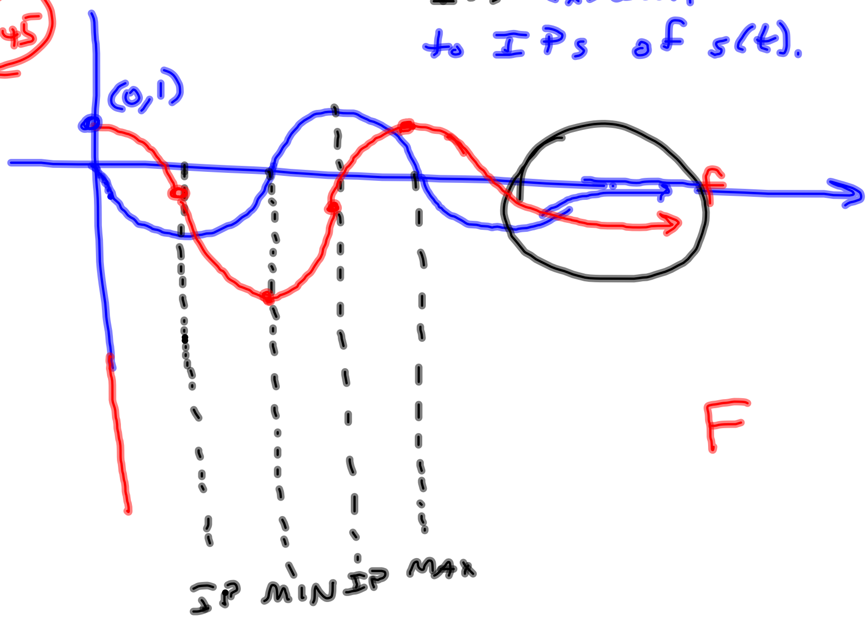
4.9 #46

Graph $s(t)$, given $v(t)$'s graph

$v(t) = s'(t)$: Its zeros are local extrema for $s(t)$

Its extrema will correspond to IPs of $s(t)$.

45



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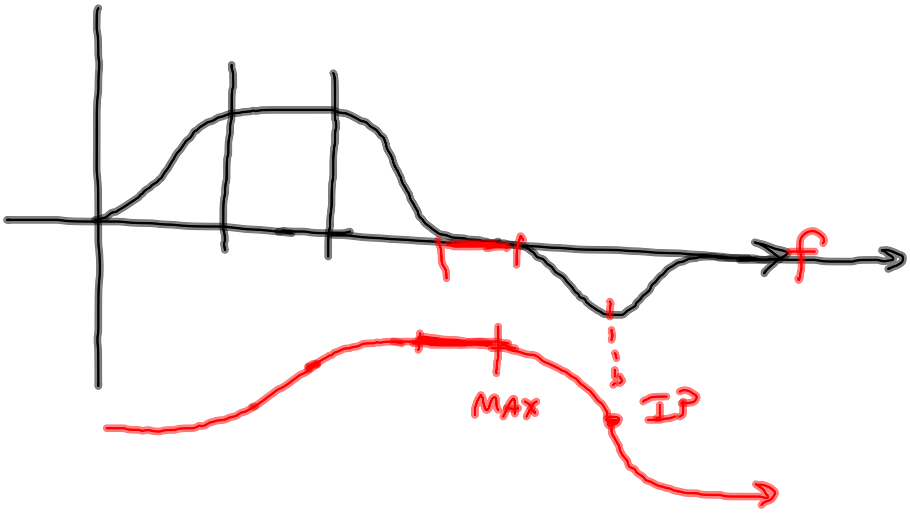

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$$\lim_{x\to-\infty}\left(\sqrt{9x^2-7x}-3x\right) = \infty \text{ or } \nexists$$

$$\lim_{x\to-\infty}\left(\overset{\infty}{\sqrt{9x^2-7x}}\ \overset{-\infty}{+3x}\right)$$

$3x^2$

$+ \quad (3x)^2 = 3^2x^2 = 9x^2$

$$= \lim_{x\to-\infty}\left(\frac{\sqrt{9x^2-7x}+3x}{1}\right)\left(\frac{\sqrt{9x^2-7x}-3x}{\sqrt{9x^2-7x}-3x}\right)$$

$$= \lim_{x\to-\infty}\frac{9x^2-7x-9x^2}{\sqrt{9x^2-7x}-3x} = \lim_{x\to-\infty}\frac{-7x}{\sqrt{9x^2-7x}-3x}$$

$$= \lim_{x\to-\infty}\frac{-7x}{\sqrt{x^2\left(9-\frac{7}{x}\right)}-3x} = \lim_{x\to\infty}\frac{-7x}{|x|\sqrt{9-\frac{7}{x}}-3x}$$

$$= \lim_{x\to-\infty}\frac{-7x}{-x\sqrt{9-\frac{7}{x}}-3x} = \lim_{x\to-\infty}\frac{-x(7)}{-x\left(\sqrt{9-\frac{7}{x}}+3\right)}$$

Because $x\to-\infty \Rightarrow x<0 \Rightarrow$
$|x|=-x.$

$$= \lim_{x\to-\infty}\frac{7}{\sqrt{9-\frac{7}{x}}+3} = \frac{7}{\sqrt{9}+3} = \frac{7}{3+3} = \frac{7}{6}$$

$f(x) = 1x^3 - 2x^2 - 5x + 10 = x^2(x-2) - 5(x-2) = (x-2)(x^2-5)$
$= (x-2)(x-\sqrt{5})(x+\sqrt{5})$

Graph it. Show all extrema, inflection pts & intercepts.

p: factors of 10 $\quad \frac{p}{q} = \pm 1, \pm 2, \pm 5, \pm 10$

q: " " 1

$$\begin{array}{r|rrrr} 1 & 1 & -2 & -5 & 10 \\ & & 1 & -1 & -6 \\ \hline & 1 & -1 & -6 & \text{No} \end{array} \qquad \begin{array}{r|rrrr} -1 & 1 & -2 & -5 & 10 \\ & & -1 & 3 & 2 \\ \hline & 1 & -3 & -2 & \text{No} \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & -2 & -5 & 10 \\ & & 2 & 0 & -10 \\ \hline & 1 & 0 & -5 & 0 \\ & x^2 & x & c & r \end{array}$$ Sweet!

$(x-2)\underline{(x^2-5)}$

$x^2-5=0$

$x = \pm\sqrt{5}$

zeros: $x = 2, \pm\sqrt{5} = -\sqrt{5}, 2, \sqrt{5}$

$(-\sqrt{5}, 0), (2,0), (\sqrt{5}, 0)$

$f'(x)$

$f(x) = x^3 - 2x^2 - 5x + 10$

$f'(x) = 3x^2 - 4x - 5 \overset{SET}{=} 0$

$a = 3,\ b = -4,\ c = -5$

$b^2 - 4ac = (-4)^2 - 4(3)(-5)$
$= 16 + 60 = 76$

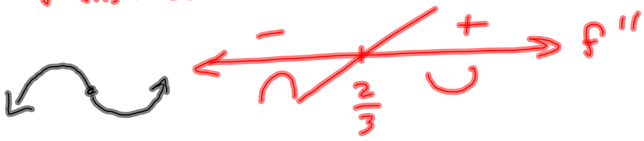
$2 \,\underline{)\,76}$
$2 \,\underline{)\,38}$
$\quad 19$

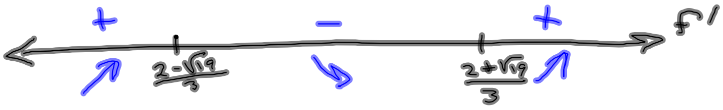
$\sqrt{76} = \sqrt{2 \cdot 2 \cdot 19} = 2\sqrt{19}$

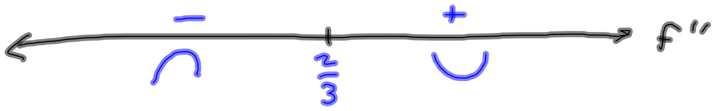
$x = \dfrac{-(-4) \pm \sqrt{76}}{2(3)} = \dfrac{4 \pm 2\sqrt{19}}{6} = \dfrac{\cancel{2}^{1}(2 \pm \sqrt{19})}{\cancel{6}_{3}}$

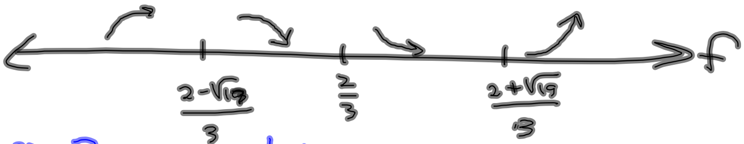
$= \dfrac{2 \pm \sqrt{19}}{3}$

$f''(x) = 6x - 4 \overset{SET}{=} 0 \implies 6x = 4 \implies x = \frac{2}{3}$

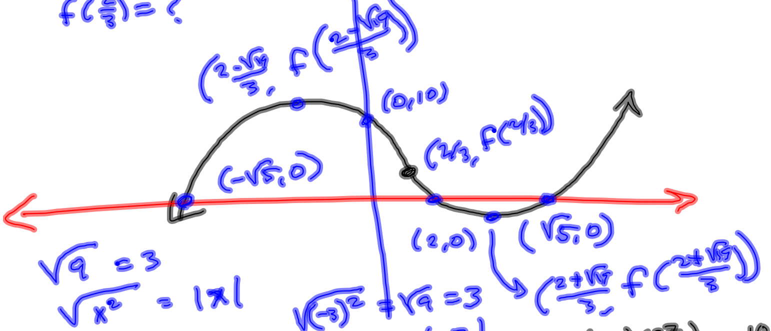








$f(\frac{2}{3}) = ?$



$\sqrt{9} = 3$

$\sqrt{x^2} = |x|$

$\sqrt{(-3)^2} = \sqrt{9} = 3$
$= |-3|$

$(10)(\frac{27}{27}) - \frac{106}{27}$

$270 - 106$

$f(x) = x^3 - 2x^2 - 5x + 10$

$$\boxed{\begin{array}{c|cccc} \frac{2}{3} & 1 & -2 & -5 & 10 \\ & & \frac{2}{3} & -\frac{8}{9} & -\frac{106}{27} \\ \hline & 1 & -\frac{4}{3} & -\frac{53}{9} & \frac{164}{27} \end{array}}$$

→ waste of time, space relative position secure.

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