

[2][a] DOMAIN OF $f = \{x \neq \frac{7}{6}\} = (-\infty, \frac{7}{6}) \cup (\frac{7}{6}, \infty)$

$$f'(x) = \boxed{-2(6x-7)^{-3}(6)(9x+10)^{\frac{2}{3}} + (6x-7)^{-2}(\frac{2}{3})(9x+10)^{-\frac{1}{3}}(9)} \quad (1)$$

$$= 6(6x-7)^{-3}(9x+10)^{-\frac{1}{3}} [-2(9x+10) + 6x-7]$$

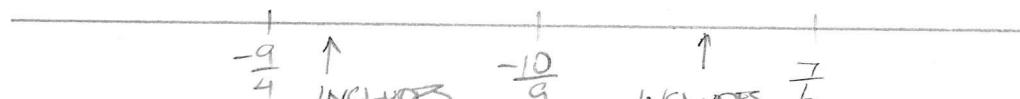
$$\stackrel{(1)}{=} \boxed{6(6x-7)^{-3}(9x+10)^{-\frac{1}{3}}(-12x-27)} \quad \text{DNE @ } x = -\frac{10}{9} \quad (2)$$

$$= 0 \text{ IF } \boxed{-12x-27=0} \quad @ x = -\frac{27}{12} = -\frac{9}{4} \quad \text{IN DOMAIN}$$

CRITICAL NUMBERS $-\frac{10}{9}, -\frac{9}{4}$

SUBTRACT $(\frac{1}{2})$ POINT FOR EACH
ADDITIONAL INCORRECT CRITICAL
NUMBER

[b]



$6(6x-7)^3$	-	+	-	-	+	
$(9x+10)^{-\frac{1}{3}}$	-	-	-	+	+	
$-12x-27$	+	-	-	-	-	
f'	+	→	-	→	+	-

$\stackrel{(\frac{1}{2})}{x = -\frac{9}{4}}$ ↗
LOCAL MAX

$x = -\frac{10}{9}$ ↘
LOCAL MIN $\stackrel{(\frac{1}{2})}{}$

[3] [a] DOMAIN OF $f = (-\infty, \infty)$

$f'(x)$ EXISTS ON $(-\infty, \infty)$

$$f'(x) = 0 \text{ IF } 20 - 15x = 0 @ x = \frac{20}{15} = \frac{4}{3}$$

$$\text{OR } 20 - 3x = 0 @ x = \frac{20}{3}$$

CRITICAL NUMBERS $\frac{4}{3}, \frac{20}{3}$

[b] $f''(\frac{4}{3}) = 5(48-96)(20-4)^2 < 0 \rightarrow x = \frac{4}{3}$ LOCAL MAX

$\frac{1}{2}$ $\begin{matrix} >0 & <0 & >0 \end{matrix}$ ↗

INCORRECT TO SAY

"NOT A MAX OR MIN"

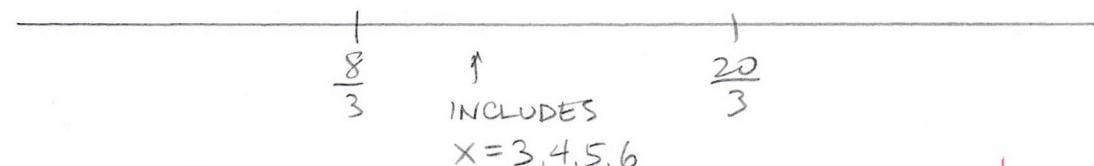
$f''(\frac{20}{3}) = 5(240-96)(0)^2 = 0 \rightarrow$

2^{ND} DERIVATIVE TEST
DOESN'T APPLY +
TELLS US NOTHING

[c] $f''(x)$ EXISTS ON $(-\infty, \infty)$

$$f''(x) = 0 \text{ IF } 36x - 96 = 0 @ x = \frac{96}{36} = \frac{8}{3}$$

$$\text{on } 20 - 3x = 0 @ x = \frac{20}{3}$$



$$5(36x-96)$$

$$(20-3x)^2$$

$$f''$$

-	+	+
+	+	+
-	→	+

$$x = \frac{8}{3}$$

INFLECTION POINT

$\frac{1}{2}$

[4] f is cont on closed interval, so global extrema exist

$$f'(x) = \boxed{9x^2 + 12x - 5} \text{ exists on } [-1, 2] \text{ since } f' \text{ polynomial}$$
$$= (3x+5)(3x-1) = 0 @ \underline{x = -\frac{5}{3}, \frac{1}{3}} \quad \begin{matrix} \textcircled{1} \\ \textcircled{2} \end{matrix}$$

\uparrow
NOT IN $[-1, 2]$

x	$f(x) = 3x^3 + 6x^2 - 5x$
-1	$-3 + 6 + 5 = 8$
$\frac{1}{3}$	$\frac{1}{9} + \frac{2}{3} - \frac{5}{3} = \frac{1}{9} - 1 = -\frac{8}{9}$
2	$24 + 24 - 10 = 38$

GLOBAL MAX @ $x = 2$ ①
GLOBAL MIN @ $x = \frac{1}{3}$ ②

SUBTRACT ② POINT FOR EACH ADDITIONAL X-VALUE PLUGGED IN

$$\begin{aligned}
 [5][a] \lim_{x \rightarrow -\infty} \frac{4x^3 - 1}{\sqrt{2x^6 - 5}} \cdot \frac{\frac{1}{\sqrt{x^6}}}{\frac{1}{\sqrt{x^6}}} &= \boxed{\lim_{x \rightarrow -\infty} \frac{4x^3 - 1}{\sqrt{2x^6 - 5}} \cdot \frac{-\frac{1}{x^3}}{\frac{1}{\sqrt{x^6}}}} \quad \textcircled{1} \\
 &= \boxed{\lim_{x \rightarrow -\infty} \frac{-4 + \frac{1}{x^3}}{\sqrt{2 - \frac{5}{x^6}}}} \quad \textcircled{2} \\
 &= \frac{-4 + 0}{\sqrt{2 - 0}} = \frac{-4}{\sqrt{2}} = \boxed{-2\sqrt{2}} \quad \textcircled{3}
 \end{aligned}$$

$$\begin{aligned}
 [b] \lim_{x \rightarrow 0^+} (1 - \sin 2x)^{\cot x} &= \lim_{x \rightarrow 0^+} [e^{\ln(1 - \sin 2x)}]^{\cot x} \\
 &\stackrel{1^\infty \text{ INDETERMINATE}}{=} \lim_{x \rightarrow 0^+} e^{(\cot x) \ln(1 - \sin 2x)} \\
 &= \boxed{e^{\lim_{x \rightarrow 0^+} (\cot x) \ln(1 - \sin 2x)}} \quad \textcircled{1} \\
 &= \boxed{e^{-2}} \quad \textcircled{2}
 \end{aligned}$$

$$\begin{aligned}
 \lim_{x \rightarrow 0^+} (\cot x) \ln(1 - \sin 2x) &= \lim_{x \rightarrow 0^+} \frac{\ln(1 - \sin 2x)}{\tan x} \quad \textcircled{1} \\
 &\stackrel{\infty \cdot 0 \text{ INDETERMINATE}}{} \quad \stackrel{0/0 \text{ INDETERMINATE}}{\\}
 \end{aligned}$$

$$\begin{aligned}
 &= \boxed{\lim_{x \rightarrow 0^+} \frac{\frac{1}{1 - \sin 2x} \cdot (-\cos 2x)(2)}{\sec^2 x}} \quad \textcircled{1} \\
 &= \frac{1(-1)(2)}{1^2} = \boxed{-2} \quad \textcircled{2}
 \end{aligned}$$

[6] f is cont on $[0, 2]$ AND DIFF ON $(0, 2)$
SINCE f IS A RATIONAL FUNCTION WITH DOMAIN $\{x \neq 4\}$

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

$$\left. -\frac{4}{(c-4)^2} - 1 \right| = \frac{f(2) - f(0)}{2-0} = \frac{-4 - 1}{2-0} = -\frac{3}{2}$$

$$-\frac{4}{(c-4)^2} = -\frac{1}{2}$$

$$8 = (c-4)^2$$

$$\pm 2\sqrt{2} = c-4$$

$$c = 4 \pm 2\sqrt{2}$$

$$c = 4 - 2\sqrt{2} \in (0, 2)$$

$$\approx 4 - 2(1.4) = 1.2$$