Panel 1

Review

$\lim_{x \to 3} \frac{x^2-9}{x-3}$

Limits: plug it in if possible or if $\frac{0}{0}$ factor

one-sided limit, limits at infinity

Continuity (1) $f(c)$ defined (2) $\lim_{x \to c} f(x)$ defined (3) same?

graph has no hole or gap

Derivative: $f'(x) = \lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$, higher order, power rules

f': slope of tangent, inst. rate of change, marginal X, velocity

incr. or decreasing → max/min

f'': concave up/down, inflection points.

1

Panel 2

$$f(x) = \begin{cases} 2x-5 & \text{if } x < 2 \\ -x & \text{if } x \geq 2 \end{cases}$$

① cont. at $x = 0$. $f(0) = -5$

$\lim_{x \to 0} f(x) = \lim_{x \to 0} 2x-5 = -5$

same? yes

② cont. at $x = 2$: $f(2) = -2$

$\lim_{x \to 2} f(x)$ = undef

same!

NO

$\lim_{x \to 2^+} f(x) = -2$

$\lim_{x \to 2^-} f(x) = -1$

2

Panel 3

$$f(x) = \begin{cases} x^2 - 1 & \text{if } x \le 2 \\ kx & \text{if } x > 2 \end{cases}$$

cont. at $x = 2$: $f(2) = 3$

$\lim_{x \to 2} f(x) = 3$

$\lim_{x \to 2^+} (kx) = 2k$

$\lim_{x \to 2^-} (x^2 - 1) = 3$

$2k = 3$

$k = 3/2$

if $k = 3/2$ yes

same ✓

3

Panel 4

Name: _____

Quiz #7

① Consider $f(x) = 2x^3 + 3x^2 - 12x + 1$. Find all critical points and determine whether they are max, min, or neither

4

Panel 5

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

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{\left[(x+h)^2 - 6(x+h) + 3\right] - \left[x^2 - 6x + 3\right]}{h} =$

$= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - 6x - 6h + 3 - x^2 + 6x - 3}{h}$

$= \lim_{h \to 0} \frac{2xh + h^2 - 6h}{h} = \lim_{h \to 0} \frac{h(2x + h - 6)}{h} =$

$= \lim_{h \to 0} 2x + h - 6 = 2x - 6$

equation of tangent line at $x = 2$ $\quad f'(2) = -2$

$y + 5 = -2(x - 2)$ $\quad f(x) = -5$

5

Panel 6

$f(x) = 4\ln(t) + \sqrt[5]{t^2} + 5e^{11} + t^{2/5}$

$f'(t) = 4 \cdot \frac{1}{t} + \frac{2}{5} t^{-3/5} + 0$

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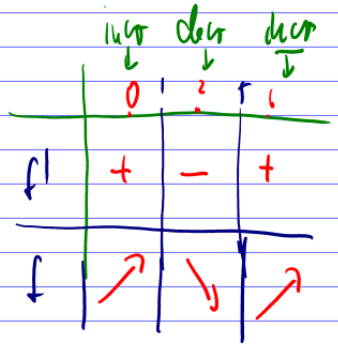
Panel 7

$f(x) = x^3 - 9x^2 + 15x - 7$

increasing / decreasing:

$f'(x) = 3x^2 - 18x + 15 = 0$

$\cdot 3(x^2 - 6x + 5) = 0 \Leftrightarrow 3(x-5)(x-1) = 0$, $x = 1, 5$



f is increasing on $(-\infty, 1] \cup [5, \infty)$

is decreasing on: $(1, 5)$

has max at $x = 1$

has min at $x = 5$

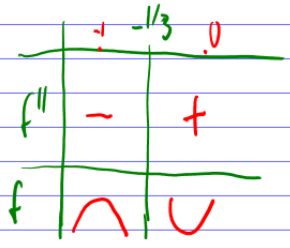
7

Panel 8

$f(x) = x^3 + x^2 - 5x - 7$

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

$f''(x) = 6x + 2 = 0 \Rightarrow x = -1/3$ ~~possible~~ inflection



concave up $(-1/3, \infty)$

concave down $(-\infty, -1/3)$

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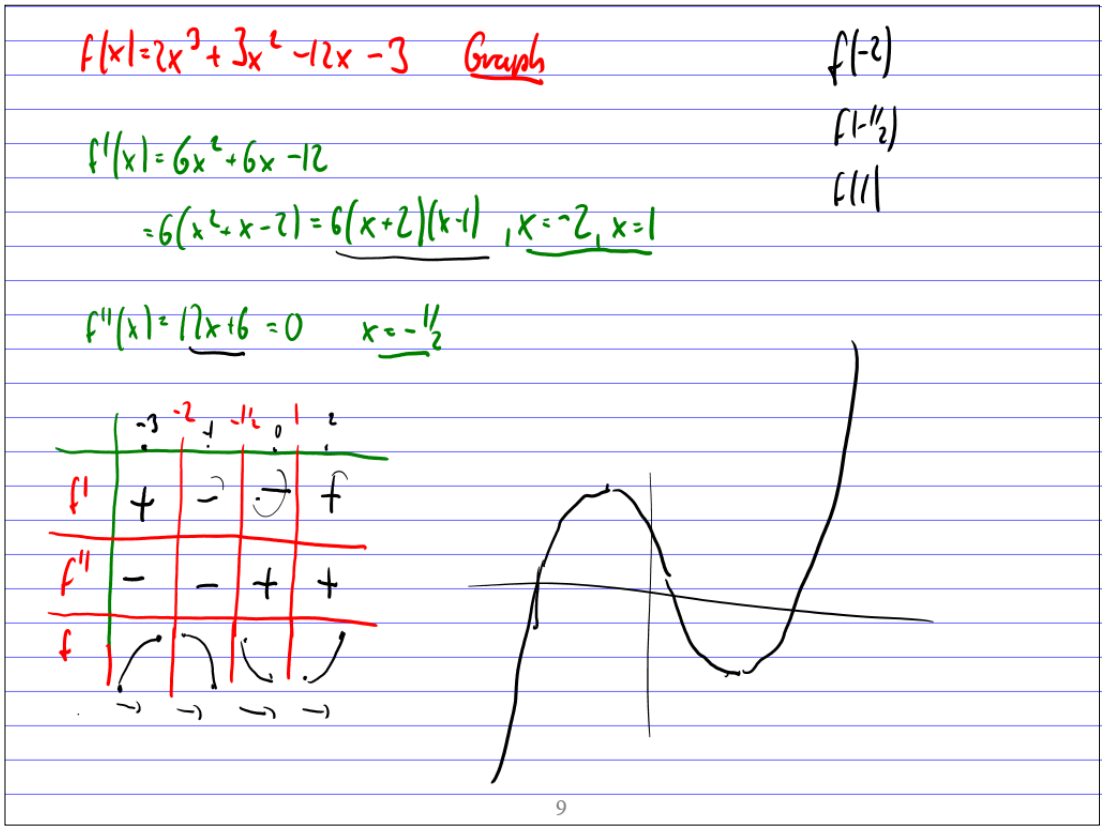
Panel 9



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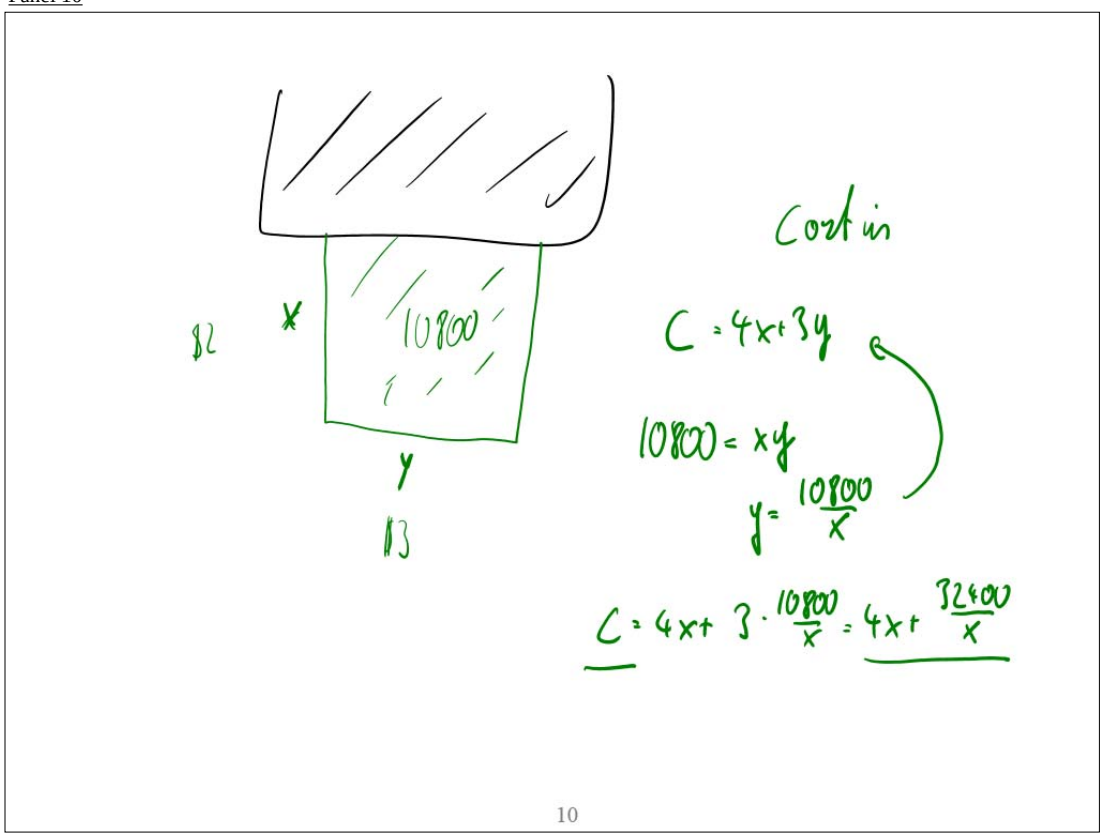
Panel 10



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