3 |3x^2 - 2x - 1| dx = 17$



b) particle moving left  $\rightarrow$  Velocity is negative.  
(below x-axis)  $(\pi, 2\pi) \cup$   
 $(3\pi, 4\pi) \cup$   
 $(5\pi, 16)$

c)  $\int_0^4 |e^{2\sin t} - 1| dt = 10.542$

d) When position = 0

$\int_0^T v(t) dt$  has to = 0

Never  $\int_0^t v(t) dt$  is always +.

$$7) t > 0 \quad a(t) = \frac{3}{t^2} \quad @ t=1 \rightarrow \text{position} = 6 \quad \text{velocity} = 2$$

a)  $\int \frac{3}{t^2} dt = 3 \int t^{-2} dt = \frac{3t^{-1}}{-1} + C \quad v(t) = \frac{-3}{t} + C$   
 $2 = -3 + C \quad v(t) = \frac{-3}{t} + 5$   
 $C = 5$

b)  $\int -3t^{-1} + 5 dt = -3 \ln|t| + 5t + C$

$$6 = -\cancel{3 \ln|1|} + 5(1) + C \quad s(t) = -3 \ln|t| + 5t + 1$$

$$6 = 5 + C$$

$$C = 1$$

c)  $s(e) = -3 \cancel{\ln|e|} + 5e + 1$   
 $= -3 + 5e + 1$   
 $= 5e - 2$

$$\textcircled{25} \quad x(t) = t^3 - 6t^2 + 9t + 11$$

a)  $x'(t) = v(t) = 3t^2 - 12t + 9$

$$v(0) = 3(0)^2 - 12(0) + 9$$

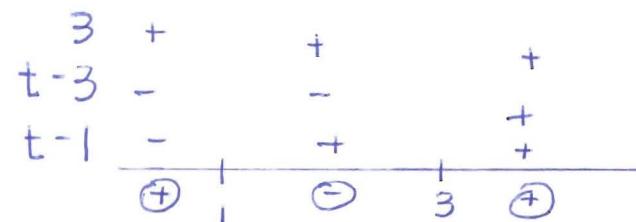
$$= 9 \text{ units/time}$$

b) moving left  $\rightarrow$  velocity is negative

$$3(t^2 - 4t + 3) = 0$$

$$3(t-3)(t-1) = 0$$

$$t=3 \quad t=1$$



$$1 < t < 3$$

c)  $\text{at } t=0 \rightarrow \text{Position} = 0^3 - 6(0)^2 + 9(0) + 11 = 11$

$\text{at } t=1 \rightarrow \text{Position} = 1^3 - 6(1)^2 + 9(1) + 11 = 15 \quad \left. \begin{array}{l} \\ 4 \end{array} \right\}$

$\text{at } t=2 \rightarrow \text{Position} = 2^3 - 6(2)^2 + 9(2) + 11 = 13 \quad \left. \begin{array}{l} \\ 2 \end{array} \right\} 4+2=6$

(26) a) @ rest  $\rightarrow v(t) = 0$

$$t = 5 \text{ seconds}$$

b)  $a(2) = 0$

$\uparrow$   
slope @  $t=2$

$$a(3) = \text{DNE}$$

$\uparrow$   
slope @  $t=3$

$$a(5) = -3/2$$

$\uparrow$   
slope @  $t=5$

c)  $3(30) + \frac{1}{2}(2)(30) + \frac{1}{2}(2)(30)$

d) y-value of 10  
 $\hookrightarrow t \approx 4.3 \text{ seconds}$

e)

$$v(t) = \begin{cases} 0 & 0 < t < 3 \\ -15x + 75 & 3 < t < 7 \end{cases}$$

$$(3, 30) \quad (5, 0)$$

$$\frac{30-0}{3-5} = \frac{30}{-2} = -15$$

$$y = -15(x-5)$$

$$y = -15x + 75$$

f) position @  $t=7 \rightarrow 150$

$$150 + 4 = 154 \text{ ft.}$$