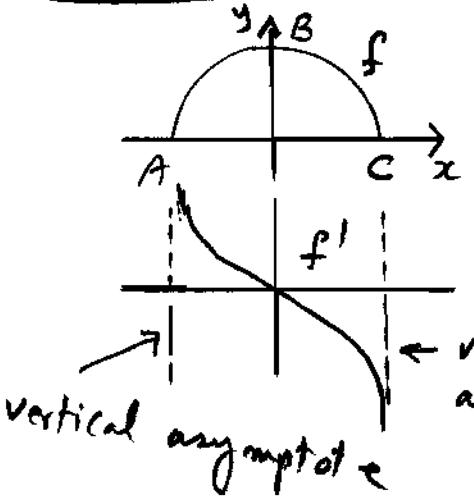
(2-9) # 10, 12, 16, 30, 46 (KEY)

$\boxed{\#10/\text{p.}173}$



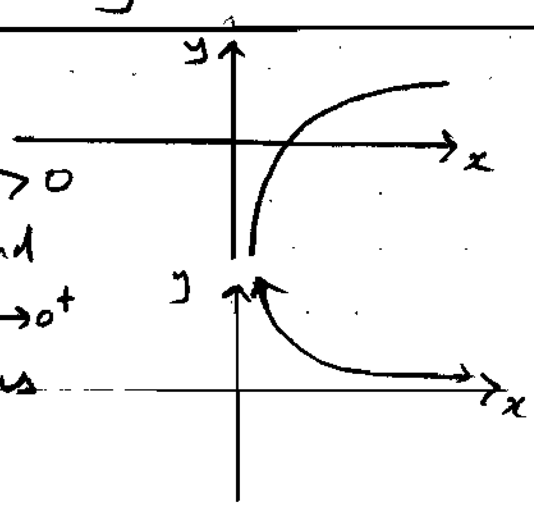
The tangent at A vertical, at B horzontal, at C vertical.

slope > 0 between A and B

slope < 0 between B and C

$\boxed{\#12/\text{p.}173}$ is very obvious.

$\boxed{\#16/\text{p.}174}$



$y = f(x) = \ln x$

The slope of $\ln x > 0$ for all $x > 0$ and approach ∞ as $x \to 0^+$ and decreasing as $x \to \infty$.

$y = f'(x) = \frac{1}{x}, x > 0$

Guess!

$\boxed{\#30/\text{p.}174}$ $g(x) = \frac{1}{x^2} \Rightarrow g'(x) = \lim_{h \to 0} \frac{g(x+h) - g(x)}{h}$

$$\Rightarrow g'(x) = \lim_{h \to 0} \frac{1}{h}\left[\frac{1}{(x+h)^2} - \frac{1}{x^2}\right] = \lim_{h \to 0} \frac{1}{h}\left[\frac{x^2 - (x+h)^2}{x^2(x+h)^2}\right]$$

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

Domain of g is $(-\infty, 0) \cup (0, \infty)$

Domain of g' is $(-\infty, 0) \cup (0, \infty)$

2a

5

$\boxed{\#46/p175}$ $f(x) = \begin{cases} 0, & \text{if } x \le 0 \\ 5-x, & \text{if } 0 < x < 4 \\ \dfrac{1}{5-x}, & \text{if } x \geq 4 \end{cases}$

a) $f'_{-}(4) = \lim\limits_{h\to 0^-} \dfrac{f(4+h)-f(4)}{h} = \lim\limits_{h\to 0^-} \dfrac{1}{h}\left[(5-(4+h)) - \dfrac{1}{5-4}\right]$

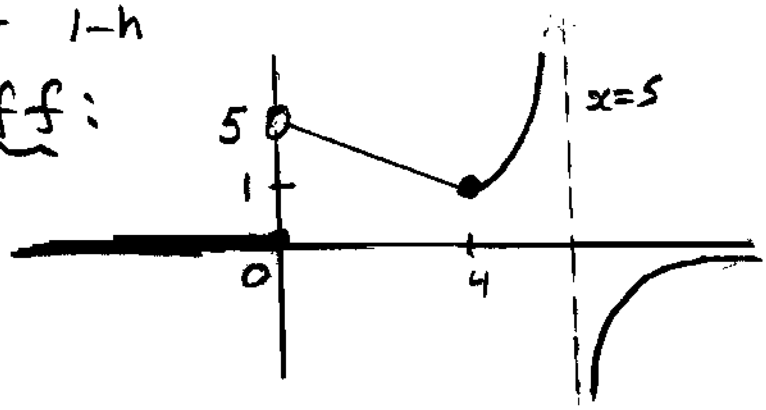
$= \lim\limits_{h\to 0^-} \dfrac{1}{h}[1-h-1] = \lim\limits_{h\to 0^-} -1 = -1$

$f'_{+}(4) = \lim\limits_{h\to 0^+} \dfrac{f(4+h)-f(4)}{h} = \lim\limits_{h\to 0^+} \dfrac{1}{h}\left[\dfrac{1}{5-(4+h)} - \dfrac{1}{5-4}\right]$

$= \lim\limits_{h\to 0^+} \dfrac{1}{h}\left[\dfrac{1}{1-h} - 1\right] = \lim\limits_{h\to 0^+} \dfrac{1}{h}\,\dfrac{1-(1-h)}{1-h}$

$= \lim\limits_{h\to 0^+} \dfrac{1}{1-h} = 1$

b) The graph of f:



c) $\lim\limits_{x\to 0^-} f(x) = 0 \neq \lim\limits_{x\to 0^+} f(x) = 5 \Rightarrow$ has a jump discontinuity at 0 .

$\lim\limits_{x\to 5^-} f(x) = +\infty$, $\lim\limits_{x\to 5^+} f(x) = -\infty \Rightarrow$ has has infinite discontinuity at 5 .

d) From (a), (b) and (c) above f is not differentiable at 0, 4, and 5 .