You must remember the following rule:

$$\frac{d(\ln x)}{dx}=\frac{1}{x} \quad \text{or} \quad \frac{d[Ln(u)]}{dx}=\frac{1}{u}\frac{du}{dx}=\frac{u'}{u}$$

**I. Find the derivative for each of the following functions, frame your final answer.**

| | |
|---|---|
| 1. $y=\frac{Ln2x}{Ln\,3x}=\frac{\frac{1}{x}}{\frac{1}{x}}=\frac{\frac{1}{x}\ln(3x)-\frac{1}{x}\ln(2x)}{(\ln(3x))^2}=\ln\left(\frac{3}{2}\right)$ | 2. $f(x)=\sqrt{1+Lnx}$ $\quad \frac{1}{2\sqrt{u}}\cdot\left(\frac{1}{x}\right)=\frac{1}{2x\sqrt{1+\ln x}}$ |
| 3. $h(x)=Ln(e^x)$ $\quad \frac{1}{e^x}(e^x)$ $\quad x=\boxed{1}$ | 4. $g(x)=x^2+Lnx$ $\quad \boxed{2x+\frac{1}{x}}$ |
| 5. $y=\frac{Lnx}{x^2+1}$ $\quad u'=\frac{1}{x}$ $\quad v'=2x$ | 6. $\boxed{\frac{(x^2+1)\left(\frac{1}{x}\right)-\ln x\,(2x)}{(x^2+1)^2}}$ |

**II. Solve the following exercises, remember to show your procedure**

1. The demand for a certain article is given by $p=50-10Lnx$, where x represents the price of the article and $x \geq 1$. Determine the rate of change of the demand with respect of the price.

$p-10\left(\frac{1}{x}\right)=p'=\frac{-10}{x}$

2. The revenue by selling "x" hundreds of articles is given by $R(x)=60\sqrt{\ln x}$, where $x \geq 1$ and R is measured in hundreds of dollars. Find the marginal revenue for 400 items.

$60(\ln(x))^{1/2}$

$=30(\ln(x))^{-1/2}\left(\frac{1}{x}\right)=\frac{30}{x\sqrt{\ln|x|}}=.0306$

$\frac{60}{} = \frac{30}{400\sqrt{\ln x}}$

Rules of Differentiation → Not in order

OK

1) $4x^3(2x+5)^4$

$u=4x^3 \quad u'=12x^2$

$v=(2x+5) \quad v'=4(2x+5)^3(2)$

$v'=8(2x+5)^3$

$f'(x)=(2x+5)^4\,12x^2+4x^3(8(2x+5)^3$

$(2x+5)^2\,12x^2+32x^3(2x+9)^3$

3. $(4x+1)^3(3-x^2)^4$

$u=(4x+1)^3 \quad u'=3(4x+1)^2(4)=12(4x+1)^2$

$v=(3-x^2)^4 \quad v'=4(3-x^2)^3(-2x)=-8x(3-x^2)^3$

$f'(x)=(3-x^2)^4(12(4x+1)^2)+(4x+1)^3(-8x(3-x^2)^3$

7. $f(x)=\frac{(2x-1)^3}{2x^3}$ $\quad u=(2x-1)^3 \quad u'=3(2x-1)^2(2)$

$v=2x^3 \quad v'=6x^2$

$f'(x)=\frac{(2x^3)(6(2x-1)^2)-(2x-1)^3(6x^2)}{(2x^3)^2}=\frac{12x^3(2x-1)^2-6x^2(2x-1)^3}{4x^6}$

13) $f(x)=\frac{(x^3+1)^8}{(1-3x)^4}$ $\quad u=\frac{(x^3+1)^8}{(1-3x)^4}$ $\quad u=(x^3+1)^8$

$v=(1-3x)^4$

$u'=8(x^3+1)^7(3x^2)=24x^2(x^3+1)^7$

$v'=4(1-3x)^3(-3)=-12(1-3x)^3$

$f'(x)=\frac{(1-3x)^4(24x^2(x^3+1)^7)-(x^3+1)^8(-12(1-3x)}{((1-3x)^4)^2=8}$

I. Circle the right answer. (5 point each)

1) Find the slope for $f(x)=-5x^2$ at $x=3$ $\quad =-10x=-10(3)=-30$

A) 30 B) – 75 C) – 45 D) -30

2) What is the equation of the tangent line for the curve $y=x^3+2$ at the point $(-1,1)$ $\quad \to y-y_1=m(x-x_1)$

A) $y=-3x+4$ B) $y=3x-4$ C) $y=3x+4$ D) $y=-3x-4$

$\frac{(x+h)^3+2-(x^3+2)}{h}$

$x^3+3h^2x+3hx^2+h^3+2$

$\frac{3h^2x+3hx^2+h^3}{h}$

$=\frac{3hx(h+1x+}{h}$

$3x(h+1x$

$3x$

3) The following functions is not differentiable at $x=-4$

a) $f(x)=|x+4|$ b) $f(x)=x^2-4$ c) $f(x)=\frac{x+2}{x-4}$ $f(x)=\sqrt{-x}+4$

4) The following function is not differentiable at $x=1$

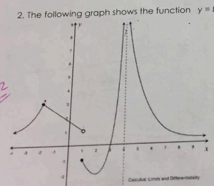
a) $f(x)=\frac{1}{x+1}$ b) $y=(x-1)^3$ c) $f(x)=|x+1|$ d) $f(x)=\sqrt[3]{x-1}$ Point of discontinuity

II. Answer the following questions.

1. The position of an object, s, at any time, t, is given by: (15 points)
$s(t)=-18t^3+15t+8$ where s is measured in feet and t is measured in seconds.
Find the equation of acceleration at any time $a(t)$.

$s(t)=-54t^2+15 \to =-108t$

2. The following graph shows the function $y=f(x)$ (20 points)




a) Find the values of "x" where the function is not continuous 1 4

b) Find the values of "x" where the function is not differentiable 4, -2 1

I. Determine if true or false for each of the following statements (5 points each)

1. F The derivative of $y=6-e^{-x}$ is $y'=e^{-x}$

2. T The derivative of $y=Ln(x-4)^{3/2}$ is $y'=\frac{3}{2}Ln(x-4)^{1/2}$ $\quad \frac{3}{2}(x-4)^{1/2}\cdot(1)$

3. T If s(t) is the function of position of an object in motion, then $a(t)=s''(t)$ is equal to the function of the acceleration of the object.

4. T If the velocity of the car is a function of time, then the derivative of this function with respect to time, describes the acceleration of the car.

II. Circle the right answer. (10 point each)

1. ( D ) The derivative for $y=2e^{3/x}$ is:

A) $y'=2e^{3/x}$ B) $y'=2e^3$ C) $y'=-\frac{6e^{3/x}}{x^2}$ D) $y'=6x^2e^{3/x}$

2. ( B ) The derivative for $y=Ln\sqrt{2x-4}$ is:

A) $y'=\frac{1}{2x-4}$ B) $y'=\frac{1}{2}Ln(2x-4)^{-1/2}$ C) $y'=\frac{1}{2}Ln\frac{2}{\sqrt{2x-4}}$ D) $y'=\frac{1}{x-2}$

$\frac{1}{2(2x-4)^{1/2}}$

$\frac{1(2x-4)^{-1/2}}{2}$

( C ) If the equation that gives the velocity of an object is $v(t)=2t^3e^{6t}$, then the equation th... es the acceleration is:

A) $a(t)=6t^2e^{6t}(2t+1)$ B) $a(t)=6t^2e^{6t}$ C) $a(t)=36t^2e^{6t}$ D) $a(t)=12t^3e^{6t}$

$6t^2\cdot(6)e^{6t}$

If $f(x)=e^{U}$ then $f'(x)=U'e^{U}$

| | |
|---|---|
| 1) $y=\frac{3}{e^{2x^2}}$ <br> $\frac{3 \cdot -4x(e^{-2x^2})}{4x(e^{-2x^2})} = \boxed{-12e^{-2x^2}}$ <br> $2x^2$ <br> $4x$ | 2) $y=\frac{e^{x^2}}{2x}$ $u'=2x(e^{x^2})$ $u=e^{x^2}$ $u'=2xe^{x^2}$ <br> $2x(e^{x^2})(+2x)$ $v=2x$ $v'=2$ <br> $\boxed{= \frac{(2x)(2xe^{x^2})-(e^{x^2})(2)}{(2x)^2}}$ |
| 3) $y=e^{3x}(2x-1)^4$ PRODUCT AND CHAIN RULE <br> $4e^{(3x)}(3)(2x-1)^3$ <br> $\boxed{12e^{3x}(2x-1)^3}$ <br> $e^{3x}(4(2x-1)^3(2)) + (2x-1)^4(3e^{3x})$ | 4) $f(x)=\frac{e^{2x}}{6}+2x^5$ $U'=2$ <br> $\boxed{\frac{2(e^{2x})}{6}+10x^4 = \frac{1}{3}(e^{2x})+10x^4}$ |
| 5) $f(x)=e^{(x^2+3x)^4}$ <br> $\boxed{4e^{(x^2+3x)^4}\cdot(x^2+3x)^3(2x+3)}$ <br> $(8x+12)e^{(x^2+3x)^4}\cdot(x^2+3x)^3$ | |

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1. If $f(5)=1$, ...

$f(5)\cdot g'(5)+f'(5)\,g(5) = (1)(2) \ldots -18$

a) $(f\cdot g)'(5)$

b) $(f/g)'(5)$ $\frac{g(5)f'(5)-f(5)g'(5)}{g(5)^2} = \frac{(-3)(6)-(1)(2)}{(-3)^2} = \frac{-18-2}{9} = \boxed{\frac{-20}{9}}$

c) $(g/f)'(5)$ $\frac{f(5)g'(5)-g(5)f'(5)}{f(5)^2} = \frac{(1)(2)-(-3)(6)}{(1)} = \frac{2+18}{1} = \boxed{20}$

2. If $f(3)=4$, $g(3)=2$, $f'(3)=-6$ and $g'(3)=5$, find the following values

a) $(f+g)'(3)$ $f'(3)+g(3)' = -6+5 = \boxed{-1}$

b) $(f\cdot g)'(3)$ $f(3)\cdot g'(3)+f'(3)\cdot g(3) = 4(5)+(-6)(2) = \boxed{8}$ <br> $20 + -12$

c) $(f/g)'(3)$ $\frac{g(3)f'(3)-f(3)g'(3)}{g(3)^2} = \frac{2(-6)-4(5)}{(2)^2} = \frac{-12-20}{4} = \frac{-32}{4} = \boxed{-8}$

3. If $h(x)=f(x)g(x)$, use the table to find $h'(-1)$, $h'(0)$ and $h'(1)$

| $x$ | $f(x)$ | $f'(x)$ | $g(x)$ | $g'(x)$ |
|---|---|---|---|---|
| -1 | 2 | 1 | 1 | 2 |
| 0 | -1 | 0 | -1 | 3 |
| 1 | 2 | -1 | 0 | 5 |

$(1)(1)+(2)(2) = h(-1) = \boxed{5}$

$(-1)(3)+(0)(-1) = \boxed{-3} = h(0)$

$(2)(5)+(-1)(0) = \boxed{10}$

$10+0$

4. If $h(x)=f(x)/g(x)$, use the table to find $h'(-1)$, $h'(0)$ and $h'(1)$

| $x$ | $f(x)$ | $f'(x)$ | $g(x)$ | $g'(x)$ |
|---|---|---|---|---|
| -1 | 2 | 1 | 1 | 2 |
| 0 | -1 | 0 | -1 | 3 |
| 1 | 2 | -1 | 2 | 5 |

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

$h(0) = \frac{(-1)(0)-(-1)(3)}{(-1)^2} = \frac{0- -3}{1} = \boxed{3}$

$h(1) = \frac{(2)(-1)-(2)(5)}{(2)^2} = \frac{-2-10}{4} = \frac{-12}{4} = \boxed{-3}$