$$\frac{1}{h}\left[\frac{1}{\sqrt{x+h}}-\frac{1}{\sqrt{x}}\right]=\left(\frac{\sqrt{x}-\sqrt{x+h}}{h\left[\sqrt{x}\sqrt{x+h}\right]}\right)\left(\frac{\sqrt{x}+\sqrt{x+h}}{\sqrt{x}+\sqrt{x+h}}\right)$$

$$=\frac{x-(x+h)}{h(\sqrt{x}\sqrt{x+h})(\sqrt{x}+\sqrt{x+h})}=\frac{-h}{h(\sqrt{x}\sqrt{x+h})(\sqrt{x}+\sqrt{x+h})}$$

$$=\frac{-1}{\sqrt{x}\sqrt{x+h}(\sqrt{x}+\sqrt{x+h})}\xrightarrow{h\to 0}\frac{-1}{\sqrt{x}\sqrt{x}(\sqrt{x}+\sqrt{x})}$$

$$=\frac{-1}{x(2\sqrt{x})}=-\frac{1}{2x\sqrt{x}}=-\frac{1}{2x\cdot x^{1/2}}=-\frac{1}{2x^{3/2}}$$

$$\frac{1}{\sqrt{x}}=x^{-\frac{1}{2}}\Rightarrow y'=-\frac{1}{2}x^{-3/2}=-\frac{1}{2x^{3/2}}$$

$$\frac{d}{dx}\left(\frac{6}{x^2}\right)=\frac{d}{dx}\left[6(x^2)^{-1}\right]$$

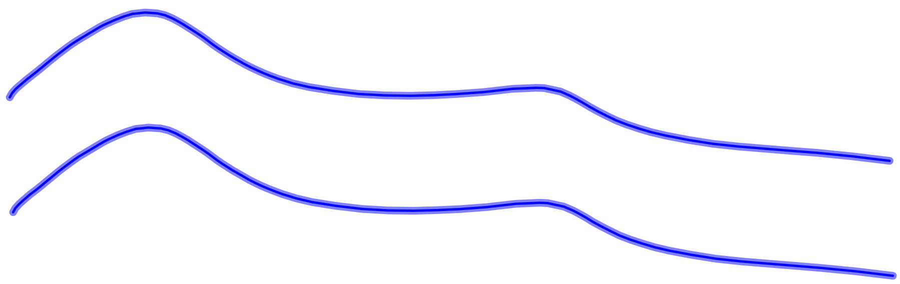
$$=-6(x^2)^{-2}(2x)=-6x^{-4}\cdot 2x=$$

$$=-12x^{-3}$$

Test 1 – Mastery Reform
Fix your mistakes,
I'll split the difference.

Cor.
Pg 212
"Parallel"

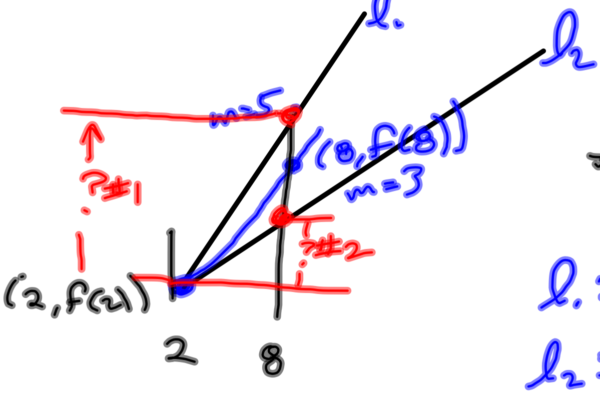
If $f'(x) = g'(x)\ \forall x$
then $f(x) = g(x) + C$



Oct 3-12:19 PM

If $3 \le f'(x) \le 5$

Find Bounds on $f(8)-f(2)$



f is between these two lines, somehow.

$l_1: y=5(x-2)+f(2)$

$l_2: y=3(x-2)+f(2)$

$x=8$: $y=5(8-2)+f(2) \ge f(8)$

$= 30+f(2) \ge f(8)$

$y=3(8-2)+f(2) \le f(8)$

$= 3(6)+f(2) \le f(8)$

$18+f(2) \le f(8)$

So

$f(2)+18 \le f(8) \le f(2)+30$

$18 \le f(8)-f(2) \le 30$

?#2 ?#1

$f(8)-f(2) \le 5(8-2)$

$f(8)-f(2) \ge 3(8-2)$

A similar "Racetrack Principle" question

If $f(1) = 10$ and $f'(x) \geq 2 \;\; \forall x \in [1, 4]$ give a lower bound on $f(4)$.

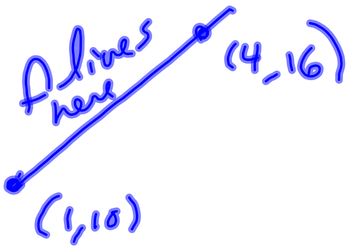
$y = 16$?

start height

steepnes

horizontal displacement.

$f(4) \geq 10 + 2(4-1)$



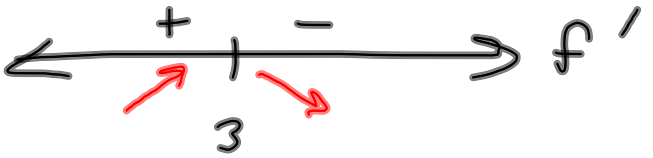
$$
\begin{aligned}
y &= m(x - x_1) + y_1 \\
&= 2(x-1) + 10 \\
&= 2(4-1) + 10 \\
&= 16
\end{aligned}
$$

§3.3

$f' > 0 \Longrightarrow$ increasing

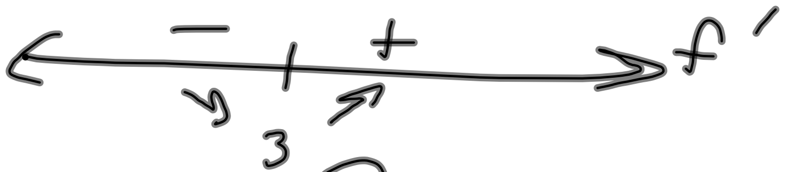
$f' < 0 \Longrightarrow$ decreasing.

§ $f'(3) = 0$. Consider the sign pattern for f':



what's this say about $f(3)$?

$f(3)$ is a local max.



min @ $x = 3$ of $f(3)$.

Give a rough sketch of

$f(x) = 4x^3 + 3x^2 - 6x + 1$

Show all local extremes.

$f'(x) = 12x^2 + 6x - 6 \overset{\text{SET}}{=} 0$

$2x^2 + x - 1 = 0$

$(2x-1)(x+1) = 0$

$2x - 1 = 0$ OR $x + 1 = 0$

$2x = 1$ $\quad x = -1$

$x = \frac{1}{2}$

$a = 2,\ b = 1,\ c = -1$

$b^2 - 4ac = 1^2 - 4(2)(-1)$

$= 1 + 8$

$= 9$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-1 \pm \sqrt{9}}{2(2)}$

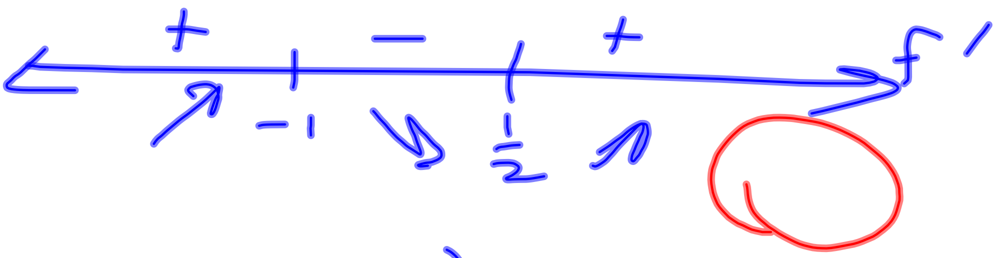
$= \dfrac{-1 \pm 3}{4}$ $\quad \frac{2}{4} = \frac{1}{2}$, $\quad \frac{-4}{4} = -1$

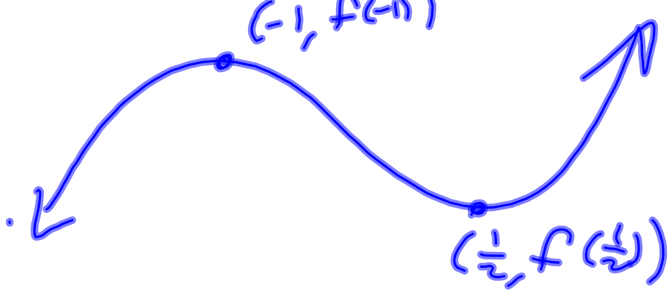
The work on the right says $2x^2 + x - 1$

$= 2\left(x - \frac{1}{2}\right)\left(x - (-1)\right)$ Factor Theorem

$= \boxed{(2x-1)(x+1)}$

$\boxed{\text{CVS}}$ $x = -1, \frac{1}{2}$





You supply the $f\left(\frac{1}{2}\right)$

$f(x) = x^3 - 6x^2 + 12x - 8$

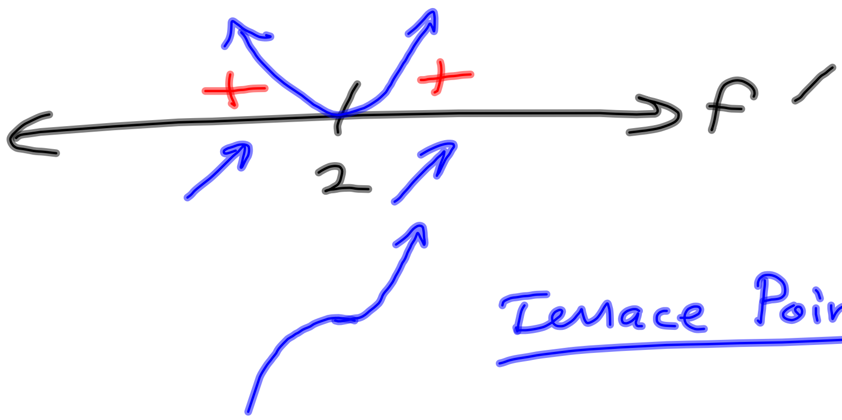
Sketch.

$f'(x) = 3x^2 - 12x + 12$

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

$\Rightarrow x^2 - 4x + 4 = 0$

$\Rightarrow (x-2)^2 = 0 \longrightarrow x = 2$



Terrace Point

§ 3.3 I #s $\boxed{\begin{matrix} 9\text{–}14 \\ \text{ALL} \end{matrix}}$ ab