① Calculate the derivative with the limit process. $f(x) = 2-5x$

$$\lim_{\Delta x \to 0} \frac{(2-5(x+\Delta x))-(2-5x)}{\Delta x}$$

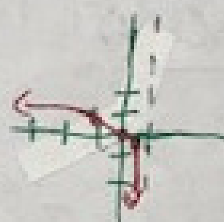
$$\lim_{\Delta x \to 0} \frac{\cancel{2}-\cancel{5x}-5\Delta x\cancel{-2}+\cancel{5x}}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{-5\cancel{\Delta x}}{\cancel{\Delta x}} \qquad \lim_{\Delta x \to 0} -5 = -5$$

② $$\lim_{x \to 1^-} \frac{x}{x-1}$$

x	-1	0	$\frac{1}{2}$	1
y	$\frac{1}{2}$	0	-1	?

$$\frac{\frac{1}{2}}{\frac{1}{2}-1} = \frac{1}{2} \cdot \frac{-2}{1}$$



$-\infty$

③ $g(x) = \sqrt{7-x}$ On what interval(s) is

$f(x) = \dfrac{x}{x^2+2}$ $f(g(x))$ continuous?

$$f(g(x)) = \frac{\sqrt{7-x}}{(\sqrt{7-x})^2+2} = \frac{\sqrt{7-x}}{7-x+2} = \frac{\sqrt{7-x}}{-x+9}$$

$7-x \geq 0$ & $-x+9 \neq 0$

$-7 \quad -7 \qquad -9 \quad -9$

$\frac{-x}{-1} \geq \frac{-7}{-1} \qquad \frac{-x}{-1} \neq \frac{-9}{-1}$

$x \leq 7$ & $x \neq 9$

④ Find $\dfrac{d^2y}{dx^2}$ for $y = \dfrac{x}{x-1}$

$$\frac{dy}{dx} = \frac{1(x-1)-(x)(1)}{(x-1)^2} = \frac{x-1-x}{(x-1)^2} = \frac{-1}{(x-1)^2} = -1(x-1)^{-2}$$

$$\frac{d^2y}{dx^2} = 2(x-1)^{-3}(1) = \frac{2}{(x-1)^3}$$

⑤ $f(x) = (5x-1)^3$ find $f''(x)$

$f'(x) = 3(5x-1)^2(5) = 15(5x-1)^2$

$f''(x) = 30(5x-1)^1(5) = \boxed{150(5x-1)}$

⑥ $f(3) = 1$ $f'(3) = 5$

Find the equation of the tangent line at $x=3$ of $f(x)$.

$y-1 = 5(x-3)$

$y - 1 = 5x - 15$
$\quad +1 \qquad\quad +1$

$\boxed{y = 5x - 14 \text{ or } y - 1 = 5(x-3)}$

⑦ $f(x) = \dfrac{x+1}{x^2-1}$ Find all critical numbers.

$f(x) = \dfrac{\cancel{x+1}}{(x-1)\cancel{(x+1)}} = \dfrac{1}{x-1} = (x-1)^{-1}$ hole at $x=-1$

$f'(x) = -(x-1)^{-2} = \dfrac{-1}{(x-1)^2}$ $\sqrt{(x-1)^2} = \sqrt{0}$

$x - 1 = \pm 0$ $x = 1$ it's a VA
$\quad +1 \quad +1$

$\boxed{\text{No critical \#s}}$

⑧ $g(x) = 2x^4 - x^2$ a) At what x values does $g(x)$ have a Rel. Min?

b) Find x values of all P of I of $g(x)$.

$g'(x) = 8x^3 - 2x = 2x(4x^2-1)$

$g''(x) = 24x^2 - 2 = 2(12x^2-1)$

ⓐ $2x=0$ $4x^2-1=0$

$x=0$ $\sqrt{x^2} = \sqrt{\tfrac{1}{4}}$ $x = \pm\frac{1}{2}$

$g''(0) = -\ \cap$ $g''(\tfrac{1}{2}) = +\ \cup$ $g''(-\tfrac{1}{2}) = +\ \cup$

$\boxed{x = \tfrac{1}{2} \text{ \& } -\tfrac{1}{2} \text{ are both Rel Mins}}$

ⓑ $12x^2 - 1 = 0$

$\sqrt{x^2} = \sqrt{\tfrac{1}{12}}$

$x = \pm \dfrac{1}{\sqrt{12}} \cdot \dfrac{\sqrt{12}}{\sqrt{12}} = \dfrac{\sqrt{12}}{12} = \dfrac{2\sqrt{3}}{12} = \dfrac{\pm\sqrt{3}}{6}$

$x < -\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6} < x < \frac{\sqrt{3}}{6}$	$x > \frac{\sqrt{3}}{6}$
+	−	+

$x = \dfrac{\pm\sqrt{3}}{6}$ are P of I

⑨ You measure the radius of a circle as 7 inches and you are within .2 inches. Find the propagated error of the area of the circle.

$r=7 \quad dr=\pm .2$

$A=\pi r^2$

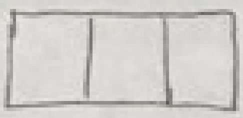
$\cancel{\frac{d}{dr}} \cdot \frac{dA}{\cancel{dr}} = 2\pi r \cdot dr$

$dA=2\pi r\, dr$

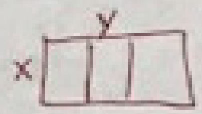
$dA=2\pi(7)(\pm .2)$

$\begin{array}{r} 14 \\ \times .2 \\ \hline 2.8 \end{array}$

$dA=\pm 2.8\pi$

⑩ 

What is the maximum area possible with 200 ft of fencing



$A=xy$

$4x+2y=200$
$-4x \quad\quad -4x$

$\frac{2y}{2} = \frac{-4x+200}{2}$

$y=-2x+100$

$A=x(-2x+100)$

$A=-2x^2+100x$

$A'(x)=-4x+100 \quad A''(x)=-4 = - \cap \text{ Max}$

$0=-4x+100$

$x=25$

$A(25)=25(-2(25)+100)$

$A(25)=25(50)=\boxed{1250 \text{ ft}^2}$

⑪ Find the horizontal asymptote for each

a) $y=\frac{5x-2}{x^2-3}$ b) $f(x)=\frac{7x-5}{x+3}$ c) $g(x)=\frac{3x}{\sqrt{5+x}}$

$\lim_{x\to\infty} \frac{\frac{5}{x}-\frac{2}{x^2}}{1-\frac{3}{x^2}} = 0$ $\quad \lim_{x\to\infty} \frac{7-\frac{5}{x}}{1+\frac{3}{x}} = 7$ $\quad \lim_{x\to\infty} \frac{3\sqrt{x}}{\sqrt{\frac{5}{x}+1}} = \infty$

a) $y=0$ b) $y=7$ c) None