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CLASSWORK 2

Given a function f(x), then

1. Give the definition of the derivative (in terms of x and h). $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$

2. Find the derivative of $f(x)=3x^2-2x+1$ using the definition of the derivative

$f'(x)=\lim_{h\to 0}\frac{3(x+h)^2-2(x+h)+1-(3x^2-2x+1)}{h}=\lim_{h\to 0}\frac{3(x^2+2xh+h^2)-2x-2h+1-3x^2+2x-1}{h}$

$=\lim_{h\to 0}\frac{6xh+3h^2-2h}{h}=\lim_{h\to 0}6x-2+3h$

$=6x-2$

Find the derivative of each function (you may use the shortcut).

3. $f(x)=-x^4+2x^3+5$

$f'(x)=-4x^3+6x^2$

4. $f(x)=\frac{3}{5x}-\sqrt{x}$ $=\frac{3}{5x}-x^{\frac{1}{2}}$, $f'(x)=-\frac{3}{5}x^{-2}-\frac{1}{2}x^{-\frac{1}{2}}$

$=-\frac{3}{5x^2}-\frac{1}{2\sqrt{x}}$

5. $f(x)=3x-\cos x$, $f'(x)=3+\sin x$

6. $f(x)=\frac{x^3-3x^2+4}{x^2}$ $=\frac{x^3}{x^2}-\frac{3x^2}{x^2}+\frac{4}{x^2}=x-3+4\cdot x^{-2}$, $f'(x)=1-8x^{-3}$

$=1-\frac{8}{x^3}$

Find the equation of the tangent line to the graph of the function at the indicated point

7. $f(x)=x^3+x$ at $(-1,-2)$, $f'(x)=3x^2+1$, at $x=-1$, the slope of tangent line at $x=-1$ is $f'(-1)=3(-1)^2+1=4$. Then the equation of line is $(y+2)=4(x+1)$.

8. $f(x)=\frac{1}{\sqrt{x}}$ at $(4,\frac{1}{2})$ $\Rightarrow f'(x)=-\frac{1}{2}x^{-\frac{3}{2}}=-\frac{1}{2\sqrt{x^3}}$, $f'(4)=\frac{-1}{16}$

" $\frac{-1}{x^2}$" line: $(y-\frac{1}{2})=-\frac{1}{16}(x-4)$

Bonus: Determine the coefficients A, B and C so that the curve $y=Ax^2+Bx+C$ will pass through (1,3) and be tangent to the line $4x+y=8$ at (2,0). let $f(x)=Ax^2+Bx+C$.

Pass through (1,3) $\Rightarrow 3=A\cdot 1^2+B\cdot 1+C=A+B+C$. — (1)

Pass through (2,0) $\Rightarrow 0=A\cdot 2^2+B\cdot 2+C=4A+2B+C$. — (2)

A tangent line at (2,0) $\Rightarrow y=-4x+8=-4(x-2) \Rightarrow$ slope $=-4$.

means $f'(x)=2Ax+B$ and $-4=f'(2)=4A+B$ — (3)

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$$A+B+C=3 \quad \Rightarrow A=1 \text{ 、 } B=0 \text{ 、 } C=4$$

$$4A+2B+C=0$$

$$4A+B=-4$$