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

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

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

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

IN DOMAIN

$$= 0 \text{ IF } \boxed{-12x-27=0 \text{ @ } x = -\tfrac{27}{12} = -\tfrac{9}{4}} \text{ IN DOMAIN} \quad \tfrac{1}{2}$$

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

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

[b]

| | $x < -\frac{9}{4}$ | $-\frac{9}{4}$ to $-\frac{10}{9}$ (INCLUDES $x=-2$) | $-\frac{10}{9}$ to $\frac{7}{6}$ (INCLUDES $x=-1,0,1$) | $x > \frac{7}{6}$ |
|---|---|---|---|---|
| $6(6x-7)^{-3}$ | $-$ | $-$ | $-$ | $+$ |
| $(9x+10)^{-\frac{1}{3}}$ | $-$ | $-$ | $+$ | $+$ |
| $-12x-27$ | $+$ | $-$ | $-$ | $-$ |
| $f'$ | $+ \longrightarrow$ | $- \longrightarrow$ | $+$ | $-$ |

2

$\frac{1}{2}$ $\boxed{x = -\frac{9}{4} \text{ LOCAL MAX}}$ $\boxed{x = -\frac{10}{9} \text{ LOCAL MIN}}$ $\frac{1}{2}$

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

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

$f'(x) = 0$ IF $\boxed{\begin{array}{l} 20-15x=0 \quad @ \; x = \frac{20}{15} = \frac{4}{3} \\ \text{OR } \; 20-3x=0 \quad @ \; x = \frac{20}{3} \end{array}}$ $\frac{1}{2}$

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

[b] $\boxed{f''\left(\frac{4}{3}\right) = \underbrace{5}_{>0}\underbrace{(48-96)}_{<0}\underbrace{(20-4)^2}_{>0} < 0}$ $\frac{1}{2}$ $\longrightarrow$ $\boxed{x = \frac{4}{3} \text{ LOCAL MAX}}$ $\frac{1}{2}$

INCORRECT TO SAY "NOT A MAX OR MIN"

$\frac{1}{2}$ $\boxed{f''\left(\frac{20}{3}\right) = 5(240-96)(0)^2 = 0}$ $\longrightarrow$ $\boxed{\text{2}^{\text{ND}} \text{ DERIVATIVE TEST DOESN'T APPLY + TELLS US NOTHING}}$ $\frac{1}{2}$

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

$f''(x) = 0$ IF $\boxed{\begin{array}{l} 36x-96=0 \quad @ \; x = \frac{96}{36} = \frac{8}{3} \\ \text{OR } \; 20-3x=0 \quad @ \; x = \frac{20}{3} \end{array}}$ $\frac{1}{2}$

$\frac{8}{3}$ $\qquad$ $\frac{20}{3}$

INCLUDES $x = 3, 4, 5, 6$

| | | | |
|---|---|---|---|
| $5(36x-96)$ | $-$ | $+$ | $+$ |
| $(20-3x)^2$ | $+$ | $+$ | $+$ |
| $f''$ | $-$ | $\longrightarrow +$ | $+$ |

$1$

$\boxed{x = \frac{8}{3} \text{ INFLECTION POINT}}$ $\frac{1}{2}$

[4] f IS CONT ON CLOSED INTERVAL, SO GLOBAL EXTREMA EXIST

$f'(x) = \boxed{9x^2+12x-5}$ EXISTS ON $[-1,2]$ SINCE $f'$ POLYNOMIAL

$= (3x+5)(3x-1) \boxed{= 0}$ (1/2) @ $\underline{x = \cancel{-\frac{5}{3}}, \frac{1}{3}}$ (1/2)

↑ NOT IN $[-1,2]$

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

(1/2)

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

SUBTRACT (1/2) POINT FOR EACH ADDITIONAL X-VALUE PLUGGED IN

[5][a] $\lim_{x\to-\infty} \frac{4x^3-1}{\sqrt{2x^6-5}} \cdot \frac{\frac{1}{\sqrt{x^6}}}{\frac{1}{\sqrt{x^6}}} = \boxed{\lim_{x\to-\infty} \frac{4x^3-1}{\sqrt{2x^6-5}} \frac{-\frac{1}{x^3}}{\frac{1}{\sqrt{x^6}}}}$ $\frac{1}{2}$

$= \boxed{\lim_{x\to-\infty} \frac{-4+\frac{1}{x^3}}{\sqrt{2-\frac{5}{x^6}}}}$ $\frac{1}{2}$

$= \frac{-4+0}{\sqrt{2-0}} = \frac{-4}{\sqrt{2}} = \boxed{-2\sqrt{2}}$ $\frac{1}{2}$

[b] $\lim_{x\to0^+} (1-\sin 2x)^{\cot x} = \lim_{x\to0^+} \left[e^{\ln(1-\sin 2x)}\right]^{\cot x}$

$1^\infty$ INDETERMINATE

$= \lim_{x\to0^+} e^{(\cot x)\ln(1-\sin 2x)}$

$= \boxed{e^{\lim_{x\to0^+}(\cot x)\ln(1-\sin 2x)}}$ $\frac{1}{2}$

$= \boxed{e^{-2}}$ $\frac{1}{2}$

$\lim_{x\to0^+} (\cot x)\ln(1-\sin 2x) = \boxed{\lim_{x\to0^+} \frac{\ln(1-\sin 2x)}{\tan x}}$ $\frac{1}{2}$

$\infty \cdot 0$ INDETERMINATE $\qquad \frac{0}{0}$ INDETERMINATE

$1$ $= \boxed{\lim_{x\to0^+} \frac{\frac{1}{1-\sin 2x}(-\cos 2x)(2)}{\sec^2 x}}$

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

[6] f IS CONT ON [0, 2] AND DIFF ON (0, 2)
SINCE f IS A RATIONAL FUNCTION WITH DOMAIN $\{x \neq 4\}$ $\frac{1}{2}$

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

$$\frac{1}{2} \quad \boxed{-\frac{4}{(c-4)^2} - 1} = \frac{f(2)-f(0)}{2-0} = \frac{-4 - -1}{2-0} \boxed{= -\frac{3}{2}} \quad \frac{1}{2}$$

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

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

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

$$\boxed{c = 4 \pm 2\sqrt{2}} \quad \frac{1}{2}$$

$$\boxed{c = 4 - 2\sqrt{2} \in (0, 2)} \quad \frac{1}{2}$$

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